UNIVERSITY OF TORONTO

OFFICE OF THE GOVERNING COUNCIL

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

TO:	Committee on Academic Policy and Programs
SPONSOR:	Susan McCahan, Vice-Provost, Academic Programs
CONTACT INFO:	(416) 978-0490, vp.academicprograms@utoronto.ca
PRESENTER:	See Sponsor
CONTACT INFO:	
DATE:	October 15, 2018 for November 1, 2018
AGENDA ITEM:	1

ITEM IDENTIFICATION:

New Graduate Program Proposal: Master of Health Science in Medical Physiology (M.H.Sc.), 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] (Nov. 1, 2018)**
2. Academic Board [for approval] (Nov. 22, 2018)
3. Executive Committee [for confirmation] (Dec. 4, 2018)

PREVIOUS ACTION TAKEN:

The proposal for the Master of Health Science in Medical Physiology received approval from the Faculty of Medicine on October 15, 2018.

HIGHLIGHTS:

This is a proposal for a 3 session professional master's degree program called Master of Health Science in Medical Physiology, to be offered by the Faculty of Medicine. Students will complete 6.0 full-course equivalents (FCE) consisting of required courses (3.5 FCE), a practicum (1.0 FCE) and electives courses (1.5 FCEs) in one of the four areas of general Physiology; Endocrine and Reproductive Sciences; Cardiovascular, Respiratory and Renal Science; and Brain and Behaviour.

The intent of the new professional MHSc in Medical Physiology is to address the need for graduates who will take existing physiological knowledge concerning human health and put it into practice. The application of the knowledge can be in direct health care delivery or in an industry related to medical sciences. The courses are designed with an emphasis on combining a high-level understanding of how an individual's health is a consequence of societal and environmental factors (e.g. level of activity and diet), integrated with the daily interplay between their organ and cellular physiology. Manipulating the interaction between the macro and micro elements to promote human health and prevent disease requires the integration of multiple sets of physiological data on cellular, whole body and societal behaviours in healthy individuals and those with pre-existing diseases.

Applicants to the M.H. Sc. In Medical Physiology will have an appropriate B.Sc. Or B.A. degree and must have completed at least third year level physiology or equivalent courses and demonstrate interest in physiology. The program will appeal to those who do not wish to pursue a research master's degree, yet wish to apply physiological knowledge regarding human health for the purpose of impacting the delivery of health and healthcare.

The expected steady state enrolment is 40 students per year. Tenure stream, one teaching stream, and clinical faculty members will contribute to the program. Five tenure stream faculty will be responsible for delivering new courses specifically designed for the new program.

Graduates of the program may pursue careers either as project managers in team science projects in biosciences laboratories/industrial settings, or as consultants to provide guidance to health professionals/public/patients on specific medical issues. There is an opportunity for individuals currently in the workforce to return to upgrade their skills and knowledge in health-related physiology.

Consultation took place within the Faculty as well as with Dean's offices in the following Faculties: Applied Science and Engineering, Arts and Sciences, Dalla Lana School of Public Health, Dentistry, Leslie Dan Faculty of Pharmacy and the Joseph L. Rotman School of Management. All supported this proposal.

The program was subject to an external appraisal on March 29, 2018 by Professors Prof. John White, McGill University and Donald DeFranco, University of Pittsburgh. The external appraisers made a number of suggestions, which resulted in changes to the program as is reflected in the Dean's response to the appraisal report.

FINANCIAL IMPLICATIONS:

The new financial obligations resulting from this program will be met at the divisional level.

RECOMMENDATION:

Be it Recommended,

THAT the proposed degree program, Master of Health Science in Medical Physiology (M.H.Sc.), as described in the proposal from the Faculty of Medicine dated September 21, 2018 be approved effective September 1, 2019.

DOCUMENTATION PROVIDED:

- *Cover*
- *Proposal for a Master of Health Science in Medical Physiology*

UNIVERSITY OF TORONTO

University of Toronto
New Graduate Program Proposal

This template is for all proposals for new graduate programs. It will help to ensure that all evaluation criteria established by the Quality Council are addressed in bringing forward a proposal for a new program. Separate templates have been developed for other types of proposals.

Full Name of Proposed Program:	Master of Health Science in Medical Physiology
Degree Name and Short Form:	MHSc (Medical Physiology)
Program Name:	Medical Physiology
Professional Program	Yes
Unit (if applicable) offering the program:	Department of Physiology
Faculty / Division:	Medicine/ Division 4
Dean's Office Contact:	Dr. Allan Kaplan, Vice-Dean, Graduate and Academic Affairs, Faculty of Medicine
Proponent:	Dr. Graham Collingridge, Chair, Dept. of Physiology Dr. Helen Miliotis, Dept. of Physiology Dr. Alison Buchan, Dept. of Physiology
Version Date*:*	September 21, 2018

New Graduate Program Proposal

MHSC in Medical Physiology
Department of Physiology
Division 4

Table of Contents

1 Summary

Please provide a brief overview of the proposed program summarizing many of the points found in more detail elsewhere in the proposal. (You may wish to complete this section last). This should include:

- *A short, clear description of what is being proposed (including the normal program length, the appropriateness of the degree designation and program name including whether the proposed program is a professional graduate program or not; expected numbers of students)*
- *The academic rationale for the program (i.e. why this program)*
- *The impetus for the program's development*
- *Any distinctive elements*

The discipline of Physiology is at the core of understanding the biological basis of health and the causes of disease. By integrating information on the behaviour of single cells, entire organs (e.g. heart, pancreas) and the integrated organ systems/intact body, physiologists are able to establish how changes at the microscopic level (e.g. products of individual and gene-cluster mutations) and at a macro level (i.e. activity and diet) affect the function of an individual. The proposed Masters in Health Science (MHSc) in Medical Physiology represents an innovative and relevant alternative to pursue graduate education in Physiology with an explicit focus on the physiology relevant to medicine and human health.

The intent of the new professional MHSc in Medical Physiology is to address the need for graduates who will take existing physiological knowledge concerning human health and put it into practice. The application of the knowledge can be in direct health care delivery or in an industry related to medical sciences. The courses are designed with an emphasis on combining a high-level understanding of how an individual's health is a consequence of societal and environmental factors (e.g. level of activity and diet), integrated with the daily interplay between their organ and cellular physiology. To manipulate the interaction between the macro and micro elements to promote human health and prevent disease, it requires the integration of multiple sets of physiological data on cellular, whole body and societal behaviours in healthy individuals and those with pre-existing diseases. Two of the new courses developed for this proposed program are designed specifically to address these requirements: Clinical Physiology and Big Data and Health. Both of these courses are unique to the Department of Physiology.

The proposed professional Masters Program has been developed to address a gap in the current graduate education offerings of the department. While we offer original research, bench science focused graduate MSc and PhD degrees, there is no professional course-based degree program for students interested in the implementation of newly discovered physiological knowledge relevant to human health.

The existing, highly competitive, MSc and PhD degrees focus on educating students to be experimentalists who design and complete original research projects. The focus of these

degrees is to prepare the students for careers as research scientists in either academic or industrial settings. These research-focused students will continue the innovation tradition established in the Department of Physiology over a 100 years ago. By expanding and implementing their scientific intuition and curiosity, they are following in the footsteps of Banting and Best, the discovers of insulin.

The program will be full-time for 3 terms with one point of entry each September, and an anticipated admission of 40 students (including 10 – 20% International students) at steady state. The curriculum is mainly course-based with 3.5 FCE required courses, 1.0 FCE Practicum and 1.5 FCE of electives to provide students with the flexibility to explore one of four areas: General Physiology; Endocrine and Reproductive Sciences; Cardiovascular, Respiratory and Renal Sciences (Integrative Sciences); and Brain and Behaviour (Neurosciences). The program will combine new and existing graduate level physiology courses, with a mentored literature review report, and a practicum in the final term to allow students to explore how human physiology is integrated and applied in different work environments. This practicum can be undertaken in basic and clinical research laboratories, entrepreneurial environments, biotechnology companies, and healthcare delivery organizations.

The degree represents an innovative and relevant alternative to pursue graduate education in Physiology with an explicit focus on human physiology. The rapid expansion in the bio-sciences workforce in Ontario (https://www.jobbank.gc.ca/content_pieces-eng.do?cid=9743) demonstrates the need to graduate additional students who can fill the positions in medical services and biotechnology industries without having to go outside of the province or country for training. Our program will be the first of its kind in Canada and will join several elite institutions in United States and United Kingdom.

2 Effective Date

Anticipated date students will start the program - September 2019

3 Program Rationale

- *Identify what is being proposed and provide an academic rationale for the proposed program (What is being created and why?)*
    - *Describe the mode of delivery of the program if distinctive (including blended or online; placement etc.) and explain why this is appropriate.*
    - *Include how the program addresses the current state of the discipline or area of study. (Identify pedagogical and other issues giving rise to the creation of this program. Where appropriate speak to changes in the area of study or student needs that may have given rise to this development)*

- *Include (you may wish to use titles as headings) :*
    - *Appropriateness of degree nomenclature and program name with reference to norms in the field and clarity.*
    - *Distinctiveness*
        - *Identify any innovative or distinguishing aspects of the proposed program*
        - *Briefly, place this program within the context of programs being offered by other universities in North America and Internationally. How is the proposed program similar to or different from existing programs at the U of T (as appropriate)?*
    - *Describe the consistency of the program with the University's mission and graduate unit/divisional academic plan and priorities*

Rationale for the Program

The Masters of Health Science designation was chosen to reflect the professional nature of the program. It will be a course-based program designed to provide both in-depth knowledge of physiology in one of four areas. It will also enable students to develop the skills required to understand and analyze complex physiological systems to derive an effective health intervention and a practical experience in a health-related field of the student's choice. The degree will focus on developing three specific skill sets:

1) the ability to critically review and assess the relevance of new physiological discoveries to human health and wellbeing,
2) the ability to accurately predict which of these new discoveries will have a direct impact on human health, and
3) the ability to successfully design interventions using new knowledge to address specific health needs.

The program is a blend of traditional graduate courses currently offered in the research focused M.Sc. and Ph.D. degree programs, and five new courses specifically designed with the professional masters degree in mind. The new courses are focused on developing the skills and knowledge required to integrate multi-level physiological data sets and define their relevance to human health and develop the interpersonal skills to work as part of large teams.

With the advent of "big-science" in human bio-sciences, there has been a significant increase in large, multi-investigator teams and with groups of 20 – 50 individuals working on related "wicked" problems in health. "Wicked" problems refer to those challenges that are caused by multi-factorial changes and have not been successfully addressed by individual investigator led teams. In order for "big-science" to be successful, the multi-investigator teams require individuals who can understand the high level (macro) context of the specific problem while also understanding the specific research areas of the individual team members (micro) and how the research from the individual team members can be integrated to address the health challenge. These individuals act as project managers. Our students will be able to undertake this role.

Positioning the Degree Program in the Environment

In the new era of data-driven health decision making, it is becoming increasingly common for health care professionals, pharmaceutical companies, patients and their families to rely on genomic data. The challenge with the shift to an emphasis on genomic traits to define specific treatments is that, in many instances, we have incomplete information on the underlying effects/risk of a given DNA mutation, let alone the effect of a combination of different mutations on the biology of an individual. The discipline of Physiology is ideally positioned to provide students with the required knowledge and skills to turn the genomic/cellular biology data into information that is relevant to clinical medicine and health care in general. In order to do this, our students will develop the critical skills and knowledge base required to understand and interpret complex physiological interactions and how changes in gene products affect human physiology and result in positive and negative health transitions.

Physiology at the University of Toronto is ranked #8 in the 2018 QS World Universities Ranking and ranked #7 in the 2017 Centre for World University Rankings. Furthermore, the proposed four streams available to the MHSc in Medical Physiology students were also ranked highly in the 2017 Centre for World University Rankings: #4 in Cardiac and Cardiovascular systems; # 3 in Peripheral Vascular Disease; #4 in Respiratory System; #3 in Gastroenterology & Hepatology; #5 in Developmental Biology; #4 in Endocrinology and Metabolism; #9 in Medical Informatics; #6 in Neurosciences. This data demonstrates that students will have access to world leaders in their areas of research interest to successfully complete their literature review project and practicum.

Health is not all about the genes. In a post-genomic era, new molecular, computational and micro-measurement techniques are revealing how our genomes and the environment interact to modify our biology and underpin health and contribute to disease development. Faculty in the Department of Physiology are utilizing this new wealth of complex biological information and integrating it with our existing understanding of bodily functions. For example, we can take data collected from heart monitors/wearables and show how changes in heart rate and electrical activity interplay with both cardiovascular health and obesity. One of the fastest growing job markets, according to the Government of Canada, is in the professional technical consulting industry (Professional, Technical, and Scientific Services: Ontario 2015-2017), with big data analytics as one of the main on-campus recruitment foci https://www.jobbank.gc.ca/content_pieces-eng.do?cid=9743 and http://www.businessbecause.com/news/mba-careers/3374/mba-jobs-market-is-booming-in-2015. Our graduates will be well-positioned to enter this growing employment sector.

Distinctiveness and Fit with the Faculty and University's Strategic Plans:

The proposed MHSc in Medical Physiology allows the department to renew and expand its graduate training offerings by providing an academic program designed to improve the career-readiness of graduates. This is also in-line with the increasing focus on translating new physiological findings into effective health interventions.

Faculty of Medicine's Taskforce on Innovation and Transformation in Graduate Education Report outlined an aspiration to develop graduate programs that reflect societal relevance and expand the future professional choices of the students. The MHSc in Medical Physiology is designed with this in mind and also aligns with the University's strategic focus of "Promoting healthy people, healthy communities and a healthy world."

The Faculty of Medicine's strategic plan outlines 3 areas of emphasis: Prepare, Discover and Partner. This degree delivers across all three areas:

- **Prepare:** the program will prepare students to succeed in the evidence-based, data rich environment of health professions and bio-sciences.
- **Discover:** the program will enable students to discriminate important new knowledge from the deluge of new information being published on a daily basis. It will also provide the student with an understanding of how to design interventions to address health challenges and apply new physiologically-based products in the market place.
- **Partner:** the program, with an emphasis on human health and team work, will enhance our students' ability to collaborate effectively and communicate with professionals and consumers alike.

The proposed program also aligns with President Gertler's emphasis of "Leveraging our Location." In an Autumn 2014 article written by Gertler, the University has collaborated

> *"with industrial, institutional and not-for-profit partners, including many local businesses and community-based organizations. As participants in these collaborations, our faculty and students are both the providers of new ideas and the beneficiaries. U of T faculty and students have created companies, jobs and entirely new industries. This has helped the city to reinvent itself continually over time. Indeed, producing well-educated graduates represents U of T's single biggest contribution to the Toronto region, to Ontario and to Canada."*

The MHSc in Medical Physiology encapsulates the essence of this strong relationship by merging the basic sciences with the advantage of local employers in health-related start-ups and innovation hubs (e.g. MaRS) to determine the best health intervention.

Programs that are most closely related to the MHSc in Medical Physiology are: the MHSc in Medical Genomics, Faculty of Medicine, which is focused on graduating individuals who will lead in the interpretation of genomic testing and the MHSc in Translational Research in the Health Sciences, Faculty of Medicine, which is focused on providing a general overview of translational practices in health sciences using a variety of approaches. These programs are focused on graduating students who can translate new information into action in a health care setting. However, these are two year programs as opposed to the proposed one year program length for the MHSc in Medical Physiology. The areas of emphasis of these programs are distinctly different from the focus of the MHSc in Medical Physiology (i.e. graduating students who have in-depth knowledge of physiology and understand how to implement new

physiological findings related to human health) and we do not expect competition between the programs for students.

In the **Canadian academic community**, the University of Windsor offers an MSc in Medical Biotechnology that can be completed in 16 months and involves the theory and practice in laboratory techniques, including business planning and entrepreneurship training. There is also a one year Masters in Biomedical Science run by the Ontario Veterinary College at the University of Guelph which is focused on veterinary medicine rather than human physiology.

Internationally there are only two comparable Applied/Clinical Physiology MSc degrees which are listed below:

Programs/University	**Program Length**	**Learning Objectives**
MSc in Molecular and Integrative Physiology, University of Michigan School of Medicine	1 year, Full-time	• Research and clinical careers • Includes a capstone project
MSc in Human and Applied Physiology, Kings College London	1 year, Full-time	• The original and foremost programme in human and applied physiology in the UK • Advanced theoretical and practical understanding of the functioning of the muscular, respiratory and cardiovascular systems, including the effects of extreme environmental conditions on whole-body physiology • Unique exposure to human physiology applied to aerospace and military medicine offered only by KCL • Training in a wide variety of relevant practical laboratory skills.

4 Fields/Concentrations [Optional]

- *Description of fields/concentrations, if any. (Please note: Graduate programs are not required to have fields/concentrations in order to highlight an area of strength or specialization within a program)*

N/A

5 Need and Demand

- *Provide a brief description of the need and demand for the proposed program focusing, as appropriate, on student interest, societal need, employment opportunities for prospective graduates, interest expressed by potential employers, professional associations, government agencies or policy bodies and how this has been determined.*
- *With specific reference to the impact on need and demand, describe how the proposed program relates to (is similar to or different from) existing programs offered by other universities in North America and Internationally (with specific reference to Canadian and Ontario examples). In doing this you may wish to append a table showing other programs.*

Student Demand

This degree program addresses an identified need from students who are looking for additional training in physiology relevant to human health. A survey of the career needs of undergraduate physiology students in 2015 identified the topic of 'Medical Physiology' as of the greatest interest. The MHSc in in Medical Physiology is designed with their comments and requests in mind.

The survey was circulated to the cohort of Physiology undergraduate specialists, majors and minors students (N = 1000) and 105 individuals responded. The majority of the students indicated that after completing their undergraduate degrees, approximately 80% intended to apply to a health professions program, 7% were interested in a business/other program, 2% in education and 12.5% were interested in a research/scientist career.

The respondents were specifically asked whether a one year graduate degree focused on expanding their knowledge of human health and how physiological knowledge is utilized in the health care environment would be of interest as a next step in their life-long learning. Please see Appendix C for a full report of this survey.

The following are a sample of quotations from students responding to the survey:

"I think this type of professional program in physiology will be popular with those who wish to gain practical applicable physiological knowledge before applying to medical professional schools. I wish this program had already been in place this year. I would have considered applying for it."

"I wish this program had been offered this year as I would have pursued this type of masters program that is course-based rather than research-based."

"This is an amazing idea, I wish you did this earlier."

Societal Need

The 2015 Life Sciences Ontario Sector report provided a detailed analysis of a vibrant community that generated in excess of $40 Billion in 2009. In Ontario, the Life Sciences sector is the third largest employer with 5,645 firms employing over 80,000 individuals. The sector is divided into 4 major segments: Agricultural, Drugs & Pharmaceuticals, Medical Device & Equipment, and Research, Testing & Medical Laboratories (www.lifesciencesontario.ca). A survey undertaken by BioTalent Canada identified management and leadership skills as the major talent gaps in the life sciences sector with 93.5% of companies identifying these skills as critical. The focus of the MHSc in Medical Physiology will provide graduates with the knowledge and skills set to immediately enter careers in three of the four segments: Drugs & Pharmaceuticals, Medical Device & Equipment and Research, Testing & Medical Laboratories.

The Department of Physiology surveyed of potential employers and recent alumni to explore the skills and knowledge gap that these graduates would fill, as well as identify future job opportunities. These findings will be summarized in a report that will be presented to the External Reviewers on March 29, 2018.

To be successful in a future health-related career, our students need critical thinking skills to be able to scan the literature of new knowledge in their area and understand how to extract those findings relevant to a given problem. Increasingly, the students will have to be able to deal with the results of "big data" whether the information is coming from genomic analysis, computer-assisted wearable devices or customers who are using advanced websearch engines. In order to address the remaining "Wicked" problems in medical sciences, multi-investigator teams are being created through programs such as the CIHR Strategy for Patient Oriented Research (SPOR). The members of these large teams can be located at a single institution or more commonly involve teams from multiple National and International institutions. The success of these large teams is largely dependent of the effectiveness of the leadership and presence of individuals who can act as project managers. These project managers need to be able to look after the logistics of large complex teams, while at the same time understanding the biological basis of the research. Our students will be able to undertake this role.

The proposed MHSc in Medical Physiology is designed to provide both the required professionalism training, an understanding of how to derive the evidence on which to base decisions on human health, while at the same time increasing the depth of knowledge of the student in their chosen physiological stream. By providing the students with this education we are preparing them for entry into the world of big-science projects in human health.

It is expected that students in this program will be interested in careers either as project managers in team science projects in biosciences laboratories/industrial settings, or establishing themselves as consultants to provide guidance to health professionals/public/patients on specific medical issues. There is an opportunity for individuals currently in the workforce to return to upgrade their skills and knowledge in health-related physiology. There is also the opportunity to attract international students,

especially those students currently in undergraduate science programs at the University of Toronto.

6 Enrolment

- *Please provide details regarding the anticipated in-take by year, reflecting the expected increases to reach steady-state. This table should reflect normal estimated program length. (Please adjust the table as necessary)*
- *Please provide an explanation of the numbers shown and their relation to the Faculty/Division's enrolment plan.*

At steady state, there will be a maximum of 40 students enrolled in a given year. This represents 25% of the total number of graduate students in the Department of Physiology and represents a key new area for the Department's educational mission.

Year of study	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**
Year 1	15	20	30	40	40
Total	**15**	**20**	**30**	**40**	**40**

7 Admission Requirements

- *Provide a formal statement of admissions requirements as they will appear in the calendar entry*
- *Indicate the undergraduate or master's programs from which students may be drawn*
- *Explain any admissions requirements that are above or in addition to the normal minimum requirements for a graduate program at this level (including higher GPA, specific knowledge or skills; additional language, portfolio, letters of intent, etc.)*
    - *How will they help to ensure students are successful?*
    - *How do they align with the learning outcomes established for the program?*

Minimum Admission Requirements

- Applicants are admitted under the General Regulations of the School of Graduate Studies. Applicants must also satisfy the Department of Physiology's additional admission requirements stated below.
- Admission is based on demonstrated exceptional scholarly achievement, using the following criteria:
    - a one page statement summarizing how this program will contribute to the advancement of the applicants' professional goals
    - curriculum vitae (CV)
    - 2 letters of reference.
- Applicants must have an appropriate bachelor degree (B.Sc. or B.A.) from a recognized university with an average of at least A- in the last two years of study. The students

must have completed at least third year level physiology or equivalent courses and a demonstrated interest in physiology.

- All potential students will be interviewed prior to final acceptance into the program. The initial selection of students will be based on a combination of their academic record, individual statement and letters of reference. These students will be asked to participate in an interview with the Program Director to determine the fit with the program and student's goals. Furthermore, the interview will provide initial direction for the Program Director to identify appropriate practicum placements
- Applicants who were educated outside Canada, whose primary language is not English, and who graduated from a university where the language of instruction was not English, must demonstrate proficiency in the English language through the successful completion of the Test of English as a Foreign Language (TOEFL) with the following minimum scores: Internet-based TOEFL: 100/120 and 22/30 on the writing and speaking sections.

Other English proficiency tests are acceptable. Please consult the website for departmental standards.

8 Program Requirements

- *Please provide full Calendar entry including a formal program description as it will appear in the Calendar and program requirements including for any fields/concentrations.*
- *Describe in your own words how the program is structured and is intended to function with particular reference to how the requirements and structure of the program are appropriate to the learning outcomes. (Note that the specific Learning Outcomes and the elements that support them are outlined below.)*
- *As an Appendix, please provide a full list of all courses including course numbers, titles, and descriptions. Please indicate clearly whether they are new/existing. (Please note that new courses need to be proposed and approved separately.)*

Please refer to Appendix B

9 Program Description

- *(Section 6 focuses on academic requirements; this section focuses on the mechanics of the proposed program)*
- *Explain if the program will be offered on a full-time basis only or will also be offered part-time and if so why.*
- *What is the program length (for both full-time and part-time students)? Address how the program requirements can reasonably be completed within the proposed time period.*

- *Describe the mode of delivery of the program if distinctive (including blended or online; placement etc.) and how it is appropriate to support students in achieving the learning outcomes of the program.*
- *Describe how any distinctive elements of the curriculum (e.g., Internships, etc.) will be administered.*
- *For research-focused graduate programs, provide a clear indication of the nature and suitability of the major research requirements for degree completion*
- *Please include the standard text which has been inserted in the box*
- *Describe how the program structure and delivery methods reflect universal design principles and/or how the potential need to provide mental or physical health accommodations has been considered in the development of this program.*

The Department of Physiology Professional Masters Degree is a full-time 3 term program (1 year, 6.0 FCE) and will provide graduates with advanced knowledge in medical physiology relevant to human health. This program is intended for those individuals who would benefit from more advanced training in medical physiology for potential careers in industry, teaching and consultancies.

The Professional Masters program in Medical Physiology will consist of a total of 6.0 FCE courses at the graduate level. The course-based component (5.0 FCE) will occur in the Fall and Winter sessions (September – April) with the final 1.0 FCE comprising the Practicum. Students will enter the program as a unified cohort each year and will progress through each of the required courses together. In the event the student cannot complete courses within the program timeframe of 1 year due to physical/mental health issues, accommodations for program extensions will be made but done on a case by case basis.

The graduate courses are clustered into three sections. The first section comprises of courses that will develop and expand the students advanced knowledge of current areas of human physiology. These are Clinical Physiology course where the students will interact with specialists from a number of clinical disciplines (PSL 4030H, 0.5 FCE); a big data in health course where students will engage in a hands-on analysis of existing large data sets relevant to human physiology (Big Data and Health, PSL 4040H, 0.5 FCE); and a Collaboration and Commercialization in Physiology course where the students will acquire the skills to build collaborative teams, identify new discoveries that can be translated into products/interventions relevant to human health, and communicate their findings accurately and succinctly (PSL 4050H, 0.5 FCE).

The second section comprises of general courses focused on individual student development. As part of the Seminar and Professional Development course each student will create an Individual Development Plan (IDP) which will identify their career goals and how these are aligned with the program outcomes. The Seminar series will combine presentations from leaders in human physiology with team-based sessions where students will prepare and present presentations based on their Critical Literature review (Seminars and Professional

Development in Physiology, PSL 4000Y, 1.0 FCE). The mentored Critical Literature Review will develop the students' analytical skills to enable identification of valid new physiological knowledge that is relevant to advances in human health. The students will be required to develop a proposed intervention based on the new knowledge and communicate this in a written review and the short seminar in the PSL 4000Y course. The students will take 1.5 FCE in courses from the existing topic specific Physiology graduate offerings, the topics will be selected based on the individuals' area of interest.

The final component is a practicum (1.0 FCE, PSL 4020H) that will be completed during the Summer session (May – August), where the student will gain hands-on skills in a potential career area of interest in which physiology principles are applied to real life scenarios. From the start, the applicant's statement of intent and the information gathered at the admission interview will help determine what initial placements to discuss with the student. The successful student will be approached again about their placement interest during the first term when they take PSL4000H. This course will teach students how to network within professional circles, write effective cover letters/resumes and develop interview skills in order to help them recognize the best practicum match. By this time, the student will be exposed to enough foundational knowledge and professional skills to make a better informed decision on their practicum placement. A final measure to ensure a student is in the appropriate practicum is through regular check-ins with the Program Director before the end of the first term of the program.

Three of the new courses developed specifically for the MHSc in Medical Physiology program will address important areas in human physiological sciences. In the Clinical Physiology course (PSL 4030H) led by Dr. S-S Bolz (a professor of physiology who originally trained as a neurosurgeon) students will interact with clinical specialists in areas such as cardiovascular, paediatric, reproductive, neurosciences and respiratory health. The lectures in this course are designed with a 20 – 30 min overview of the relevant clinical physiology followed by a 20 min question and answer period where students can drill down into specific areas of interest. The second course will involve the students in a hands-on exploration of large, biological data sets. In PSL4040H - Big Data and Health, led by Dr Brian Cox, the students will use established methods (machine learning and prediction) to analyze large datasets and interpret the data in the context of human health. Students can tailor their learning experience to one of three data types: 1) Genomics: assessing the impact of gene sequencing variations on human health, 2) Gene expression: evaluating changes in gene expression for biomarkers of illness and disease progression and, 3) Physiological and clinical data sets: examining existing data sets for predictors of disease (e.g. cardiac monitor data, blood pressure, family histories).

The third of the new core course is PSL4050H - Collaboration and Commercialization in Physiology, led by Dr. Denise Belsham. This new course will focus on how to bring discoveries to the market. Specifically, the course will provide practical examples on how to expand from an individual working alone to setting up strategic collaborations and assembling teams to address specific problems. Potential collaborative partnerships include academics, biotech companies, and government agencies. Students will understand the importance of a respectful

work environment and how to nurture successful partnerships. The course will provide examples of how to recognize the key characteristics of new basic science findings that are relevant to human health and demonstrate how to engage the partners required for further development of these findings. It will take students through the basics of how to develop a business plan, utilizing the expertise of faculty who have been successful in taking their research to market. And it will require students to think "outside the box" and generate novel strategies to take their own ideas derived from new knowledge to design an intervention for a human health challenge that will also address a Canadian economic target.

Complementing the three core courses are four areas: General Physiology; Endocrine and Reproductive Sciences; Cardiovascular, Respiratory and Renal Sciences (Integrative Sciences) and Brain & Behaviour (Neurosciences). In these streams the students will learn how to apply knowledge derived from new physiological discoveries rather than engaging in individual discovery orientated research. The students will focus on developing the critical analysis skills to identify, from the mountains of new information, those discoveries that are valid and relevant to a specific health-related problem.

The second group of courses (Mentored Literature Review, Seminar Series and Practicum) are designed to provide the students with training in analytical, communication and knowledge synthesis skills. The mentored critical literature review will cover assessing the validity of newly reported physiological sciences, how to prepare an accurate and informative summary report and to design an evidence-based health intervention using the new knowledge. The Seminar Series will combine seminars from experts in human physiology with a team-based approach to preparing the students' own short presentations of their Literature Review project. These presentations will be given to the course instructor and fellow students at the end of the course. Finally, in Term 3 the students will have the opportunity to complete a practicum in a relevant sector. The placements will range from start-up companies (e.g. TECHNA), big-science research programs (e.g. with the Banting and Best Diabetes Centre), health professionals offices, and health care organizations.

10 Degree Level Expectations, Program Learning Outcomes and Program Structure

- *Identify the specific Learning Outcomes for the proposed program for each of the DLEs and describe the elements in the program's requirements that support these.*

Table 1: Master's DLEs

MASTER'S DEGREE LEVEL EXPECTATIONS (based on the Ontario Council of Academic Vice Presidents (OCAV) DLEs)	MASTER'S PROGRAM LEARNING OBJECTIVES AND OUTCOMES	HOW THE PROGRAM DESIGN AND REQUIREMENTS SUPPORT THE ATTAINMENT OF STUDENT LEARNING OUTCOMES
EXPECTATIONS: ***This MHSc (Medical Physiology) is awarded to students who have demonstrated:*** a systematic understanding of physiology and how it is relevant to human health and disease. The program is designed to provide the student with the theoretical and practical skills to undertake critical analyses of relevant research; to understand how to implement relevant new knowledge, and to function successfully in team environments. These are transferrable skills necessary for their next stage of employment and/or education. Lastly, the student have to demonstrate the ability to accurately summarize information relevant to a complex problem and communicate their analysis via a comprehensive report and oral presentation to their peers.		
1. Depth and Breadth of Knowledge A systematic understanding of 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.	Depth and breadth of knowledge is defined in MHSc (Medical Physiology) as an understanding of advanced systems physiology and how to use new physiological knowledge to effectively promote human health. There are two Learning Outcomes (LO) associated with this DLE namely: LO 1 Analyze and evaluate the validity of new physiological knowledge and its relevance to human health. LO 2 Integrate physiological information to determine those factors contributing to current societal health problems e.g. obesity and diabetes.	The program design and requirements that ensure these student outcomes for depth and breadth of knowledge are: PSL 4000Y *Seminars in Physiology & Professionalism:* this course provides a combination of seminars from experts in the field to provide the context for advances in physiology and team-based work to enhance the students' analytical skills. PSL 4100H *Clinical Physiology:* active clinicians in a variety of disciplines will interact with the students. The experts will provide a detailed overview of the current advances in their field and then engage the students in an interactive discussion session.
2. Research and Scholarship A conceptual understanding and methodological competence that i) Enables a working comprehension of how established techniques of	Research and Scholarship is defined in MHSc (Medical Physiology) as the ability of students to critically analyse the merit of published experimental data. To achieve this the students	The program design and requirements that ensure these student outcomes for research and scholarship are:

MASTER'S DEGREE LEVEL EXPECTATIONS (based on the Ontario Council of Academic Vice Presidents (OCAV) DLEs)	**MASTER'S PROGRAM LEARNING OBJECTIVES AND OUTCOMES**	**HOW THE PROGRAM DESIGN AND REQUIREMENTS SUPPORT THE ATTAINMENT OF STUDENT LEARNING OUTCOMES**
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.	will have to understand the theoretical concepts behind the experimental design of physiological studies. Although they will not undertake research projects, the students will develop critical analysis skills and be able to assess current advances in physiology. The students will work through complex questions and reach evidence-based decisions. The MHSc will provide students with an understanding of how to critically assess big biological data sets and whether appropriate tests have been employed to answer a given question related to human health. There are two LO associated with this DLE: LO 3 Adapt and analyze big data sets to determine their relevance to human health and construct interventions based on this new knowledge. LO 4 Analyze and validate current experimental approaches to research in their area of concentration e.g. General; Endocrine & Reproductive; Integrative; Neuroscience.	LO 3 PSL 4040 Big data and Health (new). Students will have a hands-on experience (with expert guidance) in analyzing existing publically available big data sets, focusing on genomic and physiological factors. They will be capable of evaluating how these big data sets are changing our understanding of human physiology. LO 4: Each student will be able to select from graduate level advanced courses in their field of interest. The existing topic specific graduate courses provide examples and interactive discussion of current advances in the experimental design and data analysis relevant to the different physiological systems. The topic courses include; for General Physiology: PSL1040 systems biology; for Integrated Physiology PSL 1080 cardiovascular physiology; and for Endocrine Physiology PSL 1067 developmental physiology. LO 4 PSL 4010Y Literature Review project (new). The mentored Literature Review project will develop the analytical skills of the student. The student and mentor will identify a specific topic related to the student's interest and the mentor's area of expertise. The student will combine information gained from the relevant in-depth courses to identify potentially important new research. Working with the mentor the student will critically review the new evidence and assess the relevance to the chosen topic.

MASTER'S DEGREE LEVEL EXPECTATIONS (based on the **Ontario Council of Academic Vice Presidents (OCAV) DLEs)**	**MASTER'S PROGRAM LEARNING OBJECTIVES AND OUTCOMES**	**HOW THE PROGRAM DESIGN AND REQUIREMENTS SUPPORT THE ATTAINMENT OF STUDENT LEARNING OUTCOMES**
3. 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 MHSc (Medical Physiology) an understanding of how to apply physiological knowledge to promote human health in health-care and related industries. There are three LO associated with this DLE: LO 5 Combine valid and experimentally sound newly published research evidence to address a given health-related problem. LO 6 Construct and virtually test an evidence-based health intervention. LO 7 Construct a pathway for product commercialization including how to support team-based collaborations.	The program design and requirements that ensure these student outcomes for application of knowledge are: LO 5 & 6 PSL 4010Y Literature review project (new). The mentored Literature Review project will enable the students to evaluate the relevance of new knowledge and how it can be implemented in a health care setting. Once the relevant evidence has been identified (LO5) an appropriate health intervention will be designed based on the new knowledge. L0 6 PSL 4020H The Practicum experience will provide an opportunity for students to directly experience how physiological knowledge is applied in their area of concentration. LO 7 PSL 4040H Collaboration & Commercialization in Physiology (new). Students will have hands on experience in how to patent new discoveries. The students will identify the collaborations necessary for success and construct a business plan to take new physiological discoveries to market.
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) a. Decision-making in complex situations; b.	Professional Capacity/Autonomy is defined in MHSc (Medical Physiology) as the acquisition of transferrable skills the students will work through the ethical decision-making process in research, and recognize how responsibility and	The program design and requirements that ensure these student outcomes for professional capacity/autonomy are: LO 7 & 8 PSL 4050 Commercialization & Collaboration will develop the students' transferable skill in reaching out

MASTER'S DEGREE LEVEL EXPECTATIONS (based on the Ontario Council of Academic Vice Presidents (OCAV) DLEs)	**MASTER'S PROGRAM LEARNING OBJECTIVES AND OUTCOMES**	**HOW THE PROGRAM DESIGN AND REQUIREMENTS SUPPORT THE ATTAINMENT OF STUDENT LEARNING OUTCOMES**
The intellectual independence required for continuing professional development; c. The ethical behavior 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.	respect are key components of a successful career. There are two LO associated with this DLE: LO 8 Competency in understanding team dynamics and ability to work and lead teams. LO 9 Compliance with professional standards including responsible conduct of research; ethical review requirements and implications of unforeseen consequences to research projects.	and developing collaborations and working in teams. Students will work together in small teams and develop an understanding of team vs individual dynamics. The students will be exposed to examples of ethical vs unethical research and the consequences of non-professional behaviour. LO8 Professionalism in Seminar series LO 7 & 8 PSL 4020Y Practicum. This will provide students with a hands-on experience of professional physiological settings. Students will be exposed to team work in a real world setting with requirements for critical decision making, ethical behaviour and the importance of responsibility and respect.
5. Communications Skills The ability to communicate ideas, issues and conclusions clearly.	Communications Skills is defined in MHSc (Medical Physiology) as the ability to summarize current medical physiological findings in an audience specific manner. In addition to be able to communicate effectively in a team environment. There are two LO associated with this DLE: LO 10 Students should be capable of providing scientific presentations (written and oral) that are comprehensible to experts in the field and the lay public. LO 11 Students should be able to work effectively with colleagues from different backgrounds in a team setting.	The program design and requirements that ensure these student outcomes for communication skills are: LO 10 PSL4010H Literature review; and PSL4000Y Seminar and Professional Development. During the mentored literature review the students will create written reports and an oral presentation for the PSL4000Y course. LO 11 In the Commercialization and Collaboration course students will work in teams to devise product-specific commercialization strategies. In the PSL4020Y Practicum; students will work with existing teams in a real-world environment.

11 Assessment of Learning

- *Please describe the methods of evaluation for the various program requirements*
- *Describe how the methods for assessing student achievement are appropriate and effective relative to established program learning outcomes and degree level expectations (in other words, how will faculty be able to determine whether students have learned and can do what we expect them to by the end of the program)*
- *Describe how the effectiveness of the proposed program be assessed.*
- *How will the program document and demonstrate the level of performance of students' consistent with the University's DLEs*

Assessment of Learning:

Mechanisms for student evaluation:
Program coursework will include a variety of assessment modalities in which students will be required to their mastery of conceptual frameworks and ability to design physiological interventions based on their knowledge. The program is designed such that the compulsory courses combine to provide the necessary repetition and depth to ensure the students are fully engaged and stimulated throughout the program.

The evaluation of student learning will be undertaken by two main mechanisms, written and oral reports. The number of written reports required reflects in part the request of future employers, who indicated the increased need for their employees to be capable of providing accurate, succinct reports in a timely manner.

Learning Outcome	Quizzes & Examinations	Written Projects	Oral Presentation
LO 1 Analyze and evaluate the validity of new physiological knowledge and its relevance to human health.		Students will prepare an in-depth, written evidence-based report, presented in clear, well-structured, precise and succinct prose, capable of publication in a scholarly journal in PSL 4010Y	Students will be evaluated on their preparation and presentation of a short talk in PSL 4000H
LO 2 Integrate physiological information to determine those factors contributing to current societal health problems e.g. obesity and diabetes.		The students will be assessed on the caliber of weekly short reports (2 pages) on the previous weeks presentation of PSL 4030H	The students will be evaluated on the level of their engagement during the weekly discussion sessions in PSL 4030H.
LO 3 Adapt and analyze big data sets to determine their relevance to human health and construct interventions based on this new knowledge.		The students will evaluated on a written report on the results of their big-data analysis in PSL 4040	

LO 4 Analyze and validate current experimental approaches to research in their area of concentration e.g. General; Endocrine & Reproductive; Integrative; Neuroscience.	Each topic-specific course will set examinations that will determine the extent of the students' knowledge.		Students will be evaluated on their level of engagement in discussion sessions in the topic specific courses. Students will be evaluated on their performance during their practicum placement.
LO 5 Combine valid and experimentally sound newly published research evidence to address a given health-related problem.		Students will prepare an in-depth, written report capable of publication in a scholarly journal in PSL 4010Y	Students will be evaluated on their preparation and presentation of a short talk in PSL 4000H
LO 6 Construct and virtually test an evidence-based health intervention.		Students will prepare an in-depth, written report capable of publication in a scholarly journal in PSL 4010Y	Students will be evaluated on their preparation and presentation of a short talk in PSL 4000H
LO 7 Construct a pathway for product commercialization including how to support team-based collaborations.		The students will be assessed on the caliber of an in-depth report concerning product development in PSL 4040H	Students will be assessed on their abilities to function effectively in a team environment during their practicum placement.
LO 8 Competency in understanding team dynamics and ability to work and lead teams.		The students will be assessed on the caliber of weekly short reports (2 pages) on the previous weeks presentation of PSL 4000Yand PSL 4040H	Students will be evaluated on their level of engagement in discussion sessions in PSL 4040H.
LO 9 Compliance with professional standards including responsible conduct of research; ethical review requirements and implications of unforeseen consequences to research projects.		The students will be assessed on the caliber of weekly short reports (2 pages) on the previous weeks presentation of PSL 4000Yand PSL 4040H	Students will be evaluated on their level of engagement in discussion sessions in PSL 4040H.
LO 10 Students should be capable of providing scientific presentations (written and oral) that are comprehensible to experts in the field and the lay public.		The students will be assessed on the caliber of weekly short reports (2 pages) on the previous weeks presentation of PSL 4030H and PSL 4040H	Students will be evaluated on their preparation and presentation of short talks in PSL 4000Hand PSL 4040H Students will be assessed on the quality of reports prepared as part of their practicum.
LO 11 Students should be able to work effectively with colleagues from different backgrounds in a team setting.			Students will be evaluated on their level of engagement in discussion sessions in PSL 4000Y and PSL 4040H.

Evaluating the effectiveness of the MHSc in meeting the desired Learning Objectives: To understand whether the program is successfully meeting the needs of the students two approaches will be followed: firstly, all students will be provided with a questionnaire to

provide feedback on the effectiveness of the individual courses to meet their needs; and secondly, we will monitor the subsequent work placements of the students.

How will the program document and demonstrate the level of performance of students' consistent with the University's DLEs?
The MHSc in Medical Physiology will establish a Program Oversight Committee which will consist of the Program Director, key faculty and two of the external practicum site leaders. Its purpose will be to review student grades and student evaluation of courses to assess whether the program is meeting its objectives. This committee will meet at least twice a year to discuss the curriculum, specifically how to identify and address gaps in the curriculum, review the assessments of practicum placements, and identify program strengths and areas for improvement.

The program has been designed to allow for flexibility in curriculum design to incorporate new knowledge in physiology, especially those concerning human health. This structured evaluation and course-planning approach will ensure that students are being provided with effective and relevant content.

The following metrics to measure the success of the program will be implemented:

1) Course Evaluations
All students will be provided with an anonymous course evaluation form to complete at the end of the course. Their responses to this will help guide subsequent revisions to the program.
2) Review of Grades and Quality of Assignments
This committee will meet two times a year to assess whether the learning outcomes of the courses delivered have been achieved by reviewing grades and the quality of assignments
3) Tracking Careers of Graduates
Once students have graduated from the program their subsequent job placements will be monitored.

12 Consultation

- *Describe the expected impact of what is being proposed on the nature and quality of other programs delivered by the unit/division*
- *Describe the expected impact of what is being proposed on programs being offered by other units/divisions*
- *Describe any consultation with the Deans of Faculties/Divisions that will be implicated or affected by the creation of the proposed program*

The initial concept of the MHSc was first raised in 2015 and involved exploratory discussions with the faculty and students across the distributed sites of the Department of Physiology with respect to the need for a professional MHSc. The response from both students and

faculty members was uniformly positive and the MHSc. in Medical Physiology is the result. The Department also interviewed individuals from local Life Sciences companies: Johnson & Johnson (Canada, R. Yu), Boehringer Ingelheim (Canada) Ltd (D. Qinn), and Merck Frosst Canada & Co (J-F. Richard). These individuals were supported of the proposed degree and help shaped the concepts behind the new degree courses, all three are potential sites for student practicums.

In the following two years additional discussions have taken place with Departments and Centres in the Faculty of Medicine and the Faculties of Arts & Science and Applied Science and Engineering.

We explored the potential need for individuals to co-ordinate and manage large, complex research projects in the health sciences with leaders of three major extra-Departmental units: the Banting and Best Diabetes Centre (Dr. G. Lewis) and the Lewar, Heart & Stroke Cardiovascular Centre (Dr. M. Farkouh) and the Institute for Biomaterials and Biomedical Engineering (Dr. C. Simmons). They are enthusiastic supporters of the proposal and their Centres would be ideal sites for student practicums. Discussions with the Institute of Medical Sciences (Dr. M-Y Liu) included the interaction between the proposed program and the existing MHSc in Translational Research in the Health Sciences that focuses on interdisciplinary collaborative research leading to innovations in bedside care. Dr. Liu was excited by the potential of the new degree and considered that the two MHSc programs will complement one another. We do not anticipate any competition for students as the target audiences are distinct. We also discussed the potential for the MHSc. in Medical Physiology to attract international students already studying at the UofT. Dr. Liu thinks that the degree will be highly attractive and increase the career prospects for these students.

The Department of Medicine is an enthusiastic supporter of the proposal and would be interested in hosting students for their practicums. Discussions with the Departments of Biochemistry, Immunology, Nutritional Sciences and Pharmacology & Toxicology were positive and in the future there may be an opportunity to share graduate courses (many of the Departments are specifically interested in the possibility of their students taking the Big Data & Health and Commercialization & Collaboration courses).

The Department has consulted with the Dean's offices in the following Faculties: Applied Science and Engineering, Arts and Sciences, Dalla Lana School of Public Health, Dentistry, Leslie Dan Faculty of Pharmacy and Rotman School of Management. In addition we have consulted with the Associate Vice-President International Partnerships (Dr. C. Yip) and the FoM Vice-Dean Graduate and Life Sciences Education (Dr. A. Kaplan). All parties are supportive of this proposal.

Units that may be affected - No other department has a Professional Masters Program with a medical physiology focus, thus it is the first of its kind at the university and would attract students with an interest in medical physiology and its applications.

Professional organizations relevant to this program area
In on-going consultations with hospital partners we have confirmed that the large Strategy for Patient-Oriented Research (SPOR) program grants awarded to FoM researchers would be sites for placements for students in the program, and that they are looking for individuals with project management and physiology backgrounds, and can accommodate the accepted number of placements.

13 Resources

- *Please be specific where this may impact significant enrolment agreements with the Faculty/Provost's Office.*
- *Indicate if the new program will affect any existing agreements with other institutions, or will require the creation of a new agreement to facilitate the major modification (e.g. Memorandum of Understanding, Memorandum of Agreement, etc.). Please consult with the Provost's Office (vp.academicprograms@utoronto.ca) regarding any implications to existing or new agreements.*

The Department of Physiology has an extensive number of faculty distributed across the St George campus and associated Toronto Academic Health Sciences Network. There are no implications for existing agreements.

The program will require a new 0.4 FTE Program Director (Dr H. Miliotis) starting July 2018 and a 0.5 FTE Program Manager starting Spring 2019 by the Department of Physiology.

The program will be housed in existing space on the 3rd floor of the Medical Sciences Building.

13.1 Faculty Complement

- *Complete Table 4 below*
- *Provide a brief commentary on:*
    - *the adequacy of the number and quality of Graduate faculty who will teach/supervise in the program*
    - *evidence that faculty have the recent research or professional/clinical expertise needed to sustain the program, promote innovation and foster an appropriate intellectual climate*
- *Provide the CVs of all faculty, as evidence substantiating the above. The Appendix should form a separate document with a table of contents and all CVs in alphabetical order. CVs should be submitted in a standardized format relevant to the proposed program field*

The Faculty
There are 5 faculty (Drs. Belsham, Bolz, Cox, Miliotis, and Wittnich) who will be responsible for delivering new courses specifically designed for the new degree. With the exception of Dr.

Miliotis, these are senior faculty with international recognition for their research excellence and extensive educational experience.

Senior physiology faculty who have had successful research careers, but are not able to support additional laboratory research focused graduate students, will participate by mentoring students in the Critical Literature review course PSL 4010Y. In addition, many of our cross-appointees with clinical and/or industry connections will contribute to the program in the Clinical Physiology course PSL4030H and provide sites for the Practicum PSL4020Y.

Challenges to complement
Our faculty are committed to the success of this new initiative as it serves to further develop outstanding curriculum and training and supports the Department financially.

Table 2: Faculty Complement (please list alphabetically)
This table covers only those faculty directly involved with the specific MHSc in Medical Physiology graduate courses and those teaching the topic-specific graduate courses. There are additional cross-appointed Clinical faculty who will be involved as needed in mentoring students in the Literature review course and providing practicums in laboratory management skills.

Name	**Home Department / Unit** *(who holds primary budgetary appointment)*	**University Rank**	**Graduate Faculty Status and graduate unit (PSL unless otherwise stated)**	**Commitment to other programs** *(please list other programs in which the person routinely teaches / supervises)*	**Nature of contribution to this program** *Course Instructor (CI), Mentor Critical Skill (MCS), Practicum Supervisor (PS).*
Tenured					
Belsham, D.	Physiology	Professor	Full	Primary supervision of PSL graduate students and teaching in PSL courses	**MHSc Advisory Committee** Mentor - Literature review PSL4010Y; Course director, PSL 4040H. **Topic specific courses**: PSL1034H course instructor; PSL1075H course instructor;

Name	**Home Department / Unit** *(who holds primary budgetary appointment)*	**University Rank**	**Graduate Faculty Status and graduate unit (PSL unless otherwise stated)**	**Commitment to other programs** *(please list other programs in which the person routinely teaches / supervises)*	**Nature of contribution to this program** *Course Instructor (CI), Mentor Critical Skill (MCS), Practicum Supervisor (PS).*
Bolz, S-S	Physiology	Professor	Full	Primary supervision of PSL graduate students and teaching in PSL courses	Mentor - Literature review PSL4010Y; Course Director PSL 4030H **Topic specific courses:** JCV3060H course director; JCV3064H course director;
Brubaker, P.L.	Physiology	Professor	Full	Primary supervision of PSL graduate students and teaching in PSL courses	**MHSc Advisory Committee**; Mentor - Literature review PSL4010Y **Topic specific course:** PSL1014H course director
Collingridge, G. *(Chair)*	Physiology	Professor	Full	Primary supervision of PSL graduate students and teaching in PSL courses	Mentor - Literature review PSL4010Y **Topic specific course:** PSL1050H course director; JYG1555H course instructor,
Cox, B.	Physiology	Assoc. Prof	Full	Primary supervision of PSL graduate students and teaching in PSL courses	**MHSc Advisory Committee;** PSL1080H course director; PSL1040H course instructor; PSL1067H course instructor; PSL 4010Y instructor; Course Director PSL 4040H, mentor Literature review PSL4010Y
Feng, Z.P	Physiology	Professor	Full	Primary supervision of PSL graduate students and teaching in PSL courses	Mentor - Literature review PSL4010Y **Topic Specific courses** PSL1026H course director;

Name	**Home Department / Unit** *(who holds primary budgetary appointment)*	**University Rank**	**Graduate Faculty Status and graduate unit (PSL unless otherwise stated)**	**Commitment to other programs** *(please list other programs in which the person routinely teaches / supervises)*	**Nature of contribution to this program** *Course Instructor (CI), Mentor Critical Skill (MCS), Practicum Supervisor (PS).*
					PSL1053H course director
Giacca, A.	Physiology	Professor	Full	Primary supervision of PSL graduate students and teaching in PSL courses	Mentor - Literature review PSL4010Y
Gramolini, A.	Physiology	Professor	Full	Primary supervision of PSL graduate students and teaching in PSL courses	**MHSc Advisory Committee**; PSL1040H course director; PSL1067H course instructor JCV3062 course instructor; Mentor - Literature review PSL4010Y
Heximer, S	Physiology	Assoc. Prof	Full	Primary supervision of PSL graduate students and teaching in PSL courses	JCV3063H course director; Mentor - Literature review PSL4010Y
Lambe, E.	Physiology	Assoc. Prof	Full	Primary supervision of PSL graduate students and teaching in PSL courses	PSL1026H course instructor; Mentor - Literature review PSL4010Y
Matthews S.G.	Physiology	Professor	Full	Primary supervision of PSL graduate students and teaching in PSL courses	Mentor - Literature review PSL4010Y

Name	**Home Department / Unit** *(who holds primary budgetary appointment)*	**University Rank**	**Graduate Faculty Status and graduate unit (PSL unless otherwise stated)**	**Commitment to other programs** *(please list other programs in which the person routinely teaches / supervises)*	**Nature of contribution to this program** *Course Instructor (CI), Mentor Critical Skill (MCS), Practicum Supervisor (PS).*
Miliotis, H	Physiology	Assist. Prof	Pending	Responsible for the operations and senior administrative duties for the MHSc in Medical Physiology	**Program Director, MHSc Advisory Committee**;
Tweed, D.	Physiology	Professor	Full	Primary supervision of PSL graduate students and teaching in PSL courses	PSL1071H course instructor
Watt, V.	Physiology	Assoc. Prof	Full	Primary supervision of PSL graduate students and teaching in PSL courses	Placement director Practicums PSL 4020Y
Wheeler, M.	Physiology	Professor	Full	Primary supervision of PSL graduate students and teaching in PSL courses	PSL1034H course director Mentor - Literature review PSL4010Y
Wittnich C.	Physiology	Professor	Full	Primary supervision of PSL graduate students and teaching in PSL courses	**MHSc Advisory Committee;** JCV1060H course director; JCV3061H course director; JCV3061H course instructor JCV3062H course director; PSL1086H course director & instructor; Course Director PSL4020Y; Mentor - Literature review PSL4010Y

Name	**Home Department / Unit** *(who holds primary budgetary appointment)*	**University Rank**	**Graduate Faculty Status and graduate unit (PSL unless otherwise stated)**	**Commitment to other programs** *(please list other programs in which the person routinely teaches / supervises)*	**Nature of contribution to this program** *Course Instructor (CI), Mentor Critical Skill (MCS), Practicum Supervisor (PS).*
Zhuo, M.	Physiology	Professor	Full	Primary supervision of PSL graduate students and teaching in PSL courses	PSL1068H course director
Others ***(please specify – i.e., Adjunct, status only, clinical faculty, visiting or other as per U of T definitions)***					
Bear, C. *(Primary Status-Only appointment)*	Physiology (primary status only)	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1048H course instructor; PSL1053H course instructor; Mentor - Literature review PSL4010Y
Belik, J. *(Primary Status-Only appointment)*	Paediatrics	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1067H course instructor, Mentor - Literature review PSL4010Y
Brown, T.J. *(Non-budgetary cross appointment)*	Ob/Gyn	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	**MHSc Advisory Committee**; PSL1020H course director; Mentor - Literature review PSL4010Y
Caniggia, I. *(Concurrent Status-Only appointment)*	Ob/Gyn	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1067H course director JCV1060H course instructor; Mentor - Literature review PSL4010Y

Name	**Home Department / Unit** *(who holds primary budgetary appointment)*	**University Rank**	**Graduate Faculty Status and graduate unit (PSL unless otherwise stated)**	**Commitment to other programs** *(please list other programs in which the person routinely teaches / supervises)*	**Nature of contribution to this program** *Course Instructor (CI), Mentor Critical Skill (MCS), Practicum Supervisor (PS).*
Carlen, P. *(*Main Status-Only appointment)*	Medicine	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	JNR144Y course instructor, Mentor - Literature review PSL4010Y
Hare, G. *(*Main Status-Only appointment)*	Anaesthesia	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	JCV3062H course instructor; Mentor - Literature review PSL4010Y
Horner, R. *(Non-budgetary cross appointment)*	Medicine	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	**MHSc Advisory Committee**; PSL1075H course director; Mentor - Literature review PSL4010Y
Jia, Z. *(Primary Status-Only appointment)*	HSC	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	JYG1555H course instructor; Mentor - Literature review PSL4010Y
Jin, T. *(Concurrent Status-Only appointment)*	Medicine	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1070H course director; Mentor - Literature review PSL4010Y
Jones, N. *(*Main Status-Only appointment)*	Paediatrics	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1014H course instructor; Mentor - Literature review PSL4010Y
Jurisicova, A. *(Concurrent Status-Only appointment)*	Ob/Gyn	Assoc. Prof	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1067H course director; PSL1040H course instructor; Mentor - Literature review PSL4010Y

Name	**Home Department / Unit** *(who holds primary budgetary appointment)*	**University Rank**	**Graduate Faculty Status and graduate unit (PSL unless otherwise stated)**	**Commitment to other programs** *(please list other programs in which the person routinely teaches / supervises)*	**Nature of contribution to this program** *Course Instructor (CI), Mentor Critical Skill (MCS), Practicum Supervisor (PS).*
Kavanagh, B. *(*Main Status-Only appointment)*	Anaesthesia	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1069H course director; Mentor - Literature review PSL4010Y
Liu, F. *(Concurrent Status-Only appointment)*	Psychiatry	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1068H course instructor; Mentor - Literature review PSL4010Y
Ng, Dominic *(*Main Status-Only appointment)*	Medicine	Assoc. Prof	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1070H course instructor; Mentor - Literature review PSL4010Y
Nostro, C. *(Primary Status-Only appointment)*	TGRI	Assist Prof	Associate	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1048H course instructor; PSL1070H course instructor; Mentor - Literature review PSL4010Y
O'Brien, C. *(*Main Status-Only appointment)*	Surgery	Assist Prof	Associate	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1014H course instructor; Mentor - Literature review PSL4010Y
Orser, B. *(*Main Status-Only appointment)*	Anaesthesia	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	**MHSc Advisory Committee**; PSL1075H course instructor; Mentor - Literature review PSL4010Y
Pausova, Z. *(Primary Status-Only appointment)*	HSC	Professor	Associate	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1024H course director; Mentor - Literature review PSL4010Y

Name	**Home Department / Unit** *(who holds primary budgetary appointment)*	**University Rank**	**Graduate Faculty Status and graduate unit (PSL unless otherwise stated)**	**Commitment to other programs** *(please list other programs in which the person routinely teaches / supervises)*	**Nature of contribution to this program** *Course Instructor (CI), Mentor Critical Skill (MCS), Practicum Supervisor (PS).*
Post, M. *(Concurrent Status-Only appointment)*	Paediatrics	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1069H course director; PSL1067H course instructor; Mentor - Literature review PSL4010Y
Prescott, S. *(Primary Status-Only appointment)*	HSC	Assoc. Prof	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1053H course instructor; JYG1555H course instructor; PSL1047H course instructor; PSL1071H course instructor; Mentor - Literature review PSL4010Y
Rogers, I. *(Concurrent Status-Only appointment)*	Ob/Gyn	Assoc. Prof	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1067H course instructor; Mentor - Literature review PSL4010Y
Salter, M *(Primary Status-Only appointment)*	HSC	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1047H course director;
Skinner, F. *(Concurrent Status-Only appointment)*	Medicine	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	**MHSc Advisory Committee**; PSL1071H course director; Mentor - Literature review PSL4010Y

Name	**Home Department / Unit** *(who holds primary budgetary appointment)*	**University Rank**	**Graduate Faculty Status and graduate unit (PSL unless otherwise stated)**	**Commitment to other programs** *(please list other programs in which the person routinely teaches / supervises)*	**Nature of contribution to this program** *Course Instructor (CI), Mentor Critical Skill (MCS), Practicum Supervisor (PS).*
Sugita. S. *(Primary Status-Only appointment)*	TWHRI	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1026H course instructor; JYG1555H course instructor; Mentor - Literature review PSL4010Y
Sun, H. *(Non-budgetary cross appointment)*	Surgery	Assoc. Prof	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1026H course instructor; Mentor - Literature review PSL4010Y
Thomas, S. *(*Main Status-Only appointment)*	Phys Ed	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	JCV3062H course instructor; Mentor - Literature review PSL4010Y
Wang, L-Y *(Primary Status-Only appointment)*	HSC	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	**MHSc Advisory Committee**; JYG1555H course director; Mentor - Literature review PSL4010Y
Wen, X-Y *(Concurrent Status-Only appointment)*	Medicine	Assist. Prof	Associate	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1040H course instructor; Mentor - Literature review PSL4010Y
Wheeler, A. *(Primary Status-Only appointment)*	HSC	Assist. Prof	Associate	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	PSL1034 course director; PSL1070H course instructor; Mentor - Literature review PSL4010Y
Zhen, M. *(Concurrent Status-Only appointment)*	Molecular Genetics	Professor	Full	Supervises graduate students in PSL and IMS. Some teaching in PSL & primary department	JYG1555H course instructor; Mentor - Literature review PSL4010Y

**Main status means that the faculty member's primary status only appointment is with the Department of Physiology*

13.2 Learning Resources

Please see the following Appendices
Appendix D: Library statement confirming the adequacy of library holdings and support for student learning
Appendix E: Statement concerning student support services.

13.3 Financial Support for Graduate Students

- *Describe the financial assistance that will be available to students in the program, and discuss its adequacy relative to the number of students and nature of the program*

These students are not eligible for stipendary support. Students will be eligible for scholarships, loans and line of credit which is typically available to Professional Masters degree-based graduate students.

13.4 Space/Infrastructure

- *Address any unique space/infrastructure requirements including renovations to existing space, new space, information technology, laboratories, or equipment etc. and how these will be accommodated*

The Department of Physiology has space available to accommodate the programme through the recent renovations to the third floor in the Medical Sciences Building.
The space is fully accessible to all students. The students choosing to complete a practicum will matched with an appropriate placement by the Program Director and Program Manager, every effort will be made to ensure all students can be accommodated in their selected work experience.

14 Quality and Other Indicators

- *Please describe the appropriateness of the faculty's collective expertise and how it contributes substantively to the proposed program and refer to specific areas of faculty strengths, innovation, and scholarly record that will contribute to the quality of the program and student experience*
- *Please describe any elements that enhance the program's diversity*

The ability of our department to engage professors with basic science, as well as real-life clinical expertise in physiology is unique. Our faculty are world-renowned in their particular fields and will be ideal mentors for students in both the Literature review projects and supervising practicums in large research teams. We have identified several Extra-

Departmental units at the University of Toronto that will be ideal sites for the students training namely: Banting and Best Diabetes Centre, Lewar, Heart & Stroke Cardiovascular Research Centre and the new Strategy for Patient-Oriented Research in Diabetic complications. The mix of clinical sciences and commercialization will attract a diverse range of students both locally in Ontario and also Nationally and Internationally. More than 50 faculty involved in the program clearly demonstrate the Department is at the frontier of medical physiology and many are involved directly in implementing physiological knowledge in direct patient care and/or commercialization of new knowledge.

Diversity is represented in at least two levels of the proposed program. Firstly, the 50 faculty are drawn from a diverse group of human health specialties meaning that the students will be exposed to a wide and diverse range of topics. Secondly, the MHSc, course will employ a variety of educational methodologies including a traditional seminar series, case-based discussions in the Clinical Physiology course, and hands on practical experience in bio-informatics/data analysis.

15 Governance Process

	Levels of Approval Required
Consultation with Provost	
Decanal and Provostial Sign-Off	
	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 MAESD (in case of new graduate degrees and programs, new diplomas)

Appendix A: Courses

MHSc (Medical Physiology)

Program courses: (total 6.0 FCEs)

Required Courses
1.0 FCE – Literature review course (PSL4010Y);
1.0 FCE - Medical Physiology Practicum (PSL4020H)
1.0 FCE – Professional Master's Program Seminars & Professional Development (PSL4000Y);
0.5 FCE - Clinical Physiology (PSL4030H);
0.5 FCE – Big Data and Health (PSL 4040H)
0.5 FCE – Collaboration and Commercialization in Physiology (PSL 4050H)

Total: 4.5 credits

Elective Courses
1.5 FCE Selected Graduate only courses to develop topic expertise tailored to individual students' requirements, each course represents 0.5 FCE.

Courses Currently Available in the Department of Physiology

Applied Physiology:

Course #	***Course title***	***Director***	***Offered***
PSL 1086H	Diving comparative physiology	C Wittnich	Sept-Dec
PSL 1026H	Advanced topics- experimental cell physiology	ZP Feng	Sept-Dec
PSL 1040H	Systems biology in Physiology	T Gramolini	Jan-April
PSL 1075H	Biology in time	R Horner	Sept-Dec
PSL 1048H	Translational Physiology from molecules, model systems to the clinic.	L. Schlichter	Sept-Dec

Integrative Sciences:

Cardiovascular

Course #	***Course title***	***Director***	***Offered***
JCV 3060H	Advanced Topics Cardiovascular Sciences – Molecular Biololgy & Signal transduction	SS Bolz	Sept-Dec
JCV 3062H	Advanced Topics Cardiovascular Sciences - Heart Function (alternate year)	C Wittnich	Sept-Dec
JCV 3064H	Advanced Topics Cardiovascular Sciences - Microvascular Medicine	SS Bolz	Sept-Dec

JCV 1060H	Developmental Cardiovascular Translational Physiology	C. Wittnich	Jan-April
JCV 3061H	Advanced Topics Cardiovascular Sciences -hormones & CV system	C Wittnich	Jan- April
JCV 3063H	Advanced Topics Cardiovascular Sciences - Vascular (alternate year)	S Heximer	Jan-April)

Respiratory

Course #	***Course title***	***Director***	***Offered***
PSL1036H	Advanced Topics: Respiration (alternative year)	J. Duffin	Jan-April
PSL1069H	Advanced Topics: Respiratory Physiology (alternative year)	M. Post/ B. Kavanagh	Jan-April

Gastrointestinal (1 avail yearly)

Course #	***Course title***	***Director***	***Offered***
PSL1014H	Advanced Topics: The Gastrointestinal Epithelium	P Brubaker	Jan-April

Endocrine Sciences

Development/Reproduction (4 avail yearly)

Course #	***Course title***	***Director***	***Offered***
PSL 1067H	Advanced techniques in developmental physiology	I Caniggia/A Juriscova	Sept-Dec
PSL 1080H	Investigative developmental Physiology	B Cox	May-Aug
PSL 1020H	Reproductive physiology (new)	T Brown	Sept-Dec
JCV 1060H	Developmental Cardiovascular - bench to bedside	C Wittnich	Jan-April

Endocrine/Diabetes (2 avail yearly)

Course #	***Course title***	***Director***	***Offered***
PSL 1034H	Advanced topics- metabolic disorders	M Wheeler	Sept-Dec
PSL 1070H	Advanced Topics: Hormone Action (alternative year)	A Lam	Jan-April

Neuro Sciences (3 avail yearly)

Course #	***Course title***	***Director***	***Offered***
JYG1555H	Advanced Topics: Cellular and Molecular Neurobiology (alternative year)	L.Y. Wang	Jan-April
PSL1072H	Advanced Topics - Neural Basis for Sensation	S Prescott	Sept-Dec
PSL1047H	Advanced Topics: Somatosensory & Pain Neuroscience	M Salter	Jan-April
PSL1050H	Advanced Topics – The Hippocampus from Cell to Behaviour (alternative year)	M Wojtowicz	Sept-Dec
PSL1068H	Advanced Topics – Molecular Basis of Behaviour (alternative year)	M. Zhou	Sept-Dec

Sleep (1 avail yearly)

Course #	***Course title***	***Director***	***Offered***
PSL 1075H	Biology in time	R Horner	Sept-Dec

Course Descriptions

CORE - Mandatory Courses - 4.5 FCEs

Course #	***Course title & Description***
PSL4000Y **1.0 FCE**	Seminars in Physiology and Professional Development (new) *The course will dovetail with two other seminar courses: PSL1000 for MSc students and PSL2000 for PhD students. It consists of attending 12 seminars in Physiology during the academic year. For this course, 6 of these seminars will be specially created and targeted for the MHSc trainees. These will include professional development, career planning, biotechnology, statistics, and other career-related seminars. The other six seminars will be joint seminars with the PSL1000/2000 courses, given by either Physiology faculty or invited experts. Further, for this designated course, the graduate students will be required to present a seminar based on their Literature review project, which is a required part of the degree*
PSL4010Y **1.0 FCE**	Physiology Literature Review Project (new) *The core objective of this course is for the student to conduct an in-depth scholarly literature review (with individual mentorship from a Physiology faculty member) that will result in a publishable scholarly piece of written work. This written work will be on a current health challenge (e.g. obesity, stroke), supervised by a faculty member from the Department of Physiology. The student and mentor will establish deliverables and expected timelines that should be met to ensure scholarly excellence. The timing for this course would be throughout first two terms, with final report submission and an oral presentation in the Spring.*
PSL4020H **1.0 FCE**	Physiology Practicum (new) *During the summer term students will obtain a placement in a local or regional work environment. At the placement, students will apply knowledge gained from their course work and gain practical skills in a real work environment. Additionally, students will network with other employees and potential employers providing them with valuable contacts for career development. A wide range of work environments will be made accessible to these students spanning private and public sectors. The students will be evaluated on their integration and participation in the work environment and their ability to perform the required tasks. The placement supervisor will submit a written report on each student using a pre-agreed format that will be shared with the student at the start of the practicum.*
PSL4030H **0.5 FCE**	Clinical Physiology (new) *This course will demonstrate real world examples of medical physiology. Experts in different medical disciplines will utilize patient examples to illustrate: 1) integration of key physiological principals; 2) how physiological systems maintain homeostasis under differing conditions relevant to medicine; 3) how systems break down and the consequences of disease. The cases presented will be discussed in depth and be selected from the following four areas: 1) cardiovascular; 2) neurological; 3) reproduction; 4) endocrine. The course format will be weekly two hour sessions focused on a given case led by a clinical faculty member who is an expert in the area.*
PSL4040H **0.5 FCE**	Big Data and Health (new) *The students will use established methods (machine learning and prediction) to analyse large datasets and interpret the data in the context of human health. Students can tailor their learning experience to one of three data types: Genomics, assessing sequencing variation, Gene expression, evaluating changes in gene expression for biomarkers of illness and Physiological and clinical data sets (e.g. cardiac monitor, blood pressure, family histories) for prediction of disease. The students will be evaluated on their ability to complete data analyses and create prediction profiles based on their analyses.*
PSL4050H **0.5 FCE**	Collaboration and Commercialization in Physiology. (new) *This new course will focus on bringing discoveries to the market. Specifically, the course will provide practical examples on how to expand from an individual working alone to setting up strategic collaborations. Potential collaborative partnerships include academics, biotech companies, and government agencies. Students will understand the importance of a respectful work environment and how to nurture these partnerships. The course will provide examples of how to recognize the key characteristics of new basic science findings that are relevant to human health and demonstrate how to engage the partners required for further development of these findings. It will take students through the basics of how to develop a business plan, utilizing the expertise of faculty who have been successful in taking their research to market. The students will be assessed on their abilities to develop a business plan, understanding of respectful/supportive team dynamics and ability to derive a marketing strategy.*

Elective Courses

Breadth (6 avail yearly)

Course #	***Course title & Description***
PSL1048H **0.5 FCE**	Translational Physiology from Molecules to Model Systems to the Clinic: *In this course students will be exposed to published examples 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, and awareness of translational medicine resources, including journals, local seminars, centers 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.*
PSL1086H **0.5 FCE**	Comparative Systems Approach to Diving Physiology: *This specialized course will compare and contrast the physiologic and anatomical adaptations experienced by the different species of marine mammals in contrast to humans. In order to accomplish this the following areas will be explored in depth using key published scientific articles: physiologic and anatomic adaptations of the skeleton/musculature that facilitates swimming; overview of diving and its effects in humans; diving and marine mammals - what makes them so special; overview of human vs marine mammal cardiac and vascular physiology; their structural adaptations to facilitate diving; comparative lung physiology adapted to diving; blood and tissue oxygen carrying capacity; feeding & reproduction; renal homeostasis during diving, role of the neuro-endocrine system and comparative deep diving systemic effects. Where relevant the application of this knowledge to human health issues will also be discussed.*
PSL1026H **0.5 FCE**	Advanced Topics- Experimental Cell Physiology: *This course presents experimental approaches to cell physiology, with particular attention to electrical and optical recordings, and how these measurements can be employed to study the intrinsic membrane properties of various cell types, and the mechanisms of cell signaling and secretion. The main objective of the course is to provide students with the opportunity to understand physiological techniques commonly used in multiple fields, including neurobiology, endocrinology, cardiovascular, respiratory, developmental, and reproductive physiology. The course will focus on assisting the students with a contemporary understanding of not only the principles of the selected techniques, but also their applications and limitations. The course provides opportunities to participate in and/or to observe hands-on experiments with selected techniques, as well as related data analysis.*
PSL1040H **0.5 FCE**	Systems Biology in Physiology: *Systems biology is a recent area of science that links general medical scientific research approaches with 'large scale' analyses. The overall goal of systems biology science is to connect complex biological networks with biochemical and physiological outcomes. Systems biology platforms include many of the 'omic' disciplines such as: genomics, epigenetics, transcriptomics, network signaling, metabolomics, interactomics, lipidomics and proteomics. Links between cellular physiology and systems biology have profound significance to our understanding of general physiology. This course will teach students of these recent developments, and importantly, enable them to extract and utilize information at the systems biology level. The course will begin with a set of general lecture overviews of the approaches available, basic theory, and application. The remaining lectures will be student-driven, seminar-based discussions with faculty members as facilitators of this discussion. The course will cover the major systems biology literature and technical approaches. The general course detail will be relatively narrow given the topics covered, however the written essay will provide the student sufficient opportunity to explore one area in greater detail.*
PSL1053H **0.5 FCE**	Advanced Topics: Critical assessment of Ion Channel Function: *This course will provide graduate students with a broad exposure to a range of current research areas related to ion channels. Critical advances and papers dealing with ion channel structure and function will be covered. For example, activation gating of cation channels, inactivation mechanisms in cation channels, mechanisms of ion permeation and selectivity in cation channels, modulation of expression and function by accessory subunits in cation channels, permeation and regulation of water channels, allosteric*

	regulation of cation channels (by ions, lipids and phosphorylation), chloride channel regulation, and mathematical and computer modeling of ion channels.

Possible other breadth course options (4 avail yearly)

Course #	***Course title***
PSL1067H **0.5 FCE**	Advanced Topics: Advances and Techniques in Developmental Physiology: *This course is an interactive seminar course (student-oriented) designed to expose students to a wide range of current scientific advances/techniques in the general field of developmental physiology with the specific scope of understanding their application to examine developmental changes responsible for alteration of perinatal physiological function. The overall scope of this course is to teach/educate graduate students on current scientific advances and techniques in the field of developmental physiology.*
PSL1075H **0.5 FCE**	Biology in time: *Time is as much a niche in biology as physical space and behavior, and all of bacteria, fungi, plants and animals retain a sense of time and organize their physiological processes accordingly. The molecular machinery for a hard-wired and well-preserved temporal organization of physiological processes - especially circadian and rest-activity cycles - optimally suits every organism and the chemical machinery that drives them to the conditions of life. These rhythms of life are deeply rooted in ancient biology and have been conserved over time. Humans are the only organisms that now purposefully disrupt and coerce the natural rest-activity cycles and daily rhythms of our component cellular machinery to suit the demands of modern society. As examples, sleep and biological rhythm disturbances affect one in four Canadians, and have deleterious effects on cellular, organ, organismal and societal functions and health. Humans also now consume drugs in huge quantities to counter the problems associated with poor sleep, altered waking functions and disrupted rhythms, with enormous costs to the health care system. The goal of this course is for trainees to gain a broad perspective on the important role of time-dependent physiological processes to cellular and organismal functions, and how disruption of these cycles can have deleterious effects on cellular, organ and organismal health. Understanding the cellular and neuronal machinery underlying such time-dependent processes has led to major breakthroughs in topics of broad interest, including mechanisms of sleep, sedation and anesthesia, brain plasticity and learning, neurodegenerative and psychiatric disorders, endocrinology and metabolism, as well as diverse areas of clinical medicine and health care initiatives.*
PSL1080H **0.5 FCE**	Advanced Topics: Investigative Developmental Physiology: *This course represents an excellent opportunity to develop skills in presentation and critical analysis. Students need not have a strong background in many of the topics covered. In fact, a major goal of the course is to broaden the interdisciplinary background of the participants. Students will have the opportunities to hear lectures from and to meet international experts in multiple aspects of Developmental Physiology: Embryo Patterning and Organogenesis;* *Placentation and Birth; Neurodevelopment; Cardiovascular Development and Function; Developmental Origins of Health and Disease*

Focused Specialty Topic Course Options (Depth courses)

Cardiovascular (4 avail yearly)

Course #	***Course title***
JCV3060H **0.5 FCE**	Advanced Topics in Cardiovascular Sciences – Molecular Biology & Heart Signal Transduction: *This course is one of a set of five 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.*
JCV3062H **0.5 FCE**	Advanced Topics in Cardiovascular Sciences -Heart Function (alternate yr): *This course is one of a set of five advanced seminar half-credit courses dealing with current areas in the cardiovascular system. Specifically, JCV3062H covers all aspects of heart function from ultra-structure and gene regulation to whole organ and response to various environmental and disease states.*
JCV3064H **0.5 FCE**	Advanced Topics in Cardiovascular Sciences- Microvascular Medicine: *This course is one of a set of five advanced seminar half-credit courses dealing with current research areas in the cardiovascular system. Specifically, JCV3064H will provide a translational perspective on Microvascular medicine and progress from new molecular concepts of microvascular function to evaluating their clinical applicability and therapeutic value.*
JCV1060H **0.5 FCE**	Developmental Cardiovascular Physiology: *This course covers the development of the cardiovascular system from conception to adulthood with particular emphasis on the progressive maturational changes from fetus to adult, age related differences and developmental problems. Topics include: Embryology and fetal development; Post-natal changes at birth; Maturational changes in the cardiopulmonary system from infancy to adulthood.*
JCV3061H **0.5 FCE**	Advanced Topics in Cardiovascular Sciences -Hormones & Cardiovascular System: *This course is one of a set of five advanced seminar half-credit courses dealing with current research areas in the cardiovascular system. Specifically, JCV3061H focuses on hormonal influences and its role in the regulation of the cardiovascular system.*
JCV3063H **0.5 FCE**	Advanced Topics in Cardiovascular Sciences - Vascular (alternate year): *This course is one of a set of five advanced seminar half-credit courses dealing with current research areas in the cardiovascular system. Specifically, JCV3063H covers all aspects of the vascular system from genetic to molecular, including developmental biology, the diseased state and clinical treatments.*

Comparative Physiology

Course #	***Course title***
PSL1086H **0.5 FCE**	Comparative Systems Approach to Diving Physiology: *This specialized course will compare and contrast the physiologic and anatomical adaptations experienced by the different species of marine mammals in contrast to humans. In order to accomplish this the following areas will be explored in depth using key published scientific articles: physiologic and anatomic adaptations of the skeleton/musculature that facilitates swimming, overview of diving and its effects in humans; diving and marine mammals - what makes them so special; overview of human vs marine mammal cardiac and vascular physiology; their structural adaptations to facilitate diving; comparative lung physiology adapted to diving; blood and tissue oxygen carrying capacity; feeding & reproduction; renal homeostasis during diving, role of the neuro-endocrine system and comparative deep diving systemic effects. Where relevant the application of this knowledge to human health issues will also be discussed.*

Development/Reproduction (4 avail yearly)

Course #	***Course title***
PSL1067H **0.5 FCE**	Advanced Topics: Advances and Techniques in Developmental Physiology (alternative year): *This course is a half-term interactive seminar course (student-oriented) designed to expose students to a wide range of current scientific advances/techniques in the general field of developmental physiology with the specific scope of understanding their application to examine developmental changes responsible for*

	alteration of perinatal physiological function. The overall scope of this course is to teach/educate students on current scientific advances and techniques in the field of developmental physiology.
PSL 1020H **0.5 FCE**	Current Topics in Reproductive Endocrinology and Infertility: *This seminar style course will provide students with an in-depth knowledge of physiology related to major clinically relevant pathologies and topics in human reproduction. The course will consist of discussion of emerging topics in regulation of reproductive hormone activity and male and female reproductive physiology and will bring together clinical and research aspects of the topics. The majority of the course will focus on infertility. Topics in pregnancy and parturition will not be included (as these are the focus of PSL1421H). The course consists of 13 two-hour meetings, 12 of which will involve student presentations of recent and impactful research articles. Depending on enrollment, students will be divided into groups of three, with each group responsible for presentation of assigned core papers and papers of their choosing.*
JCV1060H **0.5 FCE**	Developmental Cardiovascular Physiology: *This course covers the development of the cardiovascular system from conception to adulthood with particular emphasis on the progressive maturational changes from fetus to adult, age related differences and developmental problems. Topics include: Embryology and fetal development; Post-natal changes at birth; Maturational changes in the cardiopulmonary system from infancy to adulthood.*
PSL1080H **0.5 FCE**	Advanced Topics: Investigative Developmental Physiology: *This course represents an excellent opportunity to develop skills in presentation and critical analysis. Students need not have a strong background in many of the topics covered. In fact, a major goal of the course is to broaden the interdisciplinary background of the participants. Students will have the opportunity to hear lectures from and to meet international experts in multiple aspects of Developmental Physiology: Embryo Patterning and Organogenesis; Placentation and Birth; Neurodevelopment; Cardiovascular Development and Function; Developmental Origins of Health and Disease.*

Endocrine/Diabetes (2 avail yearly)

Course #	***Course title***
PSL1034H **0.5 FCE**	Advanced Topics- Metabolic Disorders: *This is a seminar-based course that covers very recent papers and research topics in the areas of endocrinology and metabolism. The objective of this course is to improve analytical and critical thinking skills of students who have a keen interest and have a good background in at least one of the general topic areas (endocrinology or metabolism).*
PSL1024H **0.5 FCE**	Advanced Topics: Neuroendocrinology (alternative year): *This course is a seminar course and focuses on the multidisciplinary approach to the study of neuroendocrine systems in health and disease. There are six sections dealing with interrelated topics, all facilitated by professors with research expertise in the subject. Each topic will be assessed at multiple levels, ranging from populations and patients to experimental models and molecules. The overall objective of the course is to broaden the interdisciplinary background of the participants. Students will learn proper presentation techniques, expand their scientific writing abilities, and have the ability to critically judge scientific research in the field. The most up-to-date research and technologies will be presented, which will facilitate the student's own research design and encourage independent scientific judgement. Background knowledge of endocrinology is essential (PSL302Y is recommended). No textbook provides adequate coverage for the material presented due to the up-to-date format; therefore, pdfs of recent research articles on each subject will be available for each lecture.*
PSL1070H **0.5 FCE**	Advanced Topics: Hormone Action (alternative year): *The overall goal of this seminar style course is to teach students how to read and analyze scientific papers. To achieve this goal, students will be first assigned a specific paper to read, and will then present the latest physiology and molecular endocrinology findings within the paper on hormone action in the context of the study of metabolism, obesity, and diabetes. The faculty will foster an environment to guide, facilitate, and discuss major findings of the papers with the presenter and their classmates. The students will learn how to (a) make use of the latest, as well as the well-established, experimental approaches to study how various hormones exert their functional effects on metabolic organs in regulating energy homeostasis; (b) evaluate the paper with a critical assessment; and (c) suggest potential experiments to address the limitation of the current study. Students will also learn the classic, as well as the latest, discoveries in the study of metabolism, diabetes and obesity. Based on what they have learned during the presentations and discussions, the students will then individually write a literature review on their choice of a topic discussed in class.*

Gastrointestinal (1 avail yearly)

Course #	***Course title***
PSL1014H **0.5 FCE**	Advanced Topics: The Gastrointestinal Epithelium: *The gastrointestinal epithelium is a complex biological system that comprises the largest organ in the body. Originating from stem cells in the crypts, the epithelial cells differentiate and migrate to form the crypt-villus unit which carries out the unique digestive, absorptive, secretory, endocrine, barrier and immune functions of the gut, as well as interactions with the gut microbiota. Consistent with the large number of physiological roles of the gut, diseases of the gastrointestinal epithelium are commonly associated with morbidity. This seminar-style course will consider the various functions of the gastrointestinal epithelium through student presentations and class discussion of selected recent publications from the literature, as well as through manuscript and grant reviews.*

Neurosciences (3 avail yearly)

Course #	***Course title***
PSL1050H **0.5 FCE**	Advanced Topics: The Hippocampus from Cell to Behaviour (alternative year): *The link between cellular mechanisms, such as synaptic plasticity and animal behaviour, such as learning, is still elusive, but researchers are beginning to bridge the gap. One approach is to build computational or conceptual models made up of modules with each module corresponding to a cellular element. The functional contribution of each module to the system (the animal) can then be tested by experimental manipulation. Clarity of ideas is greatly enhanced when this experimentation is guided by predictions (right or wrong) from a computational approach. Ultimately, the convergence of experimental and computational approaches will lead to better understanding of how various parts of the brain contribute to behaviour.*
PSL1068H **0.5 FCE**	Advanced Topics: Molecular Basis of Behaviour (alternative year): *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, the course will explore learning and memory, pain and drug abuse.*
JYG1555H **0.5 FCE**	Advanced Topics: Cellular and Molecular Neurobiology (alternative year): *This course is jointly sponsored by the departments of Physiology, Medical Genetics & Pharmacology. Medical Genetics students taking JYG1555 are required to participate for an appropriately shorter period as required by their department and are evaluated accordingly. This course will provide graduate students with a broad exposure to a range of research areas in molecular neurobiology. However, this course is not simply a general review. Students from various backgrounds in neurobiology will be exposed to a critical understanding of current research objectives in a number of major areas of study. For example, a student with expertise in ion channels will have the opportunity to explore areas of development and plasticity as well as be exposed to techniques in molecular biology and genetics within this context. Students need not have extensive background in all areas of neurobiology.*
PSL1071H **0.5 FCE**	Advanced Topics: Computational Neuroscience (alternative year): *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 such as types of neuron and network models, and techniques from dynamical systems theory that are used to analyze different models. The emphasis in this course will be on understanding the neurobiological basis and assumptions in models and insights and understanding that can be achieved from the models and analyses. The overall objective of this course is to foster an appreciation for combinations of modeling, experiment and theory in the field so that students can read and critically evaluate computational neuroscience papers. This course is expected to enhance collaborative research training by teaching students how to interact as well as expanding and enriching their view of theoretical and non-theoretical research interactions in the future. This course is also meant to help break down communication barriers between different disciplines and to encourage dialogue between theoretical and non-theoretical type individuals.*
PSL1047H **0.5 FCE**	Advanced Topics: Somatosensory & Pain Neuroscience:

	This course provides a wide coverage of all aspects of the somatosensory system and deals with psychophysical studies, general somatosensory theories, receptors and primary afferents, and anatomical and electrophysiological aspects of central structures. Recent topics of interest will be discussed. The course will consist of a preliminary series of lectures to provide background material and an overview of the field, which will then be followed by presentations and discussion of original classical and current state of the art papers assigned to individual students. These papers will be chosen so as to cover most of the major topics. During this first part of the course (4 weeks) the students are expected to learn the basics of the somatosensory system and pain from readings in textbooks, assigned papers, lectures and classroom discussions.

Respiratory

Course #	***Course title***
PSL1036H **0.5 FCE**	Advanced Topics- Respiration (alternative year): *This course is designed for students whose main research interest is in the field of respiratory physiology. It provides a view of the leading research in this field, as well as some of the experimental techniques in current use.*
PSL1069H **0.5 FCE**	Advanced Topics - Respiratory Physiology (alternative year): *This course aims to provide students with a broad foundation in respiratory physiology. Students will participate in presentations and discussions on all aspects of physiology as it pertains to the respiratory system, and will focus on basic as well as applied aspects. Specifically, lung structure, development and host defenses will be integrated with lung mechanics and theories of gas exchange and control of breathing; novel approaches in pulmonary medicine and investigation, as well as environmental aspects will also be covered. The course will consolidate approaches characteristic of classical physiology and integrate contemporary experimental methodology and clinical application. High caliber papers and essay topics will be selected to introduce the student to key concepts and novel contemporary research.*

Sleep (1 avail yearly)

Course #	***Course title***
PSL1075H **0.5 FCE**	Biology in time: *Time is as much a niche in biology as physical space and behavior, and all of bacteria, fungi, plants and animals retain a sense of time and organize their physiological processes accordingly. The molecular machinery for a hard-wired and well-preserved temporal organization of physiological processes - especially circadian and rest-activity cycles - optimally suits every organism and the chemical machinery that drives them to the conditions of life. These rhythms of life are deeply rooted in ancient biology and have been conserved over time. Humans are the only organisms that now purposefully disrupt and coerce the natural rest-activity cycles and daily rhythms of our component cellular machinery to suit the demands of modern society. As examples, sleep and biological rhythm disturbances affect one in four Canadians, and have deleterious effects on cellular, organ, organismal and societal functions and health. Humans also now consume drugs in huge quantities to counter the problems associated with poor sleep, altered waking functions and disrupted rhythms, with enormous costs to the health care system. The goal of this course is for trainees to gain a broad perspective on the important role of time-dependent physiological processes to cellular and organismal functions, and how disruption of these cycles can have deleterious effects on cellular, organ and organismal health. Understanding the cellular and neuronal machinery underlying such time-dependent processes has led to major breakthroughs in topics of broad interest, including mechanisms of sleep, sedation and anesthesia, brain plasticity and learning, neurodegenerative and psychiatric disorders, endocrinology and metabolism, as well as diverse areas of clinical medicine and health care initiatives.*

Appendix B: Graduate Calendar Copy

Physiology: Introduction
Faculty Affiliation: Medicine

Degree Programs: Physiology
MSc
PhD

Degree Programs: Medical Physiology
MHSc

Combined Degree Programs
MD / PhD

Collaborative Programs
The following collaborative programs are available to students in participating degree programs as listed below:

- Biomedical Engineering
- Physiology, MSc, PhD
- Cardiovascular Sciences
- Physiology, MSc, PhD
- Developmental Biology
- Physiology, MSc, PhD
- Human Development
- Physiology, PhD
- Neuroscience
- Physiology, MSc, PhD
- Resuscitation Sciences
- Physiology, MSc, PhD

Overview
In the Department of Physiology, research ranges from the gene level to the organism level in areas including endocrinology and diabetes; reproduction endocrinology; fetal physiology, pregnancy, and parturition; neuroendocrinology; cardiorespiratory regulation; gastrointestinal motility; sensory physiology; motor control; brain development and aging; ionic channels and synaptic transmission; excitability, ultrastructure, and plasticity of the brain.

Contact and Address
Web: www.physiology.utoronto.ca
Email: graduate.physiology@utoronto.ca
Telephone: (416) 978-2601

Fax: (416) 978-4940

Department of Physiology
University of Toronto
Room 3217, Medical Sciences Building
1 King's College Circle
Toronto, Ontario M5S 1A8
Canada

Physiology: Medical Physiology MHSc
Master of Health Science

Program Description
The Department of Physiology's Master of Health Sciences (MHSc) in Medical Physiology is a professional course-based Masters program. The program is designed to provide graduates with the analytical and professional skills to lead large team-science projects in the bio-sciences and develop their own consultancy company.

The MHSc in Medical Physiology blends advanced topic-specific physiology courses with a mentored current Literature Review (where graduates acquire the critical analysis skills to identify new knowledge relevant to specific problems in human health), Commercialization and Collaboration (where students will acquire skills to understand how to commercialize new discoveries and how to work in a team science environment) and a practicum opportunity (where students will experience how physiological knowledge is applied to real-life scenarios in their area of interest). Each graduate will develop the analytical and communication skills to design and implement new health interventions. The students will develop an individual program based on their area of interest.

Admission Requirements
Applicants are admitted under the General Regulations of the School of Graduate Studies and must also satisfy the Department of Physiology's additional admission requirements stated below:

- Admission is based on demonstrated exceptional scholarly achievement, using the following criteria:
    - a one page statement summarizing how this program will contribute to the advancement of the applicants' professional goals
    - curriculum vitae (CV)
    - 2 letters of reference.
- Applicants must have an appropriate bachelor degree (B.Sc. or B.A.) from a recognized university with an average of at least A- in the last two years of study. The students must have completed at least third year level physiology or equivalent courses and a demonstrated interest in physiology.

- All potential students will be interviewed prior to final acceptance into the program. The initial selection of students will be based on a combination of their academic record, individual statement and letters of reference. These students will be asked to participate in an interview with the Program Director to determine the fit with the program and student's goals. Furthermore, the interview will provide initial direction for the Program Director to identify appropriate practicum placements
- Applicants who were educated outside Canada, whose primary language is not English, and who graduated from a university where the language of instruction was not English, must demonstrate proficiency in the English language through the successful completion of the Test of English as a Foreign Language (TOEFL) with the following minimum scores: Internet-based TOEFL: 100/120 and 22/30 on the writing and speaking sections. Other English proficiency tests are acceptable. Please consult the website for departmental standards.

Program Requirements

All students are required to take 6.0 FCEs full-course equivalents (FCEs) in physiology courses, with the following guidelines:

- 1.0 FCE in PSL 4000Y Seminars and Professional Development in Physiology, mandatory for all students
- 1.0 FCE in PSL 4010Y Mentored Literature Review Project in Physiology mandatory for all students
- 1.0 FCE in PSL 4020Y Practicum in Physiology
- 0.5 FCE in PSL 4030H Clinical Physiology mandatory for all students
- 0.5 FCE in PSL 4040H Big Data and Health mandatory for all students
- 0.5 FCE in PSL 4050H Collaboration and Commercialization in Physiology mandatory for all students
- 1.5 FCE selective in one of the four areas: General Physiology; Endocrine and Reproductive Sciences; Cardiovascular, Respiratory and Renal Sciences (Integrative Sciences); and Brain and Behaviour (Neurosciences).

Students will be matched with a mentor and practicum placement in consultation with the relevant Course Director and the Department of Physiology Professional Masters Program Director.

Program Length

3 terms full-time (typical registration sequence: F/W/S)

Time Limit

3 years full-time

Appendix C: Undergraduate Student Survey

In 2015, a survey was sent out to undergraduate physiology students to explore their career interests The survey was circulated to Physiology undergraduate specialists, majors and minors students (N ~1000 students) and 105 individuals responded. Below are the results.

Q1: What are your Career Goals?

	%	Number
Health Professional	**79.05%**	**83**
Scientist	12.38%	13
Business	1.90%	2
Education	1.90%	2
Other	4.76%	5
Total	**100%**	**105**

Q2: If you chose Professional Medical in Question 1, please indicate the preferred career field.
Answered: 85 Skipped: 20

	%	Number
MD	70.59%	60
DDS	5.88%	5
DVM	1.18%	1
Physiotherapist	14.12%	12
Other	8.24%	7
Total	**100%**	**85**

(Responses under the category Other include: Pharmacist, Optometry, Occupational Therapist, Physician's Associate, Phar.D., Nursing, MD/PhD, and Clinician Scientist)

Q3: If you chose Scientist in Question 1, please indicate the preferred career field.
Answered: 25 Skipped: 80

	%	Number
Academia	44.0%	11
Industry	44.0%	11
Other	12.0%	3
Total	**100%**	**25**

(Responses under the category Other include: Public Health)

Q4: Would you consider enrolling in a Professional MSc Program, if it would enhance your future career success? (choose one**)** **Answered: 104 Skipped: 1**

	%	Number
Yes	67.31%	70
No	2.88%	3
Not sure/Need to know more	29.81%	31
Total	**100%**	**104**

Q5: What length of time would you prefer for a Professional MSc Program? (Rank preferences 1 highest - 4 lowest). Your ranking will automatically be re-ordered**.** **Answered: 103 Skipped: 2**

	Ranking					
	1	**2**	**3**	**4**	**Total**	**Score**
1 year program, 3 terms (May - April)	43.69% (45)	36.89% (38)	13.59% (14)	5.83% (6)	103	3.18
1 year program, 3 terms (Sept - Aug)	34.95% (36)	45.63% (47)	9.71% (10)	9.71% (10)	103	3.06
1.5 year program, 4 terms (May - Aug)	12.62% (13)	9.71% (10)	69.90% (72)	7.77% (8)	103	2.27
2 year program, 6 terms	8.74% (9)	7.77% (8)	6.80% (7)	76.70% (79)	103	1.49

Numbers in brackets represent the number of responses

Appendix D: University of Toronto Libraries Report

University of Toronto Libraries Report for Professional Masters Degree in Medical Physiology, Faculty of Medicine, 2017

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 campus and college libraries comprise over 12 million print volumes, 5.6 million microform volumes, more than 17,000 journal subscriptions, in addition to a rich collection of manuscripts, films, and cartographic materials. The system provides access to more than 1.9 million electronic books, journals, and primary source materials 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 University of Toronto Library system has an annual acquisition budget of $31 million. 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]					
	2010-2011	**2011-2012**	**2012-2013**	**2013-2014**	**2014-2015**
ARL RANK	**UNIVERSITY**	**UNIVERSITY**	**UNIVERSITY**	**UNIVERSITY**	**UNIVERSITY**
1	Harvard	Harvard	Harvard	Harvard	Harvard
2	Yale	Yale	Yale	Yale	Yale
3	**Toronto (3rd)**	**Toronto (3rd)**	**Toronto (3rd)**	**Toronto (3rd)**	Columbia
4	Michigan	Columbia	Columbia	Columbia	**Toronto (4th)**
5	Columbia	Michigan	Michigan	Michigan	Michigan

[1] Chronicle of Higher Education, "Library Investment Index at University Research Libraries, 2014 – 2015." In the Almanac of Higher Education, 2015. http://www.chronicle.com/interactives/almanac-2016?cid=cp51#id=65_416

[2] Figures as of 2014 taken from UTL's 2015 Annual Report and 2013-2014 annual statistics. https://onesearch.library.utoronto.ca/sites/default/files/annual_reports/annualreport-2015.pdf and https://onesearch.library.utoronto.ca/annual-statistics/2013-2014

[3] Association of Research Libraries Statistics, 2014-15 http://www.arlstatistics.org/analytics

Top 5 Canadian Universities in the ARL Ranking of Major North American Research Libraries				
2010-2011	**2011-2012**	**2012-2013**	**2013-2014**	**2014-2015**
RANK/ UNIVERSITY	**RANK/ UNIVERSITY**	**RANK/ UNIVERSITY**	**RANK/ UNIVERSITY**	**RANK/ UNIVERSITY**
3/Toronto	**3/Toronto**	**3/Toronto**	**3/Toronto**	**4/Toronto**
11/Alberta	10/British Columbia	18/Alberta	22/British Columbia	27/Alberta
16/British Columbia	15/Alberta	24/British Columbia	26/Alberta	31/British Columbia
32/Montreal	18/McGill	30/McGill	35/McGill	43/McGill
38/McGill	32/Montreal	35/Montreal	36/Montreal	49/Calgary

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 Faculty of Medicine 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) Framework for Information Literacy for Higher Education.[4]

Program Specific Instruction: Instruction occurs at a variety of levels for Department of Physiology students and is provided by the faculty liaison librarian for Physiology. The Gerstein Science Information Centre facilitates formal instruction integrated into the class schedule and hands-on tutorials related to course assignments. For example, the liaison librarian presents at the graduate orientation in the fall and teaches in the undergrad class PSL495, Communicate Biomedical Science (http://guides.library.utoronto.ca/c.php?g=251664&p=1674996). Librarians at Gerstein provide one-to-one consultations with undergraduate and graduate students who are conducting literature, scoping or systematic reviews. The Library, through its liaison librarians, customizes feeds of library resources. These appear prominently in Portal/Blackboard course pages. For example: Medicine at http://guides.library.utoronto.ca/medicine and Systematic Reviews at http://guides.library.utoronto.ca/systematicreviews.

Collections: Many college and campus libraries collect materials in support of Medical Physiology, 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

[4] Association of College & Research Libraries. Framework for Information Literacy for Higher Education. ACRL, 2016. http://www.ala.org/acrl/sites/ala.org.acrl/files/content/issues/infolit/Framework_ILHE.pdf

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 Physiology at the University of Toronto.

Journals: The Library subscribes to 24 of the top 25 journals listed in Journal Citation Reports (JCR)[5] in the subject area Physiology. Of these titles, 24 are available electronically to staff and students of the University.

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

Preservation, Digitization, and Open Access: The University of Toronto Library supports open access to scholarly communication through its institutional research repository (known as T-Space), its open journal services, and subscriptions to open access publications. In addition to acquiring materials in support of Medical Physiology, the Library, in cooperation with the Internet Archive, has digitized 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: To support the research needs of students in Medical Physiology, the Library subscribes to the two major databases for clinical medicine, *Medline* and *Embase*; the *Cochrane Library*, a database of systematic reviews and register of clinical trials; and the multidisciplinary databases, *Scopus* and *Web of Science*.

Special Collection Highlights: To support program commitments in Medical Physiology, the Library has acquired *Henry Stewart Talks*, a collection of online lectures in the life and biomedical sciences http://simplelink.library.utoronto.ca/url.cfm/83832, with over 500 physiology-related talks on topics such as comparative physiology; modelling of physiological systems; and effect of physiological factors on drug metabolism. The Library also subscribes to the *Thieme E-Book Library*, which includes a collection of anatomy atlases and medical science texts, e.g. *Fundamentals of medical physiology* and *Color atlas of physiology*.

Prepared by:
Gail Nichol, Selector for Health and Life Sciences, August 19, 2016

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

[5] 2014 Journal Citation Reports® (Thomson Reuters, 2014)

Appendix E: University of Toronto Student Services Support

Student service information for Quality Assurance Framework

All University of Toronto undergraduate and graduate students have access to student services on all three campuses, Mississauga, St. George (downtown Toronto), and Scarborough, regardless of their 'home campus'. The services and co-curricular educational opportunities provide a complement to the formal curriculum by engaging and challenging students to reach their full potential as learners, leaders and citizens. At the University of Toronto (St. George Campus) these services are organized by Student Life Programs and Services, the academic division registrar offices, and the School of Graduate Studies. All these services combine to support the success of our students from the time they are admitted through degree completion and beyond.

Students have access to comprehensive **physical and mental health care** on campus, including a medical clinic, travel medicine services, immunization, contraception and sexual health education. Counselling and treatment options for psychological and emotional concerns include psychotherapy, group therapy and pharmacotherapy, as well as specialized assault counselling services provided both by the health and wellness centre and the Sexual Violence Prevention and Support Centre. In addition, a large number of wellness programs are provided, such as mindful meditation, workshops on coping skills and stress management.

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

Coaching and education in the development of key **learning skills** – from time management to overcoming exam anxiety – is provided through the Academic Success Centre. The ASC also partners with faculty to integrate success strategies and support into the curriculum. Students' career exploration and employment services are provided through a **Career Centre** offering resume and interview coaching, workshops, career resources, on and off-campus employment and volunteer listings, job shadowing, and career counseling.

Specialized services are provided for **international students** (orientation, advising, cross-cultural counselling), students with **disabilities** (academic accommodations, advising), students with **children or other family responsibilities** (advising, resources, subsidized child care), **Indigenous students** (academic support, financial counselling) and **lesbian, gay, bisexual and transgender** students (counselling, referrals, equity outreach and engagement).

Participation in **campus life** and **experiential learning** are facilitated through Hart House (clubs, committees, events), the Centre for Community Partnerships (service learning and volunteer opportunities in community settings), the Multifaith Centre (interfaith dialogue, events), and

the Student and Campus Development (leadership development, orientation, recognition and support for student groups, activities.) **Sport and recreational facilities and programs** are provided to all students through both Hart House and the Faculty of Kinesiology and Physical Education.

In the Office of the Vice Dean, Graduate and Academic Affairs in the Faculty of Medicine, is the Director of Mentorship, Professor Nana Lee, who works with students (with particular focus on professional master students) to advise them on their professional and career development prior to graduation.

School of Graduate Studies, Student Services [all campuses]

In addition to the above services available to all students, graduate student have access to registrarial services and co-curricular programs at the School of Graduate Studies that assist students in meeting their academic goals.

Administrative staff at the School of Graduate Studies (SGS) provide **registrarial** services to graduate students including but not limited to recruitment, admission, orientation, registration, fees, program progress, awards/financial assistance and graduation. Fully equipped meeting rooms, which can be booked by student groups when not used for Final Oral Examinations, are distributed across two locations, the newly renovated 63 St. George Street (home of SGS Student Services) and 65 St. George Street. Financial advising and wellness counselling services are also available at 63 St. George.

The **Grad Room** is an accessible space on the St. George campus which provides University of Toronto graduate students with a lounge area and a multi-purpose space for academic, social and professional graduate student programming. An additional lounge area for graduate students is now available at 63 St. George.

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

The **Conflict Resolution Centre for Graduate Students** offers support to the University of Toronto graduate community in taking steps to prevent or resolve conflict.
It is a peer-led services that welcomes graduate students to connect confidentially with one of our trained G2G Peer Advisors to talk about options and strategies for addressing a concern and available university supports and resources.

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

Faculty of Medicine

Starting September 2018, graduate students registered in any graduate program in the Faculty of Medicine will be able to access counselling services based in the Medical Sciences Building and at 500 University Ave.

Furthermore, any students wishing to explore career options are encouraged to make an appointment with the Director of Mentorship and Graduate Professional Development in Graduate Life & Science Education, Dr. Nana Lee.

Appendix F: Faculty CVs

See separate CV Volume.

Appendix G: Potential Employer Survey

The proposed MHSc in Medical Physiology is designed for graduates who wish to apply physiological knowledge regarding human health for the purpose of impacting the delivery of health and healthcare. The degree represents an innovative and relevant alternative to pursue graduate education in the Department of Physiology, with an explicit focus on human physiology. The rapid expansion in the bio-sciences workforce in Ontario demonstrates the need to graduate these types of students who can fill such positions in medical services and biotechnology industries.

To explore this, the Department of Physiology conducted an environmental scan of potential employers. These individuals were identified as either 1) associated with the University of Toronto and running large programs/centers, who could provide student placements and who could be employers in the future; or 2) external corporations who have interactions with UofT and/or Department of Physiology and could provide placements for students and future employment.

The survey was primarily administered via personal invitation through Survey Monkey. In some cases, individual phone calls were made to these potential employers if they were considered to be of high importance with respect to the ability to offer student placements in the future. A total of 18 potential employers responded – 13 via Survey Monkey and 5 by telephone interview.

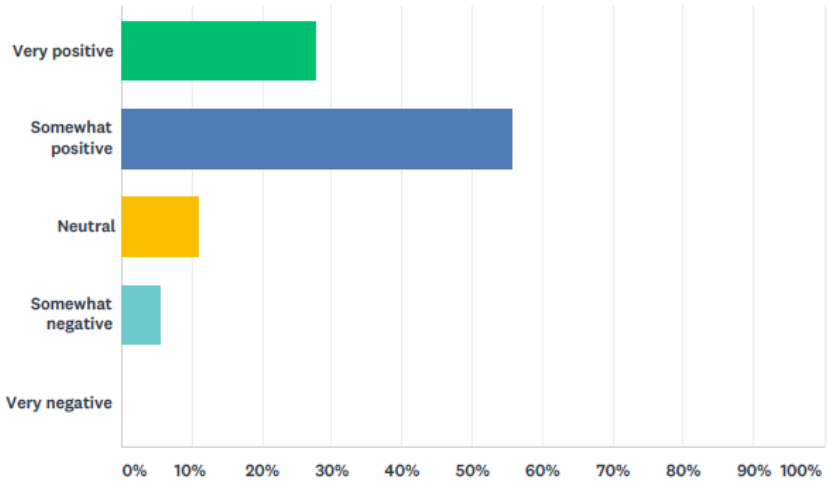
Below is a list of potential employers who were approached and surveyed to determine their interest in offering a practicum placement. Following this are the results from the survey.

Name	Title	Completed	Potential Placement Site
UofT			
Michael Farkouh	Director Lewar Centre; Vice Chair Research Department of Medicine	by phone	Yes
Gary Lewis	Director BBDC	by phone	Yes
Michael May	Director/CEO CCRM		Yes
Norman Rosenblum	CIHR Institute Director	partial	
Mansoor Hussain	Director Rogers Heart Centre		Yes
Art Slutsky	VP Research St Michaels		Yes
Simon Sharpe	Research and training director		Yes
Donald Mabbott	Program in Neurosciences & Mental health	Yes	Yes
Steven Miller	Director Centre for Brain & Mental Health	Yes	Yes
Derek Newton	AVP Innovations & Partnerships	yes email	Yes
Eva Grunfeld	Director KT Research Network OICR	Yes	

David Jaffrey	TECHNA director	Yes	Yes
Bruce Perkins	Director Clinical Research Unit	Yes	Yes
Brian Hodges	Universtiy Health Network		
External			
Susan Marlin	President/CEO Clinical Trials Ontario		Yes
Erica Nishimura	NovoNordisc Scientific Director Endocrine Division		
Shawn Penny	Lilly Endocrine Division	Yes	Yes
John Hepburn	VP Research CIFAR		
Janet Halliwell	Govt consultant Research Evaluation		
Ryan Wiley	Health Sciences Strategy		Yes
Anne Mullin	Engagment Health Sciences Strategy		Yes
Kathryn Deuchars	Director Ontario Personalized Medicine, OGI	Yes	Yes
Bettina Hamelin	President/CEO Ontario Genomics	Yes	Yes
Karl Tibelius	VP Genomics Programs	Yes	
Renee Lyons	Collaboration for Research & Innovation	Yes	Yes
Eric Bosco	MITACS Chief Business dev & partners officer	Yes	Yes
Bob Goldstein	CCTN Chief Scientific Officer	Yes	Yes
Bruce Seet, PhD, MBA,	Sanofi Pasteur, Director, Medical Affairs	Yes	Yes
Greg Francis,	HR Manager, Amgen Canada Inc.	Yes	Yes
Daniel Quinn	Manager, Medical Communications, Medical Affairs	Yes	Yes
Rebecca Yu	Manager, JLABS, Toronto	Yes	Yes
Arya Sharma	Scientific Director & CEO, Canadian Obesity Network	Yes	Yes
Antonio Ciaccia	Bayer Canada	Yes	Yes

Q1 What is your first reaction to the concept of the MHSc degree program?

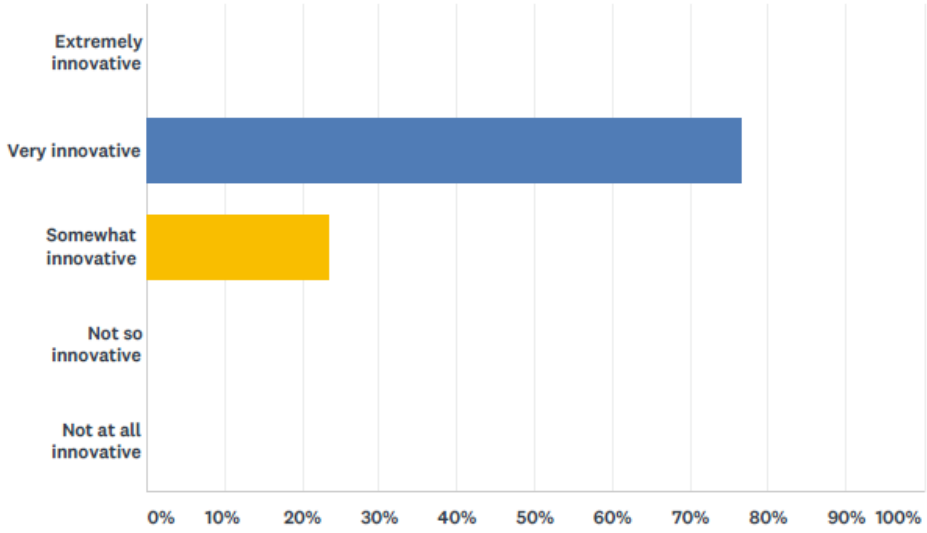
Answered: 18 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very positive	27.78%	5
Somewhat positive	55.56%	10
Neutral	11.11%	2
Somewhat negative	5.56%	1
Very negative	0.00%	0
TOTAL		18

Q2 How innovative is the design of the degree program.?

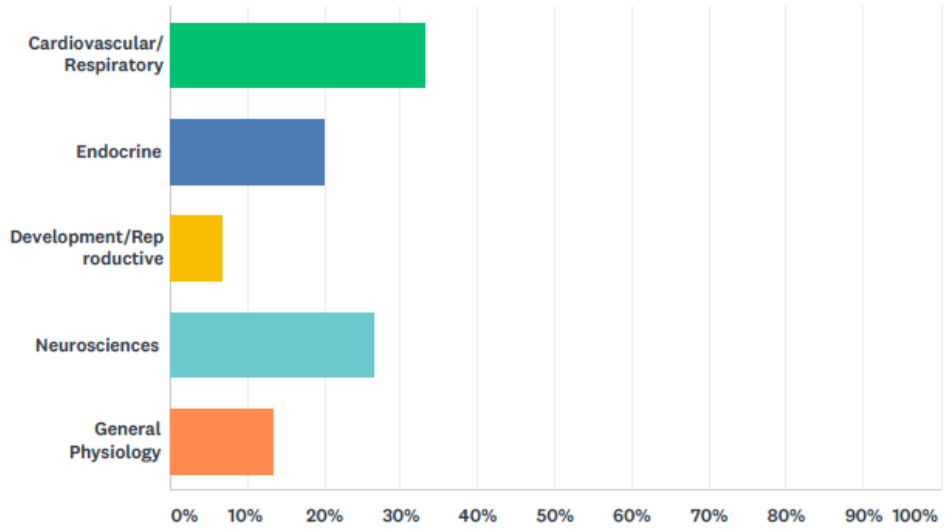
Answered: 17 Skipped: 1



ANSWER CHOICES	RESPONSES	
Extremely innovative	0.00%	0
Very innovative	76.47%	13
Somewhat innovative	23.53%	4
Not so innovative	0.00%	0
Not at all innovative	0.00%	0
TOTAL		17

Q3 Which areas of Systems Physiology would be of interest to your organization?

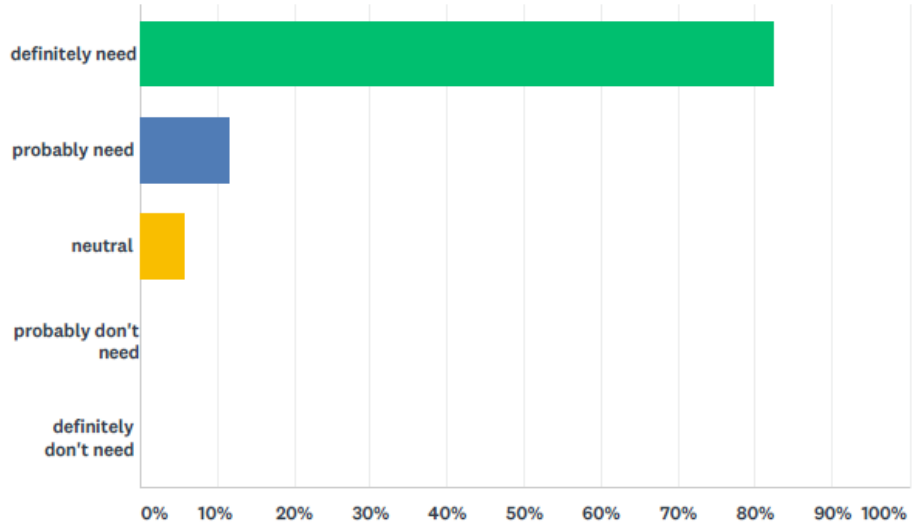
Answered: 15 Skipped: 3



ANSWER CHOICES	RESPONSES	
Cardiovascular/Respiratory	33.33%	5
Endocrine	20.00%	3
Development/Reproductive	6.67%	1
Neurosciences	26.67%	4
General Physiology	13.33%	2
TOTAL		15

Q4 Is the development of project management and team leading skills important to your organization?

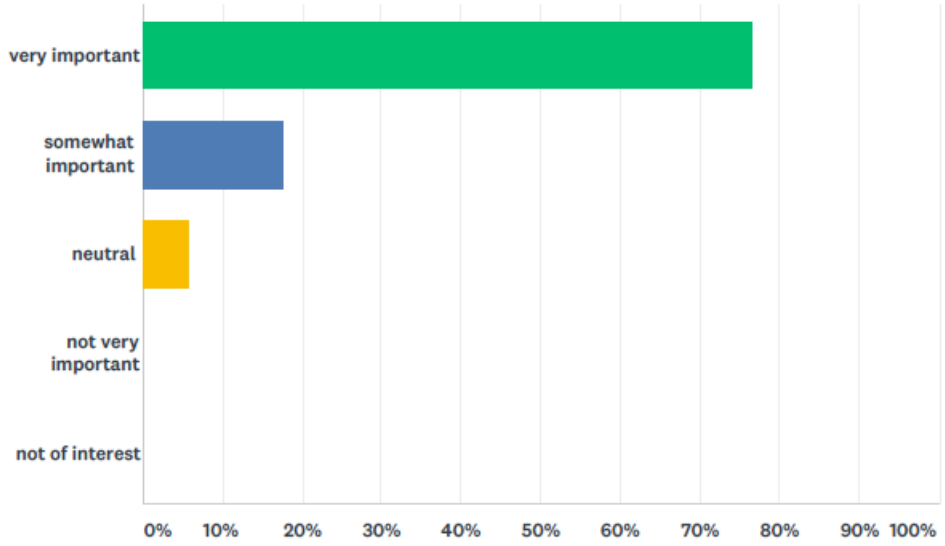
Answered: 17 Skipped: 1



ANSWER CHOICES	RESPONSES	
definitely need	82.35%	14
probably need	11.76%	2
neutral	5.88%	1
probably don't need	0.00%	0
definitely don't need	0.00%	0
TOTAL		17

Q5 How important is the ability to analyze and interpret health related big-data?

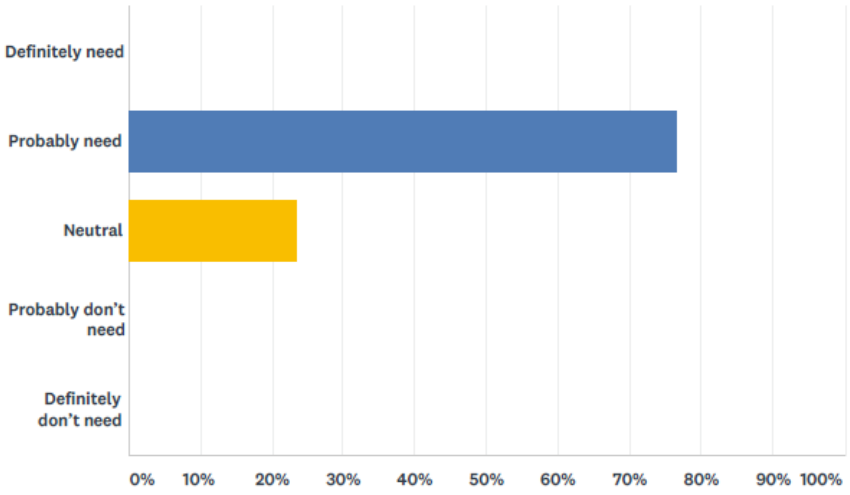
Answered: 17 Skipped: 1



ANSWER CHOICES	RESPONSES	
very important	76.47%	13
somewhat important	17.65%	3
neutral	5.88%	1
not very important	0.00%	0
not of interest	0.00%	0
TOTAL		17

Q6 When you think about the graduates from the degree would they be of interest to your organization?

Answered: 17 Skipped: 1



ANSWER CHOICES	RESPONSES	
Definitely need	0.00%	0
Probably need	76.47%	13
Neutral	23.53%	4
Probably don't need	0.00%	0
Definitely don't need	0.00%	0
TOTAL		17

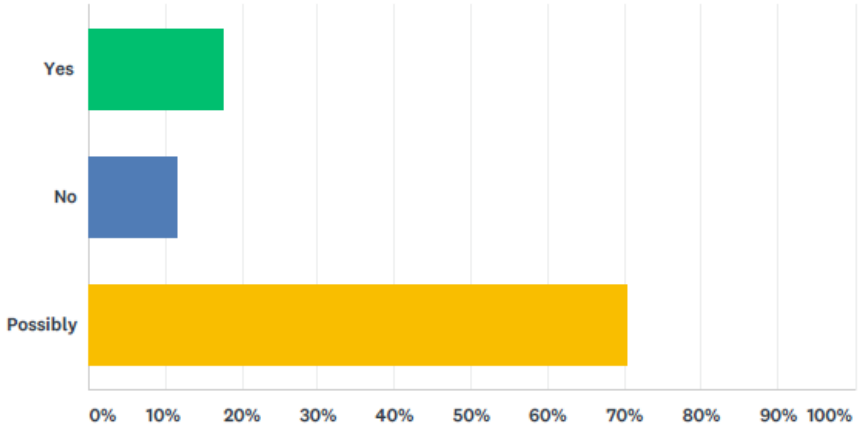
Q7 In your own words, what are the things that you like most about this new professional degree? Do you have any concerns with the proposal?

Answered: 15 Skipped: 3

#	RESPONSES	DATE
1	not at this time	3/20/2018 12:53 PM
2	none at this time	3/20/2018 12:26 PM
3	integrating big data with physiology	3/20/2018 12:22 PM
4	Need to ensure students can understand clinical importance of physiological systems.	3/20/2018 12:20 PM
5	The training in translational sciences linked to big data analytics	3/20/2018 12:18 PM
6	I like the idea of creating a group of graduates with the scientific background to tackle research problems of current relevance - in particular if they also gain research project management skills. There is a significant need for lab/clinical research project coordinators. Ideally, it would be great to train a subset of this group with clinical research skills (ethics/processes/etc) to facilitate their involvement in clinical and/or translational research. In pure lab research, managerial positions are increasingly occupied by PhD-holding Research Associates, while clinical groups require a different set of skills. WRT question 8 (hosting a student), this would require some further discussion, based around the parameters of the placement, compensation required for the student, and the precise skill sets acquired in the finalized program. However, given the size of the organization, I strongly feel we could place students from this program.	3/19/2018 11:52 AM
7	the hands on experience, professional development and the elite nature of the program	3/15/2018 2:16 PM
8	Most like: Teaching students to "be capable of managing projects requiring integration of data from multiple sources" so that the benefits of "big data" can be gleaned. Also like the inclusion of learning about the "interface between research and implementation" again to that research results better transition to implementation. My concern is that given the complexity of integration of big data and the need to use and understand bioinformatics and computational biology (or at least understand the capabilities of these tools and when to apply them) cannot be learned in just a one year course.	3/15/2018 2:06 PM
9	I am not familiar enough with big data to give you a good review. Are there companies in Canada taking advantage of this? Best to find and reach out to those companies to get their input. I imagine this would involve a good deal of statistics? Is a 1-year programme enough time to learn these skills adequately to become attractive to employers? Also, ensure that students work with influential physicians and physicians group. These relationships can be leverage when seeking employment.	3/7/2018 7:55 AM
10	The 4V's of the data that will be generated through this future will challenge our ability to interpret and use the data. We need to build skills and capacity. I would suggest you include a primer on measurement, noise, uncertainty.	2/15/2018 1:39 PM
11	The amalgamation of modern techniques in generating, organizing and managing large datasets and providing a practical experience that will aim to create value (ie: KT and commercialization) and provide trainees applied tools (project management skills etc). The only concern might being able to market the program to employers. The types of degree titles that would bring together these skills would be somewhere between epidemiological, bio-stats and a project management certification program. A degree called, and MHSc in Medical Physiology may not completely convey the breadth of training that your students will receive and the practical 'big/wicked' problems that they'll be able to solve. I'd have to think a bit more about what would be a compelling description to potential students and future employers (eg: MHSc in Applied Medical Health Systems)	2/12/2018 10:27 AM
12	There is a need for people trained to led large multidisciplinary team grants who understand the science but are also skills in project management. It is rare that those two things coexist!	2/4/2018 8:08 PM
13	focus on big data and knowledge transfer in science. The duration (12 months) may be a bit short	2/2/2018 10:05 AM
14	Big data orientation; leadership potential	1/31/2018 3:37 PM

Q8 Would your organization be able to host a student for a work experience project?

Answered: 17 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	17.65%	3
No	11.76%	2
Possibly	70.59%	12

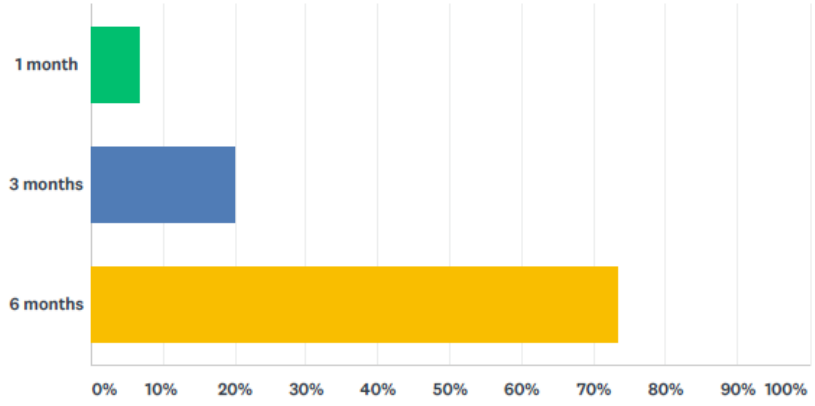
Q9 Are there any specific areas you would like to be included in the new program?

Answered: 14 Skipped: 4

#	RESPONSES	DATE
1	can't say	3/20/2018 12:53 PM
2	unable to say at this time depends on the graduates	3/20/2018 12:26 PM
3	Stem cell biology	3/20/2018 12:22 PM
4	Integrate endocrine & cardiovascular	3/20/2018 12:20 PM
5	not at this point	3/20/2018 12:18 PM
6	As outlined above, I think training in clinical research project setup and management would be a significant asset.	3/19/2018 11:52 AM
7	work integrated learning (internship)	3/15/2018 2:16 PM
8	Don't understand big data enough to be more helpful	3/7/2018 7:55 AM
9	Cardiac;	2/15/2018 1:39 PM
10	Innovation Processes and Design thinking Health Economics/Cost-Effectiveness Analysis	2/12/2018 10:27 AM
11	knowledge of REB requirements, knowledge of budget management and fundamental HR principles, knowledge of the principles of data management, scientific integrity, data storage, grant application processes	2/4/2018 8:08 PM
12	Application of basic science to human health	2/2/2018 10:05 AM
13	Brain Health; Development; Longitudinal data	1/31/2018 3:37 PM
14	(there wasn't an opportunity to raise potential concerns: To me this program seems to have elements of what a grad student could pursue in IMS, IHPME, or even the Dalla Lana school of public health.	1/31/2018 3:02 PM

Q10 If you answered yes to #8 what would be the preferred length of the practicum?

Answered: 15 Skipped: 3



ANSWER CHOICES	RESPONSES	
1 month	6.67%	1
3 months	20.00%	3
6 months	73.33%	11
TOTAL		15

Appendix H: External Appraisal Report

Proposed Program	Medical Physiology, MHSc
Commissioning Officer	Professor Trevor Young, Dean
External Reviewers	Prof. John White – Dept. of Physiology, McGill University Prof. Donald DeFranco – Dept. of Pharmacology and Chemical Biology,
Date of Visit	March 29, 2018

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

1. **OBJECTIVES**
   - **consistency of the program with the University's mission, and Faculty's and Department's academic plans**
   - **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**

As outlined in the proposal, the program is consistent with the mission of the University as highlighted by the University President's directive regarding "Leveraging our Location". The consistent message that we heard from all parties involved in the site visit was the "need" for students with training in systems physiology and "big data" analysis. This program seeks to provide students with both. The program also enhances the major teaching mission of the Department as evidenced by the large number of undergraduates (including "specialists") and PhD students they instruct in physiology. Many of the students do not seek careers in laboratory science but wish to obtain a skill set that would give them opportunities in the many expanding areas that directly and indirectly affect health care delivery, management and scientific exploration.

Given the fact that the program seeks to admit students with some advanced knowledge in physiology, which is one of its most distinctive features, the rigorous course requirements appear appropriate. The practicum experience is an important component of the student learning experience, but as will be discussed below will require considerable attention and oversight to be successful given potential barriers in finding placements for an ultimately large number of students for a somewhat limited time scale. Finally, individual course structures and variety will insure that students will attain the learning outcomes of the proposal as outlined in the proposal. In that regard, the lack of "wet lab" exposure or a Masters thesis addressing a novel question in physiology is not considered a weakness given the critical analysis, writing and oral presentation requirements in many of the advanced courses.

The naming of the program as "Medical Physiology" is appropriate given its focus on human physiology and translation of physiology knowledge to clinically relevant scenarios.

2. ADMISSION REQUIREMENTS

- **appropriateness of the program's admission requirements to the learning outcomes established for the completion 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**

The program's stated policy to admit students with significant exposure to physiology courses as undergrads is appropriate given the rapid immersion of the students in rigorous, advanced physiology courses. The expectations that students identify a practicum experience within one year (or sooner) will favor students with a clear vision of their career goal even before matriculating into the program. In that regard, it is hoped that the admissions committee pay particular attention to applicant one-page summaries describing how the program will "contribute to the advancement of (their) professional goals". This can also be probed in interviews (Will all interviews be live or some by Skype?) where it is hoped that interviewers will alert applicants to the accelerated aspect of the program and need to have career goals reasonably well formulated particularly given practicum requirement. Finally, the role of the Vice Chair of Undergraduate Instruction of the Department of Physiology to direct qualified undergraduates to the program could be expanded as well as her role in management and execution of many of the program's goals.

The program's requirements for foreign students whose native language is not English, to pass an English proficiency exam (TOEFL) is appropriate.

3. STRUCTURE

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

- **appropriateness of the program's structure and regulations to meet specified program learning outcomes and Degree Level Expectations**

As a professional degree program, the MHSc should be designed to orient students towards specific careers rather than to serve as a feeder program for other areas of study (e.g. medical school). In discussions with students, we wound up defending the design of the program against suggestions it look like a prep year to strengthen application to medical school. In fact, as designed, the program would not compete well with other "feeder programs" that exist in the US and Canada to aid students seeking admission to medical school since there is no

"linkage" to any medical school that guarantee admissions of minimally an interview and no focus on improving medical school admission test (MCAT) scores. Nonetheless, the program appears to be appropriately set up, although we do provide specific recommendations for course requirements (see program content).

The strength and depth of the academic environment and the course options available are definitely a plus. That being said, given its goals, the most important and distinctive aspect of the program is the practicum, and it is concerning the administration and organization of the practicum that the most serious concerns arose, as follows:

1. Concerns were raised about the administrative burden that placement would represent, particularly when the program reaches its 40-student limit. Discussions with representatives from other professional programs were particularly revealing; it was suggested that placement was more difficult than anticipated both in terms of administrative burden and of finding partners. The Medical Genomics program, which is just getting underway, is finding placement of a limited number of students for practicums more challenging than anticipated.
2. Given administrative issues around placement (e.g. acquiring provincial funding), there appears to be a tight timeline for finding placements for students. There was also concern that if a student discovered a research/career area that she/he had not considered halfway through course work there would not be enough time to adjust and find a new more appropriate placement. While it is hoped that in the selection process, the admission committee would seek students with clear career goals and paths (see above), there will clearly be some students whose interests change while enrolled in the program.
3. After our discussions with several parties, we were convinced that proposed future enrollment numbers (leading to a maximum of 40 students in the program) were reasonable, and, even if there were some overlap between program requirements, competition would not be a major issue because with the current number of professional programs available, demand would out-weigh supply. This raised concerns about an apparent lack of communication and coordination between professional masters programs.

These considerations led to the following recommendations:

1. Coordination between programs should be enhanced substantially. This could lead, where appropriate, to sharing of courses between programs.
2. <u>We strongly recommend</u> that the faculty set up a central "Placement Office" with adequate staffing whose mandate would be to coordinate outreach to potential placement partners. This would reduce administrative burden on the individual programs and should be cost-effective. It would also ensure that the faculty communicates with potential partners with one voice and that the same potential

partner is not contacted independently by different professional programs. Such an office would be increasingly important as enrollment in current programs increases and in the event of establishment of other professional programs in the faculty.

3. As a follow-up to 2, every effort should be made to provide in the final document describing the program an in-depth quantitative and qualitative assessment of the number and types of potential placement partners available in the GTA. Ideally, the numbers of potential placement sites should be substantially greater than the number of potential applicants once all programs are running at full capacity.
4. Ideally, all of the above should be coordinated with the provincial government to assure that appropriate provincial policies are in place to induce potential placement partners to participate in the programs.

- **rationale for program length in order to ensure that the program requirements can be reasonably completed within the proposed time period**

If appropriately organized and administratively supported, the program length of one year appears ambitious but feasible. As detailed above, flexible and efficient placement of students in practicums is essential for the success of the program. However, it was not clear how the program would deal administratively with students who wished to extend their practicum experience. Would they still be considered matriculated students at the University of Toronto? That could be a requirement of their practicum site or organization. The program needs to provide some clarity regarding this issue.

4. PROGRAM CONTENT

- **ways in which the curriculum addresses the current state of the discipline or area of study**

Although specific recommendations were made (below), there were no major concerns raised with the global course content of the program. Numerous course options taught by outstanding researchers are available to the students.

- **identification of any unique curriculum or program innovations or creative components and their appropriateness**

Overall, the physiology and big data component of the program is a terrific idea. However, concerns were raised about the relationship between the 4040 and 1040 “big data” courses as presented in the documents provided. These were partially alleviated by discussions with Dr. Brian Cox. The two appear to be largely complementary, however, it might be a good idea to have 1040 as a prerequisite for 4040 if one of the goals of the program is to turn out at least a subset of students with the skills to analyze raw data. This might require setting up specific streams within the program and have 1040 taught in the fall and 4040 in the winter.

The collaboration and commercialization component of the program (PSL4050H) was also greeted with enthusiasm.

Considering potential job options for trainees, is it worth having as an option access to a course on clinical trials and their management?

Minor comment: In the documents provided, the Diving Physio course (PSL1086H) is listed both as an Elective (Breadth) course and Focused Specialty (Depth) course. It seems it should only be the latter.

5. MODE OF DELIVERY

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

The courses contain a mixture of learning modalities that will provide students with an opportunity to interact closely with experts in the field, critically analyze the literature and raw data, work in collaborative teams on issues regarding commercialization of biomedical products and discoveries, etc. There is even flexibility in some courses for students to tailor their learning to attain specific skills in big data analysis. However, as mentioned above, there is a need for the program to have a policy regarding "flex-time" for the practicum, which could exceed the stated program length requirements.

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**

While the proposal outlines in detail mechanisms of assessment of student achievement for the 11 stated Learning Outcomes (LOs), the extent of written feedback provided to students, particularly in evaluations of their engagement in small group activities needs to be more explicitly stated.

The plan to have a "Program Oversight Committee" biannually evaluate individual student progress is appropriate and will be useful to maintain student goals and LOs.

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**

On the academic side, several outstanding researchers are committed to teaching in the program. There are no issues with expertise or degree of academic commitment.

As detailed above, it appears that the administrative burden of managing practicum placement for a program running at full capacity (and those of other programs) has not been adequately anticipated. This will almost certainly require additional HR and financial resources, and, as detailed above, would be best run at the Faculty level.

- **participation of a sufficient number and quality of faculty who are competent to teach and/or supervise in the program**

No issues.

- **adequacy of resources to sustain the quality of scholarship of graduate students, including library support, and information technology support**

No issues.

- **recent research or professional/clinical expertise of faculty to sustain the program, promote innovation and foster an appropriate intellectual climate**

Outstanding – no issues.

- **sufficiency of financial assistance for students to ensure adequate quality and numbers of students**

Appears adequate.

- **supervisory load distribution and the qualifications and appointment status of supervisors**

No issues.

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**

The program draws on a diverse group of highly successful faculty from various disciplines to provide the students with excellent opportunities to experience many emerging areas of physiology and biomedical research. Since a “wet lab” or faculty-mentored research is not a component of the program (excluding the experience gained from the practicum of course), the ability of funded faculty to support additional students who will be enrolled in this program is not an issue. Nonetheless, having funded, research-active faculty as the predominant instructors in this program will ensure that students will be exposed to the most cutting edge research and most pressing basic research and clinical problems. Finally, as outlined in the proposal, many extra-departmental sites and research centers are available for students to receive hands-on training.

Appendix I: Dean's Response to Appraisers' Report

July 10, 2018

Dr. Susan McCahan
Vice Provost, Academic Programs
University of Toronto
McMurrich Building
12 Queen's Park Crescent West, Room 103
Toronto, Ontario
M5S 1S8

Administrative Response to the External Review of new Degree Program
MHSC in Medical Physiology Conducted March 29, 2018

The Faculty of Medicine is most grateful to the external reviewers, Professor John White, Department of Physiology, McGill University and Professor Donald DeFranco, Department of Pharmacology and Chemical Biology, University of Pittsburgh for their comprehensive review of, and subsequent report on, the proposal for a new professional Master in Health Science (MHSc) in Medical Physiology. I would also like to thank Professor Alison Buchan, and the other faculty in the Department of Physiology, for their leadership and creativity in developing this innovative proposal. Overall the reviewers were very positive in their assessment of this proposal, stating that "the physiology and big data component of the program is a terrific idea" and that "(t)he program draws on a diverse group of highly successful faculty from various disciplines to provide the students with excellent opportunities to experience many emerging areas of physiology and biomedical research."

This administrative response was developed in consultation with the following individuals in the Faculty of Medicine: Graham Collingridge, Chair, Department of Physiology; Professor Alison Buchan, Department of Physiology; Dr. Allan Kaplan, Vice Dean, Graduate and Academic Affairs.

I will address the specific issues raised by the reviewers:

1. Admission requirements
The appraisers had several recommendations on the admission process which we agree with and will implement. For example, the admissions committee will pay particular attention to the applicant's one-page summary to determine how the program aligns with their professional goals and also what they envision in terms of a typical practicum placement and subsequent career prospects. As suggested, these discussions will also carry through to the interview process. In response to the appraisers' question on using Skype for the interviews, this platform will be used if a face-to-face interview is not possible.

2. Program Structure

The appraisers had a number of comments and recommendations related to the administrative burden of managing the practicum placement when the program is running at full capacity. To meet this demand, the appraisers suggested additional human and financial resources, particularly at the Faculty level, to support this program and enhance coordination between similar programs. Specifically, a Central Placement Office was suggested which would coordinate placements for all the professional programs in the Faculty of Medicine.

We agree that coordination between programs should be strengthened and efforts in this area are already underway. Program Directors of other professional programs that have placements have met and discussed joint strategies including exploring options to share courses, enhancing communications regarding placement locations, and the potential to co-host a placement "fair" inviting industry and other health care professionals to meet students. They will continue to meet and provide recommendations to the departments for future collaborative ventures.

To ensure enough placements are available for all students, the program recently surveyed potential employers and the 15 out of 18 confirmed they would have a potential placement for students in this program (Appendix G). As well, the program anticipates that the 9 teaching hospitals and 14 research institutes affiliated with the University of Toronto will also provide placement sites as well as employers in the sectors of Drug and Pharmaceuticals, Medical Device and Equipment, Research Testing and Medical Laboratories. At this time, the Faculty believes that this approach to support placements is preferable to the establishment of a Central Placement Office.

The appraisers commented that the short length of the program may not provide enough time for a student to change the their focus and potentially arrange a different practicum placement. After reviewing the External Apprasial Report and some discussion , the following protocol will be implemented to ensure all efforts are made to align a student's interest and skills to the optimal practicum placement.

From the start, the applicant's statement of intent and information gathered at the admission interview will help determine what initial placements to discuss with the student. The second point of contact will be during the first term when the student is exposed to graduate professional development in PSL4000H. This course will teach students how to network within professional circles, write effective cover letters/resumes and develop interview skills in order to help them recognize the best practicum match. A final measure to ensure a student is in the right practicum is through regular check-ins with the program director before the end of the first term of the program.

The appraisers asked how the program would handle students who wished to extend their practicum experience. This program has been designed so that students will achieve the learning outcomes in three sessions, which includes the 4 month practicum placement. Students will not be able to extend the length of their program as it would delay graduation and result in additional tuition. This would not preclude placement sites from hiring graduates.

3. Program Content

The appraisers were enthusiastic about the big data component of the program. Although partially alleviated during the site visit, there was some concerns, regarding the proposed relevant courses and suggested making the optional course, PSL 1040H (Systems Biology in Physiology), a prerequisite for the required course, PSL 4040H (Big Data and Health). The Department feels that this would be neither necessary nor appropriate. The intent of this program as it relates to the topic of big-data, is to give the students grounding in the methodologies required to explore datasets, expand their skills in big-data analysis and understand the terminology used by big-data scientists. This goal will be more easily meet through the required course PSL 4040H.

PSL 1040H is a lecture course, complemented with student seminars, that focus on the link between medical scientific research approaches with 'large scale' analyses. The overall goal of systems biology science is to connect complex biological networks with biochemical and physiological outcomes. The link between cellular physiology and systems biology have profound significance to our understanding of general physiology and the goal of PSL 1040H is to teach students of recent developments, and importantly, enable them to extract and utilize information at the systems biology level. In contrast, PSL 4040H is designed to teach students how to apply large data methods to tackle hands-on analysis of large datasets related to human health (e.g. from a wearable device). There is some overlap in the content of PSL 1040H and PSL 4040H so both are not necessary.

In terms of the assessment of teaching and learning, the appraisers requested more information regarding the written feedback that students will receive when assessed on engaging in small group activities. The type of written feedback will vary depending on the course, discussion topics, and weight of the assessment, but it will also be tailored according to a student's interest in consultation with the program director. These will include peer feedback forms, or grading rubrics that will evaluate participation and valuable contribution to discussions.

Thank you again for the opportunity to address the very helpful comments of the reviewers as we move to have this Program added to the offerings for U of T students.

Sincerely,

L. Trevor Young, MD, PhD, FRCPC
Dean, Faculty of Medicine
Vice-Provost, Relations with Health Care Institutions

Appendix J: Vice Provostial Response to Dean's Response

19 July 2018

Trevor Young
Dean, Faculty of Medicine and
Vice-Provost, Relations with Health Care Institutions

Re: Appraisal Report, Proposed Master of Health Science in Medical Physiology

Dear Trevor,

I am very pleased to receive the appraisal of the proposed Master of Health Science in Medical Physiology. Your administrative response to the appraisal nicely summarizes the report and highlights the specific suggestions made by the appraisers.

The appraisers made a number of recommendations related to supporting practicum placements. These included enhancing coordination among existing programs with a practicum requirement, creating a list of placement sites and creating a central placement office within the Faculty of Medicine. You agree with the appraisers that coordination among programs with practicums be strengthened and you indicate that this is underway. Your response indicates a survey of potential employers was done and it confirms placement sites are available. Given this, you do not feel it is necessary to create a central placement office. The appraisers commented that one year might not be adequate time to complete the program if the student wished to switch their placement area. In response, the program has developed procedures at the time of admissions and during the program to ensure student interests are matched appropriately and supported toward a timely time-to-degree.

I will be very pleased to recommend this new professional master's degree program to governance for approval, following approval at the divisional level.

Sincerely,

Susan McCahan
Vice-Provost, Academic Programs
cc.

Amy Lee, Executive Secretary to the Vice-Provost, Relations with Healthcare Institutions and Dean, Faculty of Medicine
Allan Kaplan, Vice-Dean, Graduate and Academic Affairs, Faculty of Medicine
Rachel Zulla, Graduate Affairs Officer, Faculty of Medicine
Daniella Mallinick, Director, Academic Programs, Planning and Quality Assurance, Office of the Vice-Provost, Academic Programs
Jennifer Francisco, Coordinator, Academic Change, Office of the Vice-Provost, Academic Programs