



FACULTY OF HEALTH SCIENCES
SCHOOL OF MEDICINE
SUBMISSION TO UNIVERSITY ACADEMIC PLANNING PROCESS

April 15, 2010

Table of Contents

Executive Summary	3
1. Medical Education	5
a. the MD Program	
b. Post-Graduate Medical Education	
c. Continuing Professional Education	
2. Undergraduate Education	10
Life Sciences and Biochemistry Degree Programs	
3. Graduate and Postdoctoral Education	17
4. Research	24
5. Organizational Restructuring in the School of Medicine: ...	34
Integration of the Biomedical and Molecular Sciences	

Appendices

1. 2009 Clinical Community Preceptor Teaching Hours
2. UGE Curricular Goals & Competency Based Objectives
3. Office of Health Sciences Education
4. Office of Interprofessional Education & Practice
5. MedTech
6. Global Health
7. Research – Compilation of Responses

Executive Summary

The Faculty of Health Sciences comprises the Schools of Medicine, Nursing and Rehabilitation Therapy and in significant partnership with affiliated hospital partners is responsible for a multiplicity of health professional education programs that exist within the context of a robust, innovative and recognized research environment.

The current and anticipated national and international pre-occupation with issues related to health and disease results in significant emphasis being placed on health care, health professional education, research, innovation and accountability for return on investment in Canada.

This context and the success of our existing and evolving health research strategy at Queen's, emphasizing interdisciplinary, inter-professional, thematic research programs and our relationship with academic, research hospitals presents exciting opportunity for Queen's University.

The evolving strategic plans of our academic hospitals, and the further health orientation of organizations and agencies that support research enhance those opportunities. The soon to be realized availability of new research space, the potential for expanded research liaisons across Faculties and beyond, the existence of superbly qualified intellectual and data resources (such as the ICES node and the laboratory that is the regional care system) would suggest that the University might consider identifying health research as a major plank in its forward looking research strategy.

Queen's University and this Faculty have the potential for even more meaningful contributions to health research, ranging from the sub-molecular level to the health of populations and health systems development.

The FHS academic plan contains vivid evidence and many examples of the success of adopting a bold and distinct research strategy that has resulted in differential allocation of resources and significant outcomes including new, expanded and successful graduate programs.

This nexus and superb scholarly context form the fundamental framework for biomedical science and health professional educational programs that continue to attract the brightest and best students. Educated in a competency oriented, technology supported, intimate inter-disciplinary and inter-professional environment with global outlook, our learners become leaders in their eventual fields. Curricular reform, distributed programs, and infrastructure allow the Faculty to contemplate expansion in a variety of programs that are consistent with the University's eventual plan.

It is critical to this Faculty with its many internal and external obligations and responsibilities to anchor its educational programs within an academy dedicated to excellence and innovation in research and discovery.

1. Medical Education

a) The MD Program

Overview

The goal of the four-year MD program in the School of Medicine (SOM) is to provide its students with exemplary foundations in the medical competencies requisite for success in both their subsequent postgraduate training programs and their eventual careers in health care.

Over the last several years, the MD program has undertaken unprecedented enrolment expansion of approximately thirty percent to its current class size of 105 students. Annual applications number in the vicinity of 3,000 and the quality of the accepted students – as reflected by academic success, individual attributes and capabilities, and life experiences – is very high. Output measures of program quality include strong performance of graduating students on licensing exams and the success of graduating students in the competition for postgraduate training positions.

The marked enrolment growth has necessitated the implementation of a new clinical education model in which a large proportion of the experiential clinical training of medical students is conducted at numerous health care sites across our region, including hospitals and individual primary care physician practices. The combination of the enrolment growth and the progressive reduction over the last several years in clinical training opportunities in tertiary care academic health science centres has necessitated implementation of this regional education model. Although the training of medical students within a community health care context provides significant advantages in terms of their exposure to both primary care medicine and potential career opportunities in smaller communities, the distributed education model does present significant challenges. These include, but are not limited to, the effective administration of a broadly disbursed educational network, generating appropriate funding for regional

clinical preceptors, managing the quality of the educational experience in multiple sites and environments, and developing and nurturing strong professional relationships with clinical preceptors whose level of commitment to the Queen's MD program is highly variable (to appreciate the scope of the distributed medical education program, see Appendix 1).

Regionally distributed medical education programs represent an exciting evolution in health professional education, presenting significant opportunity for regional University relationships and academic program development while also posing significant challenge in introducing the principles of medical education and scholarship in venues traditionally distant from those pursuits.

Infrastructure

Construction of a new medical building is underway with a completion target of spring 2011. This represents an extremely important acquisition that will markedly expand the facilities that support lectures and large group teaching, small group teaching, clinical simulation exercises and biomedical experiential laboratory education. The newly constructed facilities will facilitate and allow the curricular transformation currently underway. The new teaching laboratories will also provide valuable support to the undergraduate Life Sciences and Biochemistry programs. The new building, in part, expands previously limited academic capacity in the MD program, the Life Science and Biochemistry programs and, by releasing some space in Botterell Hall, the research potential of the Faculty.

Innovation

The MD program is undertaking a comprehensive process of renewal and redesign of its undergraduate curriculum. The curricular framework has been constructed on a comprehensive set of competency-based objectives (appendix 2) and the curriculum will be delivered using a variety of educational methods chosen to optimize student learning. Curricular reform and a variety of organizational initiatives in conjunction with

the acquisition of the new medical education building will allow the MD program to complete the action plan that is resulting in full compliance with accreditation standards.

The Office of Health Science Education (Appendix 3) was created by the SOM to advance scholarship in pedagogy and to enhance Teaching and Learning through Scholarship and Innovation

The goals are:

- To promote and enhance research and scholarship in teaching and learning.
- To assist in the development, dissemination, and evaluation of innovation in teaching and learning.
- To promote the value of teaching in Faculty of Health Sciences.

The Office of Inter-professional Education and Practice (Appendix 4) has led in developing a number of initiatives that incorporate elements of the three schools in the FHS. In the Faculty of Health Sciences, all health professional schools promote and support Inter-professional Education (IPE). Common IPE competencies have been identified for medicine, nursing and rehabilitation therapy. IPE is integrated throughout the core curriculum and all students have opportunities each year to participate in IPE activities through simulations, the Clinical Education Centre, or in clinical settings. Of note, students from the three schools within the FHS initiated the creation of an additional, amalgamated student society in 2008 and in March 2010 a team of Queen's students from six different professional programs won the first annual Provincial Health Care Team Challenge at the National Health Sciences Students' Association conference in Hamilton.

The Medical Education Technology Unit has proven to be a most successful resource, providing expert technologic platforms for innovative educational practices (Appendix 5).

The Southeastern Ontario Academic Medical Organization (SEAMO), the governing body of the Alternate Funding Plan for the School's clinical faculty, have allocated \$1.6 million per year to a medical education fund. This fund will be used to foster and enable the development of educational leadership, specialized educational knowledge and the educational administrative skills of the core clinical faculty who lead the implementation and delivery of the curriculum.

Internationalization

The SOM and the FHS has a long history of international activity and contributions. In recent decades, the particular contributions of the Department of Family Medicine in Bosnia, funded first by CIDA, most recently by the World Bank, have led to a comprehensive re-organization of that country's health care system and the creation of multiple training sites for family physicians under the guidance of Queen's University.

Initiatives in Tanzania (HIV/AIDS) and Afghanistan are further examples.

The interest of a number of dedicated faculty members and the significant numbers of medical students interested in global health issues has led to the use of the proceeds of an undesignated endowment fund to support international electives for students in the SOM.

A decision has recently been made to establish within the School of Medicine an Office for Global Health (see appendix 6). Key objectives for this School include the expansion of medical students' educational opportunities in global health, the facilitation of student achievement of core competencies in global health, the coordination and administration of the School's global health initiatives, enabling partnerships with international Universities and contributing to the improvement of the health of members of those international communities with which the School of Medicine partners.

b. Postgraduate Medical Education

Overview

Postgraduate medical education is the programming provided by the university for graduates of medical school. It is an educational requirement prior to practice and is designed to ensure that residents acquire the knowledge and expertise necessary for practice. Two accreditation bodies, the Royal College of Physicians and Surgeons of Canada and the College of Family Physicians of Canada, determine standards for these educational programs. The duration of the educational programs ranges from 2 to 6 years in length depending upon the specialty. Queen's University offers 32 individual postgraduate medical education programs with a total number of 419 learners. The learning environment for postgraduate residents is primarily based in our affiliated teaching hospitals and teaching clinics.

Expansion

The last decade has witnessed a period of unprecedented growth in postgraduate enrolment at Queen's University. The total number of postgraduate learners has increased by almost 60% since 2002. This expansion has occurred in response to the increased need for physicians in the province of Ontario. Queen's University has been responsive in expanding its programs with a specific emphasis on Regional Education and the development of stand-alone satellite programs in Family Medicine. Further expansion of both Family Medicine and our specialty programs is planned for future. The need to provide the appropriate resources to sustain the satellite programs will be required.

Innovation

The expansion of our programs has required the implementation of many new initiatives in terms of our delivery of medical education. Increasingly education and evaluation is being delivered using standardized patients and simulation scenarios. Teaching of core competencies has led to the creation of an educational conference-

based format for all of our first year residents. The increased number of learners and the diversity of our learners will require continued efforts to ensure high quality educational innovation. Two educational experts have joined the Health Sciences Education office to specifically provide assistance to the Postgraduate Program Directors in meeting this need: an evaluation consultant and an educational consultant.

Internationalization

Postgraduate Medical Education has experienced a dramatic growth in the diversity of its learners. The numbers have grown (in FTEs) from 6.5 in 2002 to 61.84 in 2008 an increase of more than 850%. This includes primarily physicians who are being educated for practice within Ontario. We have however, also renegotiated our affiliation agreements with Kuwait, Saudi Arabia, Oman and the Saudi Arabian Oil Company.

c. Continuing Professional Development (CPD)

An additional responsibility of medical schools is to provide continuing professional education programs to those professionals within and regionally surrounding the academy. The CPD office is subject to adhering to standards of accreditation and the programs offered are of particular importance regionally, given that an increasing proportion of those professionals are now engaged in the education of our learners. The cross-over between continuing education and faculty development is a work in progress.

2. Undergraduate Education – the Life Sciences and Biochemistry Degree Programs

Overview

The Life Sciences and Biochemistry programs are committed to providing outstanding undergraduate education in the scientific disciplines that are fundamental to the maintenance of health and the understanding and treatment of disease. These programs reside administratively within the Faculty of Arts and Science but the large majority of the core and elective courses that define the various degree programs under the Life Sciences and Biochemistry umbrella are delivered by the Faculty of Health Sciences. Furthermore, the Faculty of Health Sciences plays the lead role in the development, implementation and administration of the core elements of these programs.

The Life Sciences program is a unique interdisciplinary collaboration between seven departments devoted to basic and applied biomedical sciences; Anatomy and Cell Biology, Biochemistry, Community Health and Epidemiology, Microbiology and Immunology, Pathology and Molecular Medicine, Pharmacology and Toxicology and Physiology. The program offers a three-year general degree and several types of four-year honours degrees. The BSc.H. Major in Life Sciences allows students to combine courses in the Life Sciences with studies in a wide range of other subjects in the sciences or arts or humanities. This degree may be combined with a declared Minor. The BSc.H. SSP Life Sciences honours degree is designed for students who wish to explore basic and applied biomedical sciences in more depth.

The Life Sciences and Biochemistry programs have been very successful and have a national reputation that attracts excellent students. Incoming students are of very high academic caliber and students graduating from these programs earn a disproportionately large share of University awards and honours. Students in these programs acquire knowledge and skills that prepare them well for several career paths including biomedical research, various professional programs including Medicine, and the biomedical industry.

Interdisciplinarity

The Biochemistry and Life Sciences degree programs, and this is particularly true for the latter, are fundamentally interdisciplinary in nature. Faculty from the numerous individual disciplines and subdisciplines that constitute Life Sciences and Biochemistry not only deliver courses in their respective areas but they also collaborate on the teaching and delivery of individual cross-disciplinary courses. Collaborations around the delivery of some such cross-disciplinary courses also occur with members of cognate departments in other Faculties. Further evidence of the inherent interdisciplinary nature of the Life Sciences has been the development of the following optional streams within the program: Cardiorespiratory Science; Drug Development and Human Toxicology; Neurosciences; and Cancer Research. These streams provide students with the opportunity to place an emphasis of their program on the interdisciplinary study of a specific area of biomedical science and related diseases.

Inquiry in Education

Inquiry-based approaches to student learning have long been incorporated into the Life Sciences and Biochemistry curricula and have taken several forms. Wet laboratories have provided valuable opportunities for problem-based learning while also enabling student acquisition of technical skills that are very useful for subsequent research project courses. However, progressive erosion of educational infrastructure budgets has markedly reduced the capability of the programs to provide laboratory-based education and significantly compromised these practical and experimental components of the programs.

Inquiry is integral to fourth-year seminar courses. These low student: faculty ratio courses provide excellent opportunities for students to synthesize, analyze and integrate information as they review and prepare material for discussion and debate with their peers. Attrition of faculty due to budget challenges will limit the extent to which this type of educational experience can be provided.

The fourth year Life Sciences and Biochemistry capstone research project courses represent possibly the best examples of inquiry-based education offered by the programs. During these experiences, students are integrated into a research laboratory where they are assigned a specific independent project to complete under supervision that is usually provided by a graduate student. In this setting, students have the opportunity to develop the analytical, problem-solving and creative skills fundamental to biomedical research while also acquiring, through direct practice, the technical skills necessary for laboratory-based biomedical graduate programs. The demand for this educational opportunity exceeds supply. The supply is limited by multiple factors including research space, availability of discretionary research operating budgets to support the student projects and the availability of teaching assistantships for supervision/graduate students. Attrition of faculty will obviously also limit the number of available research project opportunities.

Incorporating Research in Education

Through the provision of laboratory-based courses, seminar courses and capstone research projects, the Life Sciences and Biochemistry programs have always integrated research experiences into their curricula. The extent to which this will be achievable in the future will be dependent on the availability of requisite infrastructure and human resources. Laboratory-based and research-based courses are not the only ways to deliver inquiry-based education in biomedical sciences but, as practical experiences, they are invaluable components of programs that have as one of their core objectives the preparation of students for laboratory-based biomedical graduate studies.

Opportunities for Innovation in Education

Through the ways in which it has structured and delivered the Life Sciences and Biochemistry programs, the School of Medicine has demonstrated its commitment to interdisciplinary biomedical education, the incorporation of inquiry-based learning into its curricula and the integration of research into undergraduate education. The

combination of the strength of this existing foundation and the current demand by incoming students for biomedical and health science education creates an opportunity to not only expand and enhance the scope of the interdisciplinary Life Sciences and Biochemistry degree programs to enable enrollment growth but to also use this experiences as a platform from which to develop an exciting novel trans-faculty program focused on global health.

To exploit these opportunities, we envision pursuing the following objectives:

- Development of a new trans-faculty program in "Challenges in Global Health". This program would be founded on the principle that the resolution of major problems in human health requires a new generation of students that are drawn from all Faculties at Queen's. These students would be immersed in a trans-faculty educational program that addresses real world problems, the approaches needed to solve them, and the leadership skills needed to form effective multi-disciplinary teams. The program would begin in second year, with a gateway course open to students from any Faculty, in which they would participate in small group-based studies to tackle a set of well-defined issues in Global Health. Through third and fourth year, the degree of independence of the student groups would increase, as would the length of time and depth of analysis of the global health-related issues. The third year would incorporate a set of modules illustrative of key problems defined by the Faculty and would consider scientific, political, socioeconomic, and cultural aspects of health determinants. In fourth year, the projects would be directed, but largely student-driven, and provide the capstone experience. The "Challenges in Global Health" Program would be specifically designed to include various sub-themes. It would be based on a flexible set of 'case studies' that address a wide range of topics demanding a trans-faculty perspective; for example, the optimal utilization of a new medical device, social neuroscience, whether a new therapeutic strategy needs to be developed.

- Expanding and enhancing the systematic and coordinated integration of the basic and clinical biomedical sciences within the Life Sciences and Biochemistry programs. The origins of this initiative closely parallel the founding principle of the trans-faculty program in "Challenges in Global Health", but at a level that enhances interdisciplinarity studies within the biomedical sciences. The goal is to make 'patient-centered' science a fundamental component of a Queen's undergraduate education in the Life Sciences and Biochemistry and is designed to complement the 'patient-oriented' research strategy recently endorsed by the Canadian Institutes for Health Research. To realize this goal, we will build on the models of basic and clinical science integration that have already been adopted by a growing number of streams (e.g. Cancer Research, Cardiorespiratory Sciences) within the Life Sciences and Biochemistry programs.
- Redesign the means by which we deliver the scientific core of our educational programs. The revised mode of delivery will:
 - Be competency based. To reach this goal, we will apply the blueprint implemented in the medical program. This provides a proven model on which to redesign our curricula.
 - Integrate independent learning modules, e-learning, and team-based learning and group projects into the curricula, and at an earlier stage.
 - Incorporate a wider range of opportunities for learning outside the classroom, such as an expanded co-op program that includes all of the basic biomedical sciences in partnerships with companies/institutions across Canada and abroad and virtual classrooms that include students and scientists in other countries.
 - Impart the excitement of discovery-based learning through the continued modernization of introductory laboratories and the expansion of opportunities for advanced training in research project courses.

Outcomes

We anticipate that the outcomes of these initiatives will include:

- Creation of a novel trans-faculty program that will link the expertise in health education and research that resides in many Faculties and Schools across Queen's.
- Increased depth of knowledge and contemporary interdisciplinarity within the educational programs in the biomedical science.
- Increased undergraduate enrolment capacity.

Challenges

Establishment of the trans-faculty program will require cooperation between faculty belonging to multiple Departments in multiple Faculties. This will challenge conventional descriptions of teaching duties in work-load documents. In contrast, the integration of the basic and clinical biomedical sciences within the Life Sciences and Biochemistry programs can be accomplished using teachers within the Faculty of Health Sciences.

Resources for teaching assistants must be identified. Small group learning formats are essential components of the trans-faculty and basic/clinical biomedical science integration proposals. Current budgets cannot meet the demands imposed by the introduction of new courses that are founded on group-based learning and the expansion of courses at the undergraduate/graduate interface involving research projects. Teaching experiences of this nature are also vital to the acquisition of communication skills by our graduate trainees.

Expansion of the co-op program and the development of virtual classrooms that bring together students/scientists from around the world will require the development of a core of dedicated staff and faculty.

Investment in continued modifications of the current laboratory courses will be required to ensure that our programs produce highly skilled undergraduates with an in-depth knowledge, exposure, and hands-on experimental training in modern scientific techniques.

3. Graduate and Postdoctoral Education

Overview

Graduate students and Postdoctoral fellows are essential participants in the research and educational missions in the Faculty of Health Sciences. The Faculty is home to approximately 60 Postdoctoral fellows, and current enrolment in the fifteen graduate programs across the three schools of the Faculty is approximately 520 Master's students and 160 Ph.D. students. Of these, just over 300 are enrolled in professional Master's programs in Physical Therapy, Occupational Therapy, Primary Health Care Nursing, and Public Health. As of November 1, 2009, the Faculty has increased its funding-eligible enrolment under the *Reaching Higher* program by 128 Master's students and 54 Doctoral students.

Interdisciplinarity

In addition to participating in discipline-based graduate programs, many of our faculty are members of inter- and transfaculty research groups/centres (fifteen in total) and graduate programs (Neurosciences, Collaborative Programs in Cancer Research and in Biostatistics). This established culture of interdisciplinary approaches to research and graduate education provides excellent opportunities for our graduate students and postdoctoral fellows to engage cross-disciplinary research and educational activities related to their particular fields of interest, and promotes better integration of the basic and clinical sciences. Some specific examples include:

- The Training Program in Transdisciplinary Cancer Research, including the Collaborative Graduate Program in Cancer Research, offers graduate and postdoctoral training opportunities in collaboration with the departments of Anatomy & Cell Biology, Biochemistry, Community Health & Epidemiology, Mathematics and Statistics, Microbiology & Immunology, Oncology, Pathology & Molecular Medicine, Pharmacology & Toxicology, Psychology and the Queen's School of Policy Studies.
- The graduate program in Neurosciences draws on faculty members from thirteen departments in the Faculty of Health Sciences (both basic medical sciences and clinical sciences) and the Faculty of Arts and Science.
- Faculty participation in the two graduate level courses in Cardiovascular Sciences includes faculty members from the departments of Anatomy & Cell Biology, Physiology, Biochemistry, Pharmacology & Toxicology, Rehabilitation Sciences, and Kinesiology & Health Studies.
- The Faculty of Health Sciences has an Office of Interprofessional Education and Practice (OIPEP), which fosters inter-professional education of students in the health professional programs at Queen's. Common inter-professional education competencies have been identified for medicine, nursing and rehabilitation therapy. Inter-professional education is integrated throughout core curriculums and all students have opportunities each year to participate in inter-professional education activities through simulations, the Clinical Education Centre, or in clinical settings.

Opportunities for Innovation

(i) Innovation in graduate student engagement in undergraduate and graduate education.

Graduate students play an essential role in the instruction/mentoring of undergraduate students in courses with a laboratory component, and teaching assistantships are an

important component of graduate student training, by providing opportunities to develop mentoring and teaching skills. Graduate student TAs also function as a resource for undergraduate students who are considering graduate studies, by providing information about graduate programs and about graduate student life in general. With anticipated reductions in lecture-based curriculum delivery and increased tutorial and small group-based learning modalities, there will be additional opportunities for graduate student engagement and contribution to competency-based undergraduate curriculum.

Graduate students in the Rehabilitation Science Program are TAs in graduate courses in the Physical and Occupational Therapy professional programs. They are often experienced clinicians, and play a significant role in teaching M.Sc. professional students because of their clinical experience. Insights gained through their research and their supervisor's research is integrated into the evidence-based practice curriculum of the professional programs. Graduate students in Rehabilitation Science also function in a supervisory capacity in the Critical Enquiry Projects undertaken in the final year of the professional programs.

The capstone educational and research experience for students in the Biochemistry program (BCHM 422) and for many students in the Life Sciences program (499), is the 4th year research project course offered through all of the basic science departments in the School of Medicine, and also through the Centre for Neuroscience Studies and the Cancer Biology and Genetics Division of the Queen's Cancer Research Institute. These courses are extremely popular and enrolment is limited by the capacity of faculty members to supervise students. Graduate students are involved in the supervision of project students to varying degrees in different departments and programs. Typically, they are responsible for the initial training of the student, ongoing discussions of experimental design, and guiding the student through data analysis and interpretation, report writing, and preparation of oral and poster presentations. Graduate student supervision of undergraduate project students is an excellent example of how we can

bridge graduate student engagement in undergraduate education while at the same time providing a direct linkage between teaching and research. However, limited TA budgets preclude greater participation of graduate students in this important mentoring activity, and limit the Faculty's ability to provide these offerings.

(ii) Increase graduate and postdoctoral participation in translational research.

The continued interest by CIHR to increase research capacity, not only in the basic sciences but also in clinical research, will provide opportunities for growth of the Faculty's graduate programs and for increasing our complement of postdoctoral fellows. With the ramping up of CIHR's patient-oriented research initiative, the Faculty will have new opportunities to expand our clinical and translational research capacity, potentially through the reestablishment of MD/M.Sc. and MD/Ph.D. programs, establishment of PT/Ph.D. and OT/Ph.D. programs, and by graduate research incorporated into clinical residency programs. In addition, increased graduate/fellowship research in clinical residency programs will be facilitated by expanded funding from the Government of Ontario for Clinician Investigator Programs, and by changes in the research accountability framework within the Southeastern Ontario Academic Medical Organization, the governing body of the Alternate Funding Plan for the clinical faculty of the School of Medicine. These activities will necessarily require consultation and coordination with the School of Graduate Studies in relation to the University's overall graduate enrolment strategy, and within the constraints on growth at the institutional level, now that the incremental growth targets under the *Reaching Higher* program have been attained.

(iii) Increase interdisciplinary research education in cardiorespiratory sciences.

An additional opportunity for enhancing graduate studies within the faculty, in the form of a Collaborative Graduate Program in Cardiorespiratory Sciences, can be anticipated with the establishment of the soon to be proposed Cardiovascular and Respiratory Research Centre. It is envisioned that this program would be modeled after the

Collaborative Graduate Program in Cancer Research, and thus while promoting interdisciplinary education and training in cardiovascular and respiratory sciences, the program would have no impact on incremental growth per se, since graduate students enrolled in the program would be attributed to one of the constituent collaborating departments. This collaborative program has the potential to capture students in all three Schools of the Faculty of Health Sciences, and also students in graduate programs in the Faculty of Arts and Science (e.g. Kinesiology & Health Studies). Key to the success of this research training program will be the integration between the fundamental and clinical “sides” of research and the collaborations amongst scientists in these complementary disciplines.

(iv) Innovation in curriculum delivery: Development of on-line certificate courses in Drug Development and Human Toxicology.

Although the DDHT stream of the Life Sciences program is currently the responsibility of the Department of Pharmacology & Toxicology, instructors come from five departments and three faculties at Queen’s, as well as from a number of pharmaceutical companies, a toxicology consulting firm, and Parteq Innovations. The Departments of Pharmacology & Toxicology, Chemical Engineering and Chemistry (and could include faculty from the School of Business) are investigating the feasibility of offering advanced education in Drug Discovery and Development. The proposal is to create a novel collaborative, multidisciplinary graduate training program involving faculty from across the university, from industry, and from the governmental sector. The approach will be to include not only the scientific aspects of drug development, but also an understanding of social context, and the business and economic aspects. It will be delivered by on-line and virtual university approaches, in combination with onsite components. Although this new program is envisioned to initially be either a Professional Master’s, Diploma or Certificate program, it is anticipated that many aspects of this program could be incorporated into new undergraduate, graduate and postdoctoral education programs as well. Anecdotal evidence from discussions with numerous industry and government representatives supports a need for this type of program, and the enthusiastic

participation of industry in existing DDHT and Chemistry courses demonstrates that this type of initiative will strengthen our links with industry and will align us with the Science and Technology Strategy of the Government of Canada (people advantage) and CIHR's Health Research Roadmap (highly qualified personnel). This is particularly timely, considering the shift of the pharmaceutical industry towards a model of increased collaboration and integration with university researchers for pursuit of their drug discovery and development agendas.

(v). Internationalization:

Development of an off-site Pattern 2 Master's program in Rehabilitation Science.

In conjunction with the ICACBR (International Centre for the Advancement of Community Based Rehabilitation), the School of Rehabilitation Science is exploring the possibility of offering a Pattern 2 Master's program in Rehabilitation Science, delivered entirely through distance education. A need has been identified by health and social services professionals in developing countries, and in countries in transition, for degree programs designed to increase awareness and facilitate development of policy and programs for people with disability. Currently, there are limited educational opportunities for these individuals. Information and communication technology can be used to bridge geographical distances and offer flexibility in the education programs. Such programs have the potential to have far reaching impact on health professionals and persons with disability in several countries. The same distribution model could also be used to reach Canadian students whose geographic location and other commitments make it difficult for them to be on-site, and could allow participation of groups who are currently underrepresented in graduate programs e.g. aboriginal students. Improved communication and collaboration between clinicians and researchers around clinical research projects could also be realized through use of technology.

A Potential Queen's University-India Pipeline in the Biomedical Sciences

Prompted by an initiative of the Department of Biochemistry, we are in the preliminary stages of considering the establishment of educational and research collaborations with academic institutes in India. India represents an emerging economy with increasing post-secondary educational needs for its population. This presents an opportunity to establish bi-national collaborations that will serve to enable development of the Indian biomedical educational and research communities while providing the Queen's biomedical scientific community with access to both top Indian research institutes and a potentially very large pool of high quality students.

There are numerous potential models for these collaborations but we are initially exploring the possibility of establishing scholarships specifically to host students, potentially both graduate and undergraduate, for research work projects of at least several months in duration. The second level of initial collaboration that is being considered is the establishment of sabbatical leaves for established Indian scientists to spend in Queen's biomedical basic science departments.

(vi) Fostering interdisciplinarity through the introduction of faculty-based graduate course offerings.

Although certain graduate courses are offered jointly with other faculties and departments, there is the potential to develop a number of courses, drawing on the expertise of faculty in multiple departments within the Faculty of Health Sciences, and potentially other faculties as well, that would be of interest to graduate students in a number of different graduate programs. Such course offerings could include: research methods, qualitative research, statistics, program evaluation, knowledge translation, and bioinformatics. Graduate students enrolled in such courses would clearly benefit from the unique perspectives and insights that faculty from different disciplines would bring to bear on common issues and themes.

(vii) Increase educational and professional development opportunities for postdoctoral fellows.

Postdoctoral fellows are an important but relatively underutilized resource with respect to the educational mission of the Faculty, and those that are interested in pursuing academic careers should be given the opportunity to gain the teaching experience that will be required for them to be competitive in the academic job market. However, the Faculty and the University needs to provide support not only to those postdoctoral fellows intending to pursue academic careers, but also to those who will pursue careers in non-academic environments, including the private and not-for-profit sectors. Professional development activities/workshops could cover a range of topics, including career paths, professional skills and transferable skills development (e.g. time, project and financial management, oral and written skills, communication skills), networking, risk management, academic job interview process, building a teaching portfolio, and supervisory/mentorship skills.

4. Research

Scope:

This document focuses on: 1) Major research themes in the Faculty of Health Sciences that have developed as the result of previous strategic planning processes, 2) The alignment of the research programs with principles underpinning the vision document for a University academic plan and 3) The strategic directions, opportunities and challenges that the Faculty anticipates will influence growth and strengthening of health sciences research over the next several years. It does not document research activity in individual departments, nor highlight the excellence of individual Faculty members.

Program structure and areas of emphasis:

Development of the research program of the Faculty of Health Sciences (FHS) has been guided by its Research Strategic Plan, first developed approximately 10 years ago. The most recent iteration of the plan is now approximately 5 years old and it is currently in early stages of review and revision. Nevertheless, its overarching principles are well

aligned with those espoused in Principal Woolf's vision document 'Where next'. Thus appropriately adapted, they may continue to provide useful guides for our future.

Inclusivity and integration:

The strategic research plan of the FHS is inclusive and recognizes the importance of integration. It involves and engages not only the three schools in the FHS (Medicine, Nursing and Rehabilitation Therapy), but also our affiliated academic hospitals, in particular Kingston General Hospital, whose own strategic plan for research is developed in close alignment with that of the Faculty. The importance and extent of the research partnership between the University and our academic hospitals is recognised in recently ratified affiliation agreements and by the jointly supported position of Vice-Dean Research, Health Sciences (FHS) and Vice-President Health Sciences (KGH). In aggregate, university and hospital based research funding to the FHS (\$84.5 million F09) comprises close to half of the overall research budget of the University. To assist with future strategic planning, the FHS has over the last 2-3 years developed a very extensive annual research report detailing research funding by source, research site (hospital/university) funding trends and research activity by various sectors/units of our faculty (available on request)

A global mission:

The mission of the FHS research plan is global in scope. It speaks to enhancing the health and well-being of the people of Canada and the world through research, research education and knowledge translation. Over the last 5 years, we have seen considerable increase in strength within the FHS with respect to knowledge translation, some of which is of a truly international nature. For reasons allude to below, this area of research is a promising area for future growth. Some examples include:

- The International Centre for the Advancement of Community Based Rehabilitation, founded with funding from CIDA, with a mandate to advance

development of community based rehabilitation to ensure full citizenship for persons with disabilities.

- The collaboration of the Practice and Research in Nursing (PRN) Group with the Joanna Briggs Institute (JBI), a global leader in evidence based healthcare. The PRN is presently the only JBI centre in Canada.
- The development of international evidence based guidelines for nutrition in a critical care setting (Clinical Evaluative Research Unit), and
- The coordination of international, practice-changing clinical trials by the NCIC Clinical Trials Group (Cancer Research Institute).

Interdisciplinarity:

One of the strategic priorities of the FHS over the last decade has been to enhance translational, interdisciplinary research. The Faculty has done so by identifying specific, thematic research areas and encouraging the development of a continuum of research in these areas that extends from discovery, through clinical validation to practice and policy development. Following, a broadly based internal review process, several themes and groupings were identified where the FHS either had established research strength that was national or international in stature, or which showed promise of attaining such stature. These areas were initially identified as sub-themes in the University's Strategic Research Plan for the Canada Research Chairs and Canada Foundation for Innovation Programs. They were, as identified in the above plan: (1) Biomolecular Studies including Medicinal and Biological Chemistry, and Protein Function and Discovery, (2) Genetics, (3) Cancer Research, (4) Cardiorespiratory Sciences, (5) Environment and Human Health, (6) Gastrointestinal Diseases, (7) Reproductive Sciences, (8) Health and Society, (9) Musculoskeletal Diseases, (10) Neuroscience, and (11) Primary Care.

Priority program areas:

To assist with strategic planning, all programmatic research groupings have provided recent annual reports (available on request) containing detailed information indicating

how the research themes have evolved and how they are functioning based on standard metrics by which research excellence is judged i.e. funding, publications, trainees, invited lectures/presentations etc. Individual research groups have also provided a description of their planned future activities which can be found verbatim in Appendix 7.

Some of the areas have flourished and have matured into physically consolidated, interdisciplinary research groups, which include basic scientists, population scientists and clinicians. Some have also attracted very substantial capital and infrastructure funding from external sources, such as the Canadian Foundation for Innovation and the Ontario Research Fund, which has had a major impact on the research resources available to the Faculty and the University. These include the Cancer Research Institute (CRI), the Centre for Neuroscience Studies (CNS), the Human Mobility Research Centre (HMRC), the Gastrointestinal Diseases Research Unit (GIDRU), the Centre for Studies in Primary Care and the Protein Function and Discovery Group (PFD).

Other research themes continue to develop, such as the Cardiovascular and Respiratory Research Group and the Group in Reproduction, Development and Sexual Function (Recently restructured and renamed as the Group for Studies on the Reproductive and Developmental Origins of Health, Disability and Disease), both of which are anticipating application for Senate recognition as a Faculty or University Centre within the next 2-3 years (Appendix 3). With the proposed restructuring in the School of Medicine and the additional space made available by construction of the School's new building, the time is opportune to reexamine the possibility of refocusing and consolidating the research themes that have developed to varying degrees over the last decade.

One the impediments to development of some of the priority research areas is attributable to the fact that members involved in these groups were geographically dispersed at their inception and have remained so. Given the range of disciplines involved, the fluidity of the groups and the limitations of available research space in FHS, it has not been possible, with the exception of the examples cited above, to

physically regroup faculty along thematic lines. Nevertheless, examples such as HMRC, CRI and GIDRU demonstrate the benefits of enabling informal, daily interaction that crosses disciplines.

To address some of the pressures on research space, the New Medical School Building has been designed to include new undergraduate teaching laboratories and other facilities, to replace those in Botterell Hall, freeing up >16000 sq.ft for redevelopment. This, combined with the proposed merging of the 5 basic science departments in the building, provides an important opportunity to invest in the creation of new and innovative, interdisciplinary nodes of investigators.

Integration of research and education:

Another priority of the FHS research strategic plan has been to expand and enhance research education and training programs. This has occurred in a number of ways and at several levels, perhaps most notably with our success in obtaining highly competitive strategic training grants from CIHR and NSERC. Over the last 7 years, research groups located in the FHS have been awarded four Strategic Training Initiative in Health Research (STIHR) grants from CIHR; two to the Cancer Research Institute and one each to the Gastrointestinal Diseases Research Unit and the Protein Function and Discovery Group. In addition, last year, the Human Mobility Research Centre was awarded a NSERC Collaborative Research and Training Experience (CREATE) grant. Each of these training programs has been supported with ~\$1.8 million from the respective agency. All are, or have been, highly innovative, emphasizing both interdisciplinarity and preparation for a wide range of research related careers. In addition, the programs bring together 'trainees' who would not normally interact in traditional programs. They include not only graduate students from various disciplines, but also post-MD and post-PhD fellows and, more recently, undergraduate students.

The identification and focus on priority interdisciplinary research themes has had a major effect on graduate education, most evidently with the creation of the first 'free

standing' interfaculty, graduate program in neurosciences and plans for an interfaculty undergraduate program in social neurosciences. More recently, a collaborative graduate program in cancer research has been launched which involves six departments within FHS and the Department of Psychology. There are now also numerous graduate level courses that have been designed to mesh with the priority research areas. Although identified as areas of research priority, the thematic interdisciplinary programs have begun to influence undergraduate education, notably in the Life Sciences Program, which now offers streams in cancer research, cardiorespiratory science and neuroscience, as well as themes that are emerging as potential areas of research growth, such as drug development and human toxicology. Such developments provide tangible evidence of the integration of research and education in health sciences, at all levels.

Opportunities for interaction among research groups within the Faculty:

A number of opportunities for interaction across research themes within FHS and elsewhere in the University have been identified in the 'Where next' submissions from individual groups (Appendix 3). Within the FHS, we have recently examined cross-cutting research interests to identify common ground among research themes as part of a planning process for CFI applications. The objective was to identify infrastructure needs that would benefit a broad range of investigators particularly with respect to translational and clinical research, as well as to identify opportunities for consolidation or pooling of resources. We will be using such information to inform our planning process for the redevelopment of space in Botterell Hall and elsewhere following completion of the new medical school building. The matrix below provides examples of potential 'overlap areas' which were identified among a number of the priority research themes in the Faculty.

Examples of opportunities for interfaculty research collaboration:

Opportunities exist in the areas of population health and health services and policy research for enhanced interfaculty coordination involving the Centre for Studies in Primary Care, the Centre for Health Services and Policy Research, the School for Policy Studies, the Cancer Care and Epidemiology Division of the Cancer Research Institute, the Queen's node of the Institute for Clinical and Evaluative Sciences (ICES) and the Department of Community Health and Epidemiology, as well as individual investigators in other units. At the level of individual investigators, a number of collaborations that cross groups already exist. This was made apparent during the process that led to the creation of the now discontinued, Institute of Population and Public Health. Despite the decision to discontinue this initiative, consideration of alternative structure(s) that may more effectively capture and leverage the existing strength in health services and policy research may be warranted.

The potential benefits of combining strengths in the areas of Protein Function and Discovery and Drug Development and Toxicology with expertise in the Departments of Chemistry and Chemical Engineering has already been recognised to some extent with formation of the Queen's University Mass Spectrometry and Proteomics Services Unit (MSPSU), which will exploit the complementary proteomic and small molecule mass spectrometry capabilities that exist across the units. This initiative is well aligned with growing interest within the Cancer Research Institute and the Department of Pathology and Molecular Medicine in the area of predictive and prognostic markers of cancer response and outcome. Major CFI applications are anticipated in both of these areas.

There is potential for expanding the strong linkages that already exist between areas of strength in the FHS and the Faculty of Applied Sciences. The most mature of these linkages exists in the Human Mobility Research Centre and involves both research and more recently, educational initiatives, such as the NSERC CREATE program. Some of these research linkages date back approximately 10 years and involve members of the School of Computing and the Departments of Mechanical and Chemical Engineering.

These linkages originally focussed on image guided surgery and medical devices, but are now expanding into tissue engineering and regeneration, as well as additional imaging modalities. Recent recruitments in the School of Computing have created strength in cancer imaging and associated robotic surgical techniques. Cancer imaging and radiation therapy is also a strengthening area in the FHS and at Kingston General Hospital (see also individual where next submissions from HMRC and CRI, Appendix 1)

Where next:

As indicated above, 'Where next' responses from individual research groups are provided in Appendix 7. Comments below are intended to supplement this information and relate to broader, longer-term issues pertaining to the future challenges to health sciences research faced by the university and our affiliated hospitals.

An exciting new proposal is to create a Centre for Military Health Research as a collaborative venture involving Kingston General Hospital, the Royal Military College, National Defence and the University.

Our future strength as an academic health sciences centre, or as the research intensive hub of an academic health sciences network (as envisioned in the draft report of the Academic Health Sciences Centres-National Task Force: 'Three Missions...One Future'), will depend to a very significant extent on the ability to grow our clinical/patient oriented research programs. While we have foci of true clinical research excellence, the programs are presently driven by a relatively small number of, in some cases, senior members of our Faculty and they will need to be supported, expanded and reinvigorated.

Given population demographics and the increasing challenges faced by our health care system, it appears inevitable that health research will remain a major priority for both the public and government, and that we will see escalating demand for demonstrable return on investment, as evidenced by launch of the CIHR Strategy for Patient Oriented Research. While this presents us with very significant opportunities for growth in health

research, research education and education in health research, it has to be recognised that we compete for funding with academic health science centres which are typically located in much larger cities, where hospital based institutes have become very significant research contributors. In some locations, such as Toronto and Ottawa, the hospital research institutes are responsible for garnering the majority of peer review funding. These institutes also receive very significant financial support from their respective hospital foundations. In contrast, in Kingston, our affiliated academic hospitals do not have research institutes and historically, the hospital foundations have focused overwhelmingly on fundraising for hospital redevelopment. In the current, increasingly competitive environment, it is essential that we take full advantage of the opportunity presented by the extensive interactions and close working relationships that exist among the university and its fully affiliated hospitals, to develop a more formally coordinated, focused health research agenda, and to work collectively to enhance its visibility and impact to the benefit of all partners.

Several factors, both local and external, suggest that this is an opportune time to move toward the creation of a health research 'umbrella' that formally recognises and promotes the contributions made by its partners.

With the differentiation of clinical care across our three fully affiliated hospitals (ambulatory care at Hotel Dieu, rehabilitation and geriatric care at Providence Care and acute, complex care at Kingston General) we have an outstanding opportunity to develop a highly complementary, rather than duplicative or competitive, research program with strong ties to basic and applied science programs at Queen's.

The definition of what we presently think of as an academic hospital is changing, with increasing emphasis being placed on research as a defining characteristic. For example, the new strategic plan of the Council of Academic Hospitals of Ontario is overwhelmingly research focused, thus distinguishing its members from large community based hospitals which are becoming increasingly involved with distributed models of medical education. Similarly, language in the federal budget referred to the

importance of research intensive, rather than academic hospitals, to health care and the science and technology arena.

The terms of reference of our hospital foundations may be expected to change in the not too distant future as redevelopment progresses, with a greater emphasis being placed on health research. Similarly, health research provides a relatively untapped fundraising opportunity for Queen's.

Lastly, we are fortunate that the South Eastern Ontario Medical Association (SEAMO), to which the Clinical Teachers' Association of Queen's University (CTAQ), Queen's, Kingston General, Hotel Dieu and Providence Care are signatories, is currently funded by a Provincial Alternative Funding Plan (AFP) that recognises to an exceptional degree, compared with similar plans elsewhere in Ontario, the academic responsibilities of our clinical faculty. In recognition of these responsibilities, a recent task group convened by SEAMO has recommended significant changes to the funding formula of the AFP, endorsed by the governors of SEAMO, which places far greater emphasis on the importance of SEAMO's academic role. Most notably with respect to research, by the creation of a fund dedicated to the recruitment of a new generation of clinician scientists.

5. Organizational Restructuring in the School of Medicine: Integration of the Biomedical and Molecular Sciences

In the Spring of 2009, the School of Medicine recognized that projected reductions in base budgets would, in the intermediate term, place in significant jeopardy the quality and sustainability of educational and research programs in the basic sciences that were integral and of critical importance to the School's academic mission. Consequently, the Dean's Advisory Group on Restructuring (AGoR) was established to design an organizational model for the basic sciences that would enable its high level of academic performance to be maintained in an environment of diminishing resources.

Over the course of the last year, AGoR completed a detailed, comprehensive and inclusive design process that was based on three general design themes:

1. Integration

The organizational structure must enable functional integration of the basic sciences and facilitate interdisciplinary collaboration in the development and administration of educational and research programs.

2. Operational capability

The organizational structure of the basic sciences must enable the most efficient and effective management of human, financial and infrastructure resources.

3. Strategic capability

The organizational structure of the basic sciences must enable adaptability to environmental change and the development and the exploitation of competitive advantages.

The outcome of the design process was a proposal that the School of Medicine adopt an organizational model in which all educational and research programs of the basic sciences, as well as the associated infrastructures, are integrated within a single new Department of Biomedical and Molecular Sciences. The principle features of the model are:

- The Department of Biomedical and Molecular Sciences is formed by the merger of the Departments of Anatomy and Cell Biology, Biochemistry, Microbiology and Immunology, Pharmacology and Toxicology, and Physiology.
- The Department of Community Health and Epidemiology remains as a discrete unit with continuing responsibility for the advancement of the public health sciences.
- The undergraduate Biochemistry and Life Sciences programs remain unchanged as independent degree programs. The delivery of these programs becomes the

responsibility of the Department of Biomedical and Molecular Sciences under the authority of the relevant Associate Deans of the Faculty of Arts and Sciences and Faculty of Health Sciences.

- All graduate programs in the School of Medicine remain unchanged. The delivery of the Anatomy and Cell Biology, Biochemistry, Microbiology and Immunology, Pharmacology and Toxicology, and Physiology graduate programs becomes the responsibility of the Department of Biomedical and Molecular Sciences under the authority of the Associate Dean, Graduate and Postdoctoral Education of the Faculty of Health Sciences and the School of Graduate Studies.

The proposal to integrate the basic sciences to foster and enable interdisciplinary collaboration in education and research aligns closely with Principal Woolf's anticipated direction for the University. This organizational model will also markedly improve the capability to manage resources, to respond effectively to environmental change and to invest resources strategically. The principle benefits of the integrated department include the following:

Enhanced interdisciplinary collaboration

- Basic science faculty will be linked by common departmental missions and visions for education and research. Historical boundaries will become obsolete and their disappearance will significantly mitigate internal competition for resources.
- Assigning responsibility for the delivery and administration of both undergraduate and graduate educational programs to a single integrated department will enable growth and implementation of interdisciplinary approaches to teaching and learning.
- Creation of a single home for the large majority of basic biomedical research faculty will remove existing administrative boundaries and facilitate expansion of interdisciplinary research.

Improved Operational Flexibility and Effectiveness

- Consolidation of resources within a single administrative unit will enable their timely reallocation to areas of need and strategic importance.
- Uniting the basic science faculty within one department necessitates establishment of a single faculty work-load document. This will enable the equitable division of teaching responsibilities among faculty, the efficient use of faculty teaching time and the allocation of appropriate teaching resources to areas of strategic need. Improving the efficiency with which the faculty teaching resources are employed will facilitate the protection of faculty time for scholarship.
- Achieving alignment of responsibility and authority for the administration of educational programs and research infrastructure will facilitate planning, decision-making and management, and reduce duplication of effort.

Increased Efficiency of Resource Utilization

- Establishment of a single administrative unit will enable optimal coordination of administrative processes and resource management.
- Resources can be optimally aligned with function.

Enhanced Responsiveness and Strategic Management Capability

- Integration of the basic sciences will enable the establishment of a cohesive and coordinated strategy for education and research.
- Alignment of responsibility with authority will promote organizational responsiveness by enabling timely and effective planning, decision-making and the implementation of decisions.

The proposal for organizational restructuring of the basic sciences has been approved by the School of Medicine Executive, School of Medicine Academic Council and Faculty

Board of the Faculty of Health Sciences and will now be submitted to Senate for approval. The target for the establishment of a functional Department of Biomedical and Molecular Sciences is the start of the 2011/12 academic year.

The full proposal of the Dean's Advisory Group on Restructuring is available on request.