

# **McGill Faculties of Medicine and Dentistry Strategic Research Plan**

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## Table of Contents

<b>Executive Summary</b> .....	<b>3</b>
<b>1. Introduction</b> .....	<b>5</b>
<b>2. Outline</b> .....	<b>6</b>
<b>3. Disease Areas</b> .....	<b>7</b>
<b>3.1 Infection and Inflammation</b> .....	<b>7</b>
<b>3.2 Cancer</b> .....	<b>8</b>
<b>3.3 Neurosciences and Mental Health</b> .....	<b>9</b>
<b>3.4 Aging, Disability and Chronic Diseases</b> .....	<b>10</b>
<b>4. Strategic Priorities</b> .....	<b>12</b>
<b>4.1 Patient Experience, Population Health and Health Services</b> .....	<b>12</b>
4.1.1 Social and environmental determinants of health .....	12
4.1.2 Healthcare information technology .....	12
4.1.3 Patients’ experience with health and illness, patient/family engagement, and interactions across the continuum of care .....	12
4.1.2 Optimal health trajectories over the life-course .....	13
<b>4.2 Genetic and Environmental Determinants of Health and Disease</b> .....	<b>13</b>
4.2.1 Gene discovery in rare diseases and in common complex disorders .....	14
4.2.2 Epigenetic modulation of the genome in disease .....	14
4.2.3 Extracellular matrix in normal cell signalling and in pathological situations .....	14
4.2.4 Host-microbe interactions in infection, inflammation, development and cancer .....	14
<b>4.3 Systems and Networks Approaches to Health Research</b> .....	<b>15</b>
4.3.1 Integrated “omics” approaches to biomedical research .....	15
4.3.2 Integrating with health data .....	15
4.3.3 Computational approaches to quantitative biology .....	15
4.3.4 Imaging of cellular networks .....	16
<b>4.4 Personalized Medicine: Customized Approaches to Patient Care</b> .....	<b>16</b>
4.4.1 Biomarkers- and molecular signature-based strategies for disease diagnosis, monitoring and treatment including clinical trials .....	16
4.4.2 Tailored health interventions for patients and families .....	17
4.4.3 Personalized health improvement devices and delivery systems .....	17
4.4.4 Precision engineering of animal-, cell- and protein-based models of human disease .....	17
4.4.5 Customized health care delivery for the population.....	18

## Executive Summary

In 2014, The Deans of the Faculty of Medicine and the Faculty of Dentistry engaged in a strategic planning exercise to assist the Faculties in establishing priorities for research, recruitment, space allocation, and for financial support for research activities. The resulting strategic research plan (SRP) was originally approved in 2014 and the current document represents a 2017 update.

The SRP contains forward-looking research priorities that will provide McGill with the greatest likelihood of success in ensuring continued leadership in health research over the coming decade. The research priorities build on current areas of excellence, and are strategically positioned to stimulate innovation in a fundable environment. The overarching goal is to achieve a high level of research excellence in selected areas, while training the next generation of health researchers in a highly competitive and inter-disciplinary research environment. The SRP is anchored on a renewed focus on translating science from research results into improved clinical practice, better health outcomes and enhanced economic activity. The SRP takes into account research directions from individual schools, academic and clinical departments, centers and networks of the Faculty, as well as research institutes from affiliated teaching hospitals.

The plan acknowledges that future research at McGill should not only focus on promoting and improving health over the course of life, but should also aim to improve health outcomes in disease areas of major medical and societal importance including cancer, infections and inflammation, neurosciences and mental health, aging and chronic diseases. To optimize research activity, the plan proposes several timely cross-cutting priorities that aim to not only significantly advance knowledge but to apply an active program of engagement and translational science to improve health and clinical practice in the above-mentioned disease areas. These priorities build on current strength while taking advantage of recent investments in infrastructure and people. The focus of these priorities aims at: Improving patient experience, population health and health services; Identifying and characterizing the genetic and environmental determinants of health and disease; Developing and implementing systems and networks approaches to health research that are more patient-oriented; Prioritizing personalized medicine and tailored approaches to patient-centered care. The plan elaborates novel implementation methods and stakeholder-engagement strategies to maximize research output, and to facilitate knowledge translation of research results into improved health of people and their families and better clinical care. Support of key infrastructure and technology platforms will be prioritized. Building new groups to foster multidisciplinary research and training at unique interfaces will be undertaken. The SRP acknowledges the breadth of current research streams in the Faculties, and also recognizes the dynamic and rapidly evolving nature of health research. Hence, the SRP is a living document that will be periodically reviewed and updated to take into account novel and timely research opportunities. An Implementation Group has been created to a) activate the plan, b) monitor progress on its stated objectives and using pre-defined metrics, c) develop a process to acquire feedback from the community on an on-going basis and d) update the SRP.

The first iteration of the SRP (2014) focused on building on existing strength to achieve high levels of excellence in prioritized research areas. That version of the SRP also emphasized the creation of interdisciplinary teams and programs to facilitate knowledge transfer across disciplines and creation of new research interfaces; examples of this included the creation of the

Global Health initiative, the School of Population and Global Health, the initiative in Computational Medicine, and the revamping and expansion of the MD/Ph.D program. The current update of the SRP (2017) places renewed emphasis on developing new strategies, programs, networking and engagement of researchers, clinicians, health care professionals and other stakeholders and knowledge users to enhance the translational value of research results and their implementation across different populations, clinical settings and disease fields. The impact of research will be enhanced through the creation of new partnerships with the public sector and with industrial partners, active engagement with patients, clinicians and communities to facilitate commercialization and implementation of research results for improved diagnosis, treatment, and health interventions that will improve the health of Canadians.

## 1. Introduction

The educational mission of the Faculties of Medicine and Dentistry is reinforced by a broad, dynamic and highly successful research enterprise that extends from fundamental molecular and cellular biology, to computational biology, to public and population health, to clinical research at the bedside and in the community. This robust research activity within the Faculties of Medicine and Dentistry represents the core of McGill's research effort, accounting for more than 60% of total research funding to McGill, while supporting undergraduate, graduate and post-doctoral education as well as training of health care professionals.

Our goal has been to develop a plan to support research excellence in strategic areas, train the next generation of health researchers, and facilitate the translation of new knowledge into beneficial health outcomes for patients, the population of Quebec, and provide key information to policy makers. To this end, the Faculties of Medicine and Dentistry have developed a joint strategic research plan (SRP). The strategic research plan will assist the Faculties in establishing priorities for recruitment, attribution of space, direct financial support for research activities, as well as help with targeted fundraising.

Primary responsibility for the 2014 version of the SRP was given to the Planning Committee, which made initial recommendations on strategic research priorities. The final product was overseen by the Steering Committee which further developed and refined the document. Together, the two committees identified the key areas of health and diseases to be targeted, developed a set of strategic areas of research, and designed an implementation strategy which was used to produce the current document. An international advisory committee further reviewed the SRP, and made final recommendations to the Deans.

This plan must be considered in the appropriate context. It aims to complement the University's own SRP, providing specific applications of that plan within the Faculties. It similarly does not supersede more focused research plans developed in parallel by individual units, departments, schools or affiliated research institutes from teaching hospitals. Nevertheless, it was not possible for the SRP to represent all areas of excellence in health research at McGill without losing strategic focus. In particular, health professional educational research will be the subject of separate strategic planning process. The very dynamic and rapidly evolving nature of health research, including the profound and sudden transformative effects of technological advances, makes it imperative that the SRP be periodically reviewed and updated to take into account evolving research context and emerging opportunities.

The first review and update of the SRP took place in spring 2017. It was coordinated by the Dean, the Vice-Dean for Life Sciences, and the Associate Dean Research of the Faculty of Medicine, and was assisted by a Working Group with broad representation from health professional Schools, basic sciences and clinical departments, the Faculty of Dentistry and affiliated research institutes. In response to a request for new strategic priorities and strategic initiatives emerging across the FoM, the group has identified and coordinated the inclusion of these new strategic activities in the revised SRP, with final approval by the Deans of the Faculty of Medicine and the Faculty of Dentistry and by their respective Faculty Councils.

## 2. Outline

The overarching goal was to develop a plan that would support a very high level of research excellence in selected areas, while training the next generation of health researchers in a highly competitive and interdisciplinary research environment with a clear focus on translating knowledge from research results into beneficial health outcomes for individuals, their families and communities. We recognized that health research activities of the Faculties cover an enormous range of disciplines and approaches. Hence, it was not possible (nor was it desirable) for the SRP to encompass and accurately represent all areas of excellence in health research at McGill without losing strategic focus. Rather, strategic research areas were identified through a broad consultation and consolidation process.

Given the complexity and scope of the research effort in the Faculties, the SRP looks at strategy from 3 perspectives: i) health and disease areas to focus on, ii) strategic priorities that cut across multiple disease entities, and iii) cross-cutting implementation strategies. The choice of disease areas and priorities reflects input from a broad consultation of faculty members, coordinated by the SRP planning and the steering committees. The identified strategic research themes and activities correspond to areas of established or emerging strength in which McGill can excel and which bring together the efforts of multiple groups across the campus, in community clinics and in the teaching hospitals. These are supported by a series of implementation initiatives aimed at ensuring that these strategic priorities can move forward. Mechanisms have also been put in place to execute these initiatives, and develop new ones based on regular feedback from the research community.

The major disease groupings include: 3.1) Infection and Inflammation; 3.2) Cancer; 3.3) Neuroscience and Mental Health; and 3.4) Aging, Disability and Chronic Disease. The cross-cutting strategic priorities include: 4.1) Patient experience, population health and health services; 4.2) Genetic and environmental determinants of health and disease; 4.3) Systems and networks approaches to health research; and 4.4) Personalized medicine: Customized approaches to Patient Care. The implementation strategies build on existing tools (recruitment, training, knowledge translation), and favor novel multidisciplinary groupings (new institutes, virtual programs), while exploring novel strategies for financial support (strategic funding, commercialization, targeted fundraising).

### 3. Disease Areas

Emerging from the very wide areas of interest within the Faculties are four major disease themes: Infection and Inflammation; Cancer; Neuroscience and Mental Health; Aging, Disability and Chronic Disease. In addition to addressing the most important health issues of the moment, McGill has specific opportunities to enhance its research performance in each of these areas.

#### 3.1 Infection and Inflammation

The 21<sup>st</sup> century is witnessing the re-emergence of infectious diseases as a major threat to global health. This is due in part to increased prevalence of highly antibiotic-resistant microorganisms as well as the continuous appearance of new and highly virulent pathogens. Antimicrobial overuse, increased globalization, population mobility, and a changing climate all additionally contribute to the growing threat of infectious disease. At the same time, studies of inflammatory and immune responses to infection and tissue injury are providing novel insight and new therapeutic opportunities in major chronic inflammatory disorders ranging from inflammatory bowel disease, multiple sclerosis and periodontal disease to asthma, that are major sources of morbidity and healthcare costs in Canada. Most recently, we have come to better understand the complex relationship between the host and the microbial world around it. We now recognize that the microbiome found on the body's mucosal surfaces plays a central role in the programming and regulation of the immune response, and is a major determinant of health and disease.

At McGill, the efforts in this area will build on long-established strengths and will take advantage of the presence of substantial resources in genomics, informatics and epidemiology. Specific areas of effort will be in the field of tuberculosis (McGill International TB Center), chronic viral diseases (including human papilloma virus) and, in concert with McGill's Institute of Parasitology, key parasitic infections such as *Leishmania* and malaria. The newly created Global Health Program of the School of Population and Public Health will play a leading role in facilitating studies of neglected infectious diseases. Work on the microbiome will be pursued by the Innovation Centre and by the Microbiome and Disease Tolerance Centre (MDTC) led by the Department of Microbiology and Immunology. Vaccine development will be focused in the Centre for Innovative Medicine at the RI-MUHC, taking advantage of new facilities at the Glen Yards campus.

We will also build on longstanding excellence in clinical and fundamental research in connective tissue diseases, chronic inflammatory and autoimmune diseases such as inflammatory bowel disease, multiple sclerosis and rheumatoid arthritis. These efforts will bring together strengths in clinical, epidemiologic and translational research at the MUHC and JGH, with the study of fundamental mechanisms in cell and animal models at the McGill Research Center for the Study of Complex Traits, and efforts in genomics and epigenetics at the Innovation Centre, as well as expertise in several disease-specific campus and hospital-affiliated centers.

### 3.2 Cancer

Cancer remains a leading cause of premature death in the western world and is now a significant global challenge in the developing world. The complex nature of cancer reflects the interaction between genetics and the broad range of environmental factors including exposure to carcinogens to lifestyle choices to infectious agents that contribute to cancer development. Although new treatment modalities have improved outcomes, where the care of some cancer patients increasingly involves the management of a chronic condition over long periods of time, our ability to successfully treat cancer has yet to be fully realized. One of the greatest challenges is the recognition that cancers are highly heterogeneous and rapidly evolving. This poses challenges for effective therapeutic intervention. Improved outcomes reflect enhanced mechanistic understanding of genetic and epigenetic changes as cells move from pre-malignancy to invasive cancer. Cancer research at McGill will continue to focus on these basic mechanisms of neoplastic transformation at the genomic as well as cellular level, interaction of tumor cells with host microenvironments, dissemination and metastasis of cancer cells, response to radiation, chemotherapeutic and targeted treatments as well as mechanisms of resistance. This will be complemented by a parallel focus on developing novel marker sets for refined clinical diagnosis, and that can support improved screening programs as well as targeted and more efficacious therapeutic interventions. In addition, cancer research at McGill focuses on a multidisciplinary approach to cancer treatment, building on a particular strength in psychosocial oncology and health services research to enhance patients' and their families' coping with harduous treatments and taxing side effects.

The McGill clinical cancer research community has and will continue to actively participate in clinical trials. Future success of such activities will depend on improved collaboration and cooperation among the major cancer research units within the McGill community, bringing together bench scientists and their clinical counterparts. This effort will be centered in the Department of Oncology, which hosts the Rossy Cancer Network (RCN). Key goals of the RCN are to harmonize not only treatment strategies but also informatics and outcomes measurement, initially across McGill teaching hospitals and eventually branching out across the McGill RUIS. In addition to enhancing our capacity to carry out outcomes research, the advent of the RCN further strengthens McGill's efforts in psychosocial oncology, health services research, palliative care and related fields.

By bringing together the cancer care efforts of the new MUHC Cancer Centre, the Segal Cancer Centre at the JGH and the cancer program at St. Mary's hospital, the RCN will provide a platform for excellence in translational research in cancer, complementing the leading edge fundamental research underway in the Goodman Cancer Research Centre, the Lady Davis Institute and the RI-MUHC. Specific areas of focus will include molecular and genomic markers for breast, brain, colorectal and lung cancer, leukemia and familial cancers as well as metabolic programming as part of the development of approaches to personalized cancer interventions, which allow for adjustment of therapy to match the biological behavior of malignancies. The study of these novel approaches will be comprehensive, taking advantage of McGill's strengths in health outcomes research, model systems, molecular pathology and clinical trial infrastructure. Also considered priority is the considerable strength that McGill has in the area of population

health research on cancer prevention. McGill's cancer epidemiology teams have been instrumental in bringing to the world HPV vaccination, and new molecular-based technologies for cervical cancer screening.

### *3.3 Neuroscience and Mental Health*

Although considerable progress has been made in the management of stroke and other acute brain injuries, chronic diseases of the nervous system remain a major source of morbidity in all age groups. Central nervous disease also manifests itself as severe neurological and psychiatric disorders, which account for an enormous burden of disease. All of these disorders have limited therapeutic options, creating the need not only for better understanding of the underlying neurobiology, but for improvements in rehabilitation strategies and models of care delivery that better take into account the needs of patients and their families. To better address these needs, McGill will move toward a unified approach to chronic brain disease, bringing together psychiatry, neurology, rehabilitation sciences and related clinical disciplines such as nursing and family medicine. Research in neuroscience, cognitive neuroscience, and mental health will be supported in part by the recent major Canada First Research Excellence Fund award McGill received, entitled "Healthy Brains for Healthy Lives", and a number of large disease-specific philanthropic initiatives in this area.

From a biological point of view, McGill will build on our strengths in neuroscience, particularly imaging and genetics, as well as on research examining the molecular mechanisms of neural networks and neuronal signaling, and the development of disease-relevant transgenic animal models. The Montreal Neurological Institute and Hospital (collectively, the Neuro), and the Douglas Mental Health University Institute will be major players in these efforts, forming a nucleus of excellence in fundamental neuroscience research, neuroimaging and bioinformatics. The Neuro will work in close collaboration with the RI-MUHC to bring together the neuroscience efforts across the MUHC, including the MGH-based Centre for Research in Neuroscience. With the recruitment of new leadership, the Douglas Research Centre is poised to serve as a leading partner in neuroscience research related to severe mental illness, and to capitalize on the Douglas Institute's strengths in clinical-research integration and the study of psychosocial determinants of brain disorders.

Researchers based at the Neuro and the Douglas will work closely with those at the Lady Davis Institute of the JGH, which has developed a leading program on Alzheimer's Disease. These efforts will be complementary to active research programs in basic and cognitive neurosciences that are taking place in academic and research units, such as Pharmacology, Physiology, Biomedical Engineering, and the Centre for Research on Brain, Language & Music, as well as Brain@McGill, which is a virtual center consisting of senior neuroscience representatives from the main McGill stakeholder institutions to establish an international collaborative partnership involving neuroscientists at McGill, University of Oxford, Imperial College London, Tel Aviv University and the Neuroscience Center of Zurich.

There will be continued emphasis on understanding the biological and developmental determinants of neurological disorders, making use of existing strengths in neuroimaging, bioinformatics and animal models. Genomics technology will be used to better understand the

interaction between genetics and environment and its impact on the development of chronic neuropsychiatric disorders. These efforts will be complemented by continuing clinical research programs in eating disorders, social and trans-cultural psychiatry, novel strategies for neurorehabilitation and recovery, as well as studies of mental health services, and policy.

### *3.4 Aging, Disability and Chronic Disease*

As a result of important demographic changes in our population, and our continuing success in managing acute illnesses, aging and chronic diseases constitute overwhelming challenges for the coming decades. In addition, disability is not solely a consequence of aging: it can be congenital but can also be acquired at any time during the life-course, in the form of physical, cognitive or mental impairments that are accompanied by diminished health and limitation in everyday meaningful activities.

Such disabilities have important consequences not only for the affected individuals but also their families and for society at large. The complexity of managing chronic diseases and disabilities requires a multidisciplinary approach, including efforts at preventing, treating or repairing chronic conditions, and development of optimized management strategies and effective health and social policies. To address this challenge, McGill will bring together the efforts of the Schools of Nursing, Communication Sciences and Disorders and of Physical and Occupational Therapy, in partnership with the clinical departments and the Faculty of Dentistry's Oral Health and Society division to work towards the development and implementation of approaches that improve the quality of care offered to patients, to promote enabling social, physical and policy environments and to optimize outcomes.

In addition, a number of risk factors such as smoking, obesity, physical inactivity and poor nutrition, have an overwhelming impact on health status. Developing strategies to effectively modify or diminish the negative impact of these behaviors will engage all elements of the community, including not only health professionals, but also families, educators, and neighbors in participatory research and action processes. The participatory research group in Family Medicine and at the Ingram School of Nursing will co-lead this effort. Participatory research approaches that allow for integrated knowledge translation is essential for including vulnerable populations where these factors have an even higher health impact. As this research is not specific to a disease, organ system, cellular or chemical process, it is necessarily interdisciplinary.

McGill has a rich history and will continue to build on research excellence in endocrine and metabolic disorders including studies of osteoporosis, bone, calcium homeostasis, diabetes and other chronic diseases of metabolism, as well as mental illnesses spanning the lifetime, which together contribute enormously to morbidity and disease burden in our society. In cardiovascular health, McGill will focus its efforts on fields in which it can make unique contributions including congenital heart disease, hyperlipidemia and hypertension as well of the study of risk factors and behavioral interventions aimed at prevention. Expertise in health outcomes research and patient-oriented research will be combined with McGill's strengths in genomics to help better understand the interaction between genes and environments in these high-prevalence conditions.

McGill has a long tradition as a leading centre for pain research. With the recent awarding of a Canada Excellence Research Chair in Pain Research, the Faculties will further develop pain research as a key priority, which brings together clinicians, hospital-based researchers and basic scientists from several departments and divisions.

McGill has an excellent level 1 trauma centre based at the MGH, providing an opportunity to conduct interdisciplinary research in areas related to trauma, such as traumatic brain injury. The Faculties will build on the established successful programs in trauma, ranging from the development of novel approaches to trauma programs in developing countries to the development of novel tools. In addition, research in trauma requires an effort at improving our ability to repair injury. This will be pursued in the form of device development in orthopedics, cardiac surgery and other areas and the development and application of stem cell therapies.

These efforts will be complemented by new initiatives, built around the CIHR's Strategy for Patient-Oriented Research (SPOR). Led by the Departments of Family Medicine and Epidemiology, research will be extended to community-based clinical settings, permitting large-scale translational research programs that will ultimately promote wellness and better health outcomes across the lifespan. Using an interdisciplinary approach with diverse strengths in Medicine (Internal Medicine, Family Medicine, Epidemiology, Nursing, Physical and Occupational Therapy, Psychiatry) and Dentistry, McGill will collaborate with the healthcare system to build on established excellence in participatory and health outcomes research with an emphasis on knowledge translation and implementation sciences.

## 4. Strategic Priorities

### 4.1 Patient Experience, Population Health and Health Services

Through the following themes, McGill will build on its traditional strengths in fundamental research by taking on the complementary goal of studying the roles of the environment, socioeconomic factors and lifestyles, including family and community context, as determinants of health outcomes.

#### 4.1.1 Social and environmental determinants of health and health behaviours

Most diseases that have broad societal impact are multifactorial in origin, reflecting complex interactions between genes and the social and physical world we live in. The major determinants of health and disease status in populations include the social and economic environment, the physical environment, and the person's individual characteristics and behaviors. McGill will take advantage of its strengths in epidemiology, public health, sociology, nursing and other fields, to work in concert with our teaching hospitals and the McGill RUIS. By bringing together key units within the Faculties such as the Department of Family Medicine and the Institute for Health and Social Policy, as well as units across the University including the Center for Population Dynamics in the Faculty of Arts, we aim to be Canada's leading centre for research on social and environmental determinants of health.

#### 4.1.2 Healthcare information technology

Health care is a supremely data-driven activity and the advent of modern information technology is central to current approaches to clinical management, investigation and treatment. There is an enormous need for the development and use of advanced health informatics. McGill's unique strengths in health information technology and in the analysis of large-scale, linked databases, have led to ground-breaking research in pharmaco-epidemiology and drug safety, patient self-management tools, clinical decision tools, public health surveillance, and population health research. The Faculties will build on recent recruitments and research initiatives to enable McGill to become an international leader in the application of health informatics to population based research including genetic epidemiology. These activities will be led in part by the new Faculty of Medicine strategic initiative in Computational Medicine led by G. Bourque (Department of Human Genetics). In addition, the Faculties will focus on key areas of additional inquiry to understand the rapidly evolving cognitive needs and contexts of technology users, to develop innovative analytical methods and systems, and to evaluate their impact through rigorous trials. Robust models of how people interact with technology are critical to ensure that novel systems address important needs. The development of novel statistical and informatics methods to manage and analyze complex, longitudinal data is a unique opportunity given McGill's strengths in biostatistics.

#### 4.1.3 Patients' experience with health and illness, patient/family engagement, and interactions across the continuum of care

In recent years, embedding the patient perspective has come to be considered a hallmark of quality in clinical research, as it takes into consideration individuals' preferences, needs and values – elements that are crucial to understanding health-related behaviours and outcomes. Patient experience in healthcare is the sum of all interactions, shaped by an organization's culture, and that influence patient perceptions across the continuum of care. Recently, significant progress has been made to develop and implement sophisticated approaches to probe multiple

aspects of patient experience, and to use this information systematically to intervene and modulate healthcare delivery, and to inform re-engineering of the healthcare system. These reforms have become a more global endeavor, where patient experience and patient-oriented research are at the centre of national priorities (e.g., CIHR in Canada and the US ‘Triple Aim’ framework for quality improvement). McGill will develop innovative approaches to understanding the patient experience, as well as that of the family and community, and will use this knowledge to improve and optimize the quality of care delivered to patients and their support network.

#### 4.1.4 Optimal health trajectories over the life-course

The health status of populations and individuals cannot be adequately understood without recognizing the influence of health determinants--genetic, environmental and social--from the earliest stages of development and throughout the lifespan. There is a need for an improved understanding of health trajectories and their determinants, with a particular focus on childhood and adolescence. McGill has unique expertise and experience both in child health and human development and in life-course research with projects such as the Canadian Longitudinal Study of Aging, as well as unique methodological strengths to develop new models for the analysis of these complex data systems. In addition, working together with units such as the Centre for Population Dynamics in Arts, the Faculties of Medicine and Dentistry will focus on using these data and expertise to provide new knowledge on population trends to better understand the relationships of a wide range of social, economic, educational and other factors on health trajectories among Canadians. We will renew emphasis on the necessity of McGill researchers to take part in provincial and national opportunities in longitudinal cohort studies.

McGill’s traditional strength has been in bench and clinical research, translating discoveries from bench to bedside, particularly, for example, in neuroscience and cancer. But it is no longer sufficient to demonstrate efficacy in selected populations through clinical trials for medications, diagnostics, procedures and health systems interventions. Not only does this knowledge need to be rapidly integrated into clinical practice that touches the majority of patients, governments need to and want to know what will be the impact of these medications, diagnostics, procedures and health interventions once they are utilized in the healthcare system (effectiveness). There is now a unique opportunity to position McGill as an innovator in translational science in moving research from *«bench to bedside to the community»*, linking McGill’s traditional strengths in bench and clinical research to patient-oriented, community-based work, with potential for novel innovative research programs attractive to funding bodies, government and industry. With the implementation of Electronic Medical Records within our Family Medicine network, we now have access to a large community-based patient population from which benefits may be drawn across the spectrum of health researchers at McGill.

#### 4.2 Genetic and Environmental Determinants of Health and Disease

The “disease state” results from interactions between intrinsic genetic risk factors of the individual and extrinsic environmental triggers. The intrinsic genetic component may be simple as in rare disease-causing and highly penetrant mutations, but is often complex and heterogeneous, involving additive contributions of multiple weak genetic effects modified by unknown environmental determinants. Research in these areas is rapidly evolving and is expected to be distributed across the campus, taking place at multiple sites in academic departments, centres and research institutes, while building on McGill’s substantial investment in

genomics and bioinformatics at the Innovation Centre. The Faculties will explore this area along the following themes.

#### 4.2.1 Gene discovery in rare diseases and in common complex disorders

The advent of whole-genome sequencing now permits the systematic characterization of simple and complex genetic effects in disease. McGill researchers and clinicians will work together to identify the cause of rare disorders and neglected diseases that affect isolated populations, or that are found in populations with strong founder effects, including ultra-rare disorders of little economic value for the pharmaceutical sector. Modern genome technologies can now be used to tackle more common diseases, which have a complex and heterogeneous genetic component. Further, in order to define genetic risks shared across multiple diseases and to identify disease-specific genetic signatures, detailed clinical, demographic and life-style data, along with other assessments of environmental factors, will be incorporated into the analysis of complex common human diseases in large and very-large patient cohorts.

#### 4.2.2 Epigenetic modulation of the genome in disease

Regulated genome expression is a complex process that involves assembly of transcription complexes that bind to specific sites in the genome, the access of which is modulated by many chromatin-modifying enzymes that are expressed in a cell- and time-specific fashion. The epigenetic regulation of genome expression is critically positioned at the interface of genome-environment interactions, and is a major determinant of health and disease. Recent technological advances now permit genome-wide monitoring of histone modification status, binding of transcription factors, and measuring levels of individual gene transcripts with unprecedented accuracy and sensitivity. Researchers in the Faculties will establish at the tissue and cell level the patterns of genome expression and associated epigenetic modification in order to determine how such modifications are associated with disease causation, onset, progression, response to treatment and outcomes. Research will also focus on studying the impact of discrete genomic variations, and environmental factors on epigenetic regulation, and how these ultimately influence health and disease status.

#### 4.2.3 Extracellular matrix in normal cell signalling and in pathological situations

The sensing of environmental and positional cues in the extracellular milieu is a dynamic process that is essential for homeostasis including tissue patterning during development, and tissue repair following injury. McGill researchers are using novel genetic, cell biological and imaging approaches to study physiological calcification in mineralized tissues whose disruption leads to severe defects in joint, bone, tooth and otoconia formation and function. They are also studying the mechanisms responsible for immune cells trafficking and sensing of injured, damaged or infected tissues, which represent critical steps in tissue repair and remodelling that are often compromised in patients suffering from chronic inflammatory conditions. Research in these areas will focus on studying the interaction between extracellular cues, their cognate receptors, and their intracellular signaling pathways that together modify cellular metabolism and cell function during normal development and to maintain tissue homeostasis.

#### 4.2.4 Host-microbe interactions in health, infection, inflammation, development and cancer

The interaction between the genetic background of an individual and the outside microbial world is being recognized as a major determinant of health and disease. This is not only true in revealing obvious primary immunodeficiencies, or severe infections, but also for common inflammatory diseases such as inflammatory bowel disease, systemic lupus

erythematosus and rheumatoid arthritis that are all thought to have a microbial and/or autoimmune component. Microbial populations at mucosal surfaces (microbiota) are also suspected to play a role in many unrelated diseases including cancer, diabetes, obesity, and autism. McGill researchers are engaged in implementing novel approaches to gain better understanding and characterization of these relationships. McGill will develop and implement novel omics-based approaches to characterize changes in microbiota that are associated with health or disease, including defining unbiased qualitative and quantitative genetic fingerprints of otherwise impossible-to-cultivate microorganisms. Specific efforts will be made to define the potential role of microbiota in the modulation of cancer biology.

#### *4.3. Systems and Networks Approaches to Health Research*

New advances in the “omics” and imaging fields have generated highly precise biological datasets on an unprecedented scale, which hold the promise of enabling the detailed analysis of biochemical, physiological, and environmental interactions that determine health and disease, both in humans and in animal models. This opens the door to a systems or network approach to understanding biology, which will be explored in the following themes.

##### *4.3.1 Integrated “omics” approaches to biomedical research*

Whole genome sequencing is generating deep and high-quality sequence data for thousands of individuals; RNA sequencing in the same biological samples makes it possible to link intrinsic genetic information with epigenetic regulation of RNA expression (transcriptome), but also with other large datasets from patients’ clinical samples such as profiles of metabolites and abundance of proteins. McGill will build on its substantial strategic investments in infrastructure and personnel for data acquisition to investigate how the different “omics” datasets relate not only to each other but also to biological effects at the cell and organismal levels, including determinants of health and disease. The future of “omics”-based research at McGill will involve multidisciplinary teams of clinicians and scientists working together to develop new and effective analytic methods for integrating different kinds of “omics” datasets with clinical data.

##### *4.3.2 Integrating with health data*

Public and primary health research using large linked datasets from electronic medical records, healthcare administration, and surveillance offers a unique opportunity to understand the complex interplay between genetic, environmental and behavioural determinants of health, the interaction with the healthcare system and ultimately health outcomes. This constitutes an area of current and future strategic interest to McGill researchers, who will build on previous successes such as in drug safety research. To move this forward, the Faculties will promote the development of advanced methodologies and systems for storage, retrieval and handling of electronic data, and advanced methods in pattern recognition, causal inference, and epidemiology. This activity stream is a major focus of the CFREF-funded “Healthy Brains for Healthy Lives” research and training program at McGill (A. Evans, program leader).

##### *4.3.3 Computational approaches to quantitative biology*

The future of biological research is quantitative, and mathematics, computing and engineering are in turn increasingly influenced by biology. The major limiting factor in biomedical research is now rapidly shifting from data production to data processing, interpretation and modeling. Investigators within the Faculty of Medicine have long been pioneers in the development and application of mathematical biology and biophysics to questions

of biomedical and clinical relevance. For example, the recently created and expanded Centre for Applied Mathematics in Bioscience and Medicine (CAMBAM) has developed applications of mathematics to address challenges in bioscience and medicine through partnership with industry, government and other stakeholders in society. The Faculties will build on these accomplishments, with the goal of translating new knowledge into practical solutions for problems of societal and industrial importance. McGill scientists will continue to develop innovative and efficient mathematical and statistical approaches to analyze vast amounts of data generated by “omics” research as well as highly dynamic systems involving the simulation of protein dynamics or metabolite changes on a time-scale of milliseconds with a time resolution of femtoseconds. This research will be supported in part by the new strategic initiative of the FoM in Computational Medicine, and the recently created interdisciplinary training program in Quantitative Life Sciences.

#### 4.3.4 Imaging of cellular networks

Advanced imaging techniques from cryo-electron microscopy to magnetic resonance imaging to optogenetics are allowing scientists and clinicians to resolve tissue architecture in real time and with remarkable precision. They are also rapidly advancing our understanding of cellular networks and circuits in animal models, in healthy individuals, and in disease states, thereby providing a framework for the design of computational models of cellular networks. The activity of these networks can be manipulated experimentally by enhancing or silencing individual components, permitting an evaluation of their role in cell and organ function and behaviour as well as disease state. McGill will build on its internationally-recognized excellence in these areas to foster the development of new imaging technologies and their application to fundamental research, translational and clinical domains.

#### *4.4. Personalized Medicine: Customized Approaches to Patient- and Family-Centered Care*

The advent of powerful tools allowing detailed genetic analyses and careful marker-based patient stratification opens the door to novel clinical approaches that are specifically adapted to the patient’s needs. Personalized medicine also applies to health education interventions for the primary, secondary, and tertiary prevention of disease. This burgeoning area of research will be pursued in the following themes.

##### 4.4.1 Biomarkers- and molecular signature-based strategies for disease diagnosis, monitoring and treatment including clinical trials

Personalized approaches are being developed to capture an individual’s “molecular signature” in order to reliably establish a correct diagnosis, provide accurate information regarding prognosis, enable tracking of disease activity even when subclinical, and contribute to making the most informed treatment decisions that together maximize the balance between efficacy and safety for each individual patient. McGill researchers will explore the development of platforms that can define risk, separate disease from non-disease and detect prognostically important disease subtypes as well as monitor disease progression and response to therapy. McGill clinical investigators will lead international efforts to applying the use of biomarkers to stratify patients in innovative clinical trial designs that accelerate the development of new treatments. Additional efforts will be made to use a pharmacogenomics approach to optimizing therapy as a key focus of pharmacologic studies at McGill.

#### 4.4.2 Tailored health interventions for patients and families

Personalized medicine also applies to the health education and psychosocial aspects of disease prevention, of coping with illness and treatment and also of optimal rehabilitation and re-establishment of health in all dimensions. These efforts will be complemented by studies aimed at enhancing the quality of patient- and family-centred care, involving tailored interventions in management of disease by bringing together providers from different disciplines, as well as involving families, patients and other stakeholders in participatory research.

#### 4.4.3 Personalized health improvement devices, technological innovations and delivery systems

Because of its dependence on detailed biological information, personalized medicine will require reconfiguration of the multidisciplinary therapeutic team to include a central role for expertise in bio specimen collection and analysis. McGill will pioneer interdisciplinary training, research and clinical practice to optimize the implementation of personalized health care. McGill will, in partnership with manufacturers and information technology providers, work to develop analytical technology, both for discovery research and for clinical application. A particular emphasis will be on enabling the ‘patient partnership’ by complementing electronic health records with patient portals to provide access to medical records and molecular data. In addition, as noted above, McGill will continue its research into the development of devices and approaches aimed at improving health, including mechanical engineering (e.g. stents, pumps) as well as stem cell engineering, to replace neural, osseous, pancreatic and cardiovascular tissue, amongst others. The SRP will foster the creation of new interdisciplinary initiatives in bioengineering aimed at facilitating the development of innovative materials, devices, and tools and support their translation into clinical practice to improve health

#### 4.4.4 Precision engineering of animal-, cell- and protein-based models of human disease

To further the understanding of the cellular and molecular basis of disease requires precise animal, cell-based and molecular models that accurately mimic both the normal and the pathological state. McGill will continue to lead in the development of novel technologies to design models in which to test and validate personalized medicines, including *in vitro* (cell lines) and *in vivo* animal models. Recent advances have revealed the substantial therapeutic potential of stem cells for cell replacement in damaged organs and tissues. The identification of biological drivers and stem cell-specific markers now allows the selection and expansion of specific subsets of stem cells that are able to regenerate, repair or reconstruct a plethora of tissues. Importantly, the development of Induced Pluripotent Stem cells (iPS) now permits autologous cell transfers, eliminating the antigenic burden of non-autologous grafting. The SRP recognizes the importance of this quickly-advancing domain and supports research in all aspects of stem cell research. McGill will also continue and expand its focus on the study of protein structure and function at the atomic level by nuclear magnetic resonance, X-ray scattering and diffraction, cryo-electron microscopy and other biophysical methods that enable elucidation of static and dynamic structures of proteins of medical relevance. In partnership with Université de Montréal, the facility for electron microscopy research (FEMR, based in the Department of Anatomy and Cell Biology) will continue to play a critical role in the acquisition and implementation of novel electron microscopy infrastructure for the study of new materials, and biological specimens (molecular machines, organelles). These technologies will be linked to molecular diagnostics and therapeutic efforts to better understand disease and design treatments.

#### 4.4.5 Customized health care delivery for the population

Problems of access to high quality health care in Canada, particularly among vulnerable groups, are well recognised. Furthermore, the changing demographics and cultures, education and finances, health problems and health care needs of people living in Canada, along with the fast-changing health care technologies and communication means of today, represent considerable challenges and opportunities to improve health care delivery. McGill's health professional schools are well positioned to work together and with their multiple primary health care and community partners to develop and test innovative means to deliver health care to, for instance infants, children and youth, the institutionalized elderly, recent immigrants, the working poor and aboriginal groups. Examples include the "Rehabilitation Research on Brain Health" program of the School of Physical & Occupational Therapy (SPOT), a translational research program covering the spectrum of brain circuitry to community. Using a combination of the SPOR and Pathways programs at CIHR, among other opportunities, McGill will build teams embedded in the community to affect change in health service delivery and government policy enabling the timely delivery of high quality care to vulnerable groups. The establishment of the Observatory on Health Care Reform, led by the Institute for Health & Social Policy (IHSP) and the Department of Family Medicine, will allow us to document how changes to the health care system affect the quality of care. This will include training and research that focuses on the different methodological approaches used in basic biomedical science, health research and policy development and implementation that inform the translation of discovery into action to address real-world unmet clinical needs. We will accomplish this by fostering the development of a shared language of basic and clinical sciences and the principles of collection and analysis of datasets relevant to that shared language, as well as the range of ethical and epistemological issues that must be considered in translating research to policy.

## 5. Implementation Strategies and Strategic Initiatives

One key goal of the SRP [<https://www.mcgill.ca/medicine/research/new-strategic-research-plan>] is to develop and implement innovative research frameworks tailored to prioritized areas that aim to facilitate translation of research results into tangible health outcomes at all levels of medical care. This will be accomplished in part by promoting interactions among different groups along a continuum of research and innovation, and by establishing partnerships between laboratory scientists, clinical investigators, health services researchers, health professionals and patients. This overarching goal will be emphasized in identifying and prioritizing strategic initiatives in the current update (Spring 2017) of the SRP.

We wish to promote creative environments that will foster innovation and entrepreneurship in health research, and that will support the development and testing of novel ideas and concepts. Furthermore, the SRP will encourage novel groupings of health researchers with diverse but complementary expertise, perhaps not traditionally aligned, but that can create novel synergies and an innovative research continuum. Such groupings will train the next generation of health researchers in a dynamic and productive interdisciplinary environment.

The SRP also provides opportunities for timely and productive partnerships with Canadian industry to develop new technologies to improve quality of life, and to detect and treat diseases. These will rely on traditional intellectual property-based approaches and also on novel mechanisms of open innovation.

Finally, translating research results into better health and improved treatment of illness will be a central component of our implementation strategy. Although knowledge translation can follow different paths, we will encourage transfer along a continuum from discovery to clinical research to improved care delivery and on to optimal clinical decision-making and health policy. This transfer of knowledge will be built on a series of underlying activities including validation of animal model data in humans, clinical evaluation of diagnostic and therapeutic candidates, epidemiological investigations, studies on molecular targets, biomarkers of disease, candidate molecules, mechanistic studies, health intervention studies, and technology development. More mature stages of translation will rely on dissemination of knowledge and results to key stakeholders, including patients, health care providers, and regulatory agencies, and will entail community engagement to increase uptake.

The Faculties will continue to develop implementation initiatives into 3 categories: organizational, infrastructure and administrative.

## 6. Organizational

To encourage inter-disciplinarity, the Faculties will build on existing schools, departments, and divisions, to develop novel groupings that can further synergize research activities and maximize past and future investments. Future advances will emerge from interdisciplinary grouping that makes use of a broad range of technologies and experimental approaches tailored to individual fields and creating novel productive research interfaces. In 2014, the first of several new interdisciplinary organizational units was proposed, bringing together investigators from multiple units and institutions: the Global Health Initiative (approved and funded in 2015)

[<https://www.mcgill.ca/globalhealth/research>], coupled with the new School of Population and Global Health (approved and funded in 2016)

[[https://www.mcgill.ca/medicine/files/medicine/faculty\\_council\\_spgh\\_june2016.pdf](https://www.mcgill.ca/medicine/files/medicine/faculty_council_spgh_june2016.pdf)] and the newly created Initiative in Computational Medicine (approved and funded in 2017).

Transitioning between pillars and activity stream in a translational research framework also involves training of researchers at the various interfaces. With this in mind, we have revamped and expanded our MD/PhD program at McGill under the direction of Dr. Mark Eisenberg [<https://www.mcgill.ca/medicine/medicaleducation/mdcm-undergraduate-medical-education/mdcm-md-phd>]. Progress on all currently approved strategic initiatives of the FoM can be found in the 2015 and 2016 Progress Reports posted on the Faculty of Medicine web site.

In the context of the 2017 update of the SRP, we describe potential new strategic initiatives approved by the Steering Committee for recommendation to the Dean.

### 6.1 Stem Cells and Regenerative Medicine (SCRM)

SCRM will be a critical therapeutic field in the coming decade; therefore, it is crucial that McGill expand its investment in this field to remain a top international centre for biomedical research.

Targeted investments in SCRM will permit our growing network of stem cell investigators to advance our understanding of both the fundamental mechanisms of stem cells and their importance in the treatment of numerous diseases, including cancer. Stem cell replacement therapy and regenerative medicine is providing an increasingly powerful scaffold that will ultimately lead to cell replacement therapy for damaged tissues and organs. Indeed, stem cell replacement therapy has been employed for decades at McGill's affiliated hospitals, e.g., in bone marrow transplants, for the treatment of cancers, hematologic disorders, and an increasing number of other conditions. In addition, given its economic potential, investing in this domain will help to ensure that McGill takes its place in the commercialization of regenerative medicine therapies.

### 6.2 *BIO<sup>X</sup>McGill : Centre for Interdisciplinary Research and Innovation in Science, Engineering and Medicine.*

Biosciences have undergone a radical transformation, driven mainly by new technologies (nanotechnology genomics, computation, imaging) and interdisciplinary collaboration. The term BIO<sup>X</sup> is meant to symbolize and catalyze interdisciplinary research with biological and medical themes. BIO<sup>X</sup> will leverage McGill's historic excellence and reputation by meshing across the entire campus via empowering research and education in new emerging interdisciplinary BIO<sup>X</sup> areas. This is facilitated by tapping into McGill's vibrant culture of collaboration so that Bio<sup>X</sup>

will leverage current groups like the Quantitative Biosciences Institute (QBI) and HBHL efforts, and provide a platform to connect them with a wider research base at McGill and beyond. The BIO<sup>X</sup> initiative will focus on interdisciplinary areas, including preventative and precision medicine, neuroscience, neuroengineering, microbiome, immuno-engineering, nanomedicine and synthetic biology. Bio<sup>X</sup> includes all “wet lab” efforts and as such will complement efforts in data sciences such as the McGill initiative in Computational Medicine (MiCM). The long term goal of the BIO<sup>X</sup> centre is to grow into a horizontal, non-hierarchical and evolvable network to effectively pursue and tackle societal, scientific and technological challenges focused on health. A Bio<sup>X</sup> centre will help marshal McGill and partner resources for the ultimate benefit of citizens and patients in Canada and in the world.

### *6.3 Centers of Excellence in Translational Research and Knowledge Translation*

The term “knowledge translation” (KT) allows for a diverse set of definitions, including but not limited to translating findings from fundamental research to humans, to clinical interventions, to practice guidelines and health policies and to population and global health. McGill has demonstrated strengths in all of these areas, as well as unique expertise in knowledge translation research as a domain in itself. The goals of this initiative are to support various efforts to promote the translation of research results into better health and improved treatment of illness. The program recognizes that knowledge translation follows different paths, and will encourage transfer along multiple paths involving, but not limited to research pillars, from basic research in the lab, to clinical research, to patient outcomes, to community and family impact, as well as to clinical decision-making and health policy. The Faculty of Medicine recognizes that no one single initiative can encompass the breadth of translational research taking place across campus, in the Schools, community-based care and hospital-based research institutes. Instead, the program will function as an umbrella to receive, evaluate and prioritize research proposals in this area for funding.

Centers of Excellence in Translational Research and Knowledge Translation should be interdisciplinary by nature, have a critical mass of funded researchers and should have objectives that necessitate the creation of such a Center. Membership may be drawn from a number of groups, including but not limited to bench researchers, clinician scientists, health services researchers, clinicians, and other health professionals, as well as other stakeholders in the community, the final combination of participants depending on the targeted health areas and proposed translational activities. The Centers may be funded by a matched funding system with equal contribution from the Faculty and other stakeholders critical for the coherence of the translational research in the Center. Such funding may be used for seed grants to support interdisciplinary work carried out by close collaboration among members of the center. Centers would formulate proposals with obvious added value derived from the creation of new collaborative arrangements. Centers might also focus on KT research directly and could potentially include a service component that could generate matching funds, providing, for example, consultation on means to effectively engage knowledge users in research or to improve knowledge synthesis in the development of practice guidelines.

### *6.4 Life Sciences Complex: Bioinformatics*

The Life Sciences Complex (LSC) is an inter-disciplinary research complex that opened in 2008 and was enabled by a major CFI award. The LSC comprises 5 non-departmental thematic research groups (Cancer, Cell Information System, Developmental Biology, Structural and Chemical Biology, Complex Traits) supported by cross-cutting technology platforms. An in-depth scientific review of the LSC commissioned by the Dean was conducted in 2015 and recommended the creation of a sixth cross-cutting theme in the LSC to maximize its research potential. This new theme would be positioned in the areas of systems, networks or quantitative biology with a focus on bioinformatics. Membership of this new theme would be seeded in each of the 5 existing themes at the LSC, and possibly in other relevant sites on campus. This new theme will contribute an added dimension to inter-disciplinary research at the LSC by bringing an added computational framework. This is in recognition of the increased dependency of all modern biomedical research on bioinformatics approaches, including access to and analysis of complex clinical datasets. The creation of such a research theme and recruitment of its leadership will be a continued strategic priority of the Faculty. In fact, the Faculty has proposed the recruitment of a Canada Excellence Research Chair in genomic medicine who could potentially lead the proposed new Bioinformatics theme.

## **7. Infrastructure**

In the face of limited resources, key choices must be made for infrastructure investment. For these difficult decisions, it is important to consider past investments, future opportunities and the need to develop infrastructure that is complementary to that being developed in the research centres of the teaching hospitals, while avoiding duplication. In addition, it is critical that while supporting research areas of key strategic interest, infrastructure investments have the maximum impact for researchers in the Faculties.

### *7.1 Technology Platforms*

Successful research programs rely on diverse enabling tools and platforms whose core elements and efficient utilization often lie outside the means of any single investigator. In recent years, CFI funding has been the main mechanism for the development of infrastructure. However, CFI funding does not yet bring long term operational support, leaving a substantial void. To optimize the impact of the available resources, the Faculties will prioritize platforms that are both cost-effective and which benefit multiple users. As initiated in 2014, the Faculty of Medicine will provide financial support to platforms by re-investing a portion of the institutional CFI overhead (IOF Reserve Fund). We have currently secured the future of this funding program for the next 4 years.

The Faculties have also prioritized specific areas for continued infrastructure investment. These areas are critical for the implementation of the strategic research priorities across different fields of health and disease.

## 7.2 Genomics

Given the central importance of “omics” in general and genomics in particular, in modern biomedical research across different fields, and the potential for multidisciplinary research and imminent impact on clinical outcomes, the Faculties will build on the already substantial investments in the McGill University and Genome Quebec Innovation Centre (MUGQIC), including acquisition of key infrastructure (CFI), and operational support for this infrastructure (CFI/MSI, Genome Canada) through the newly approved Initiative in Computational Medicine. The Faculties will build on the substantial investment already in place, but promote increased collaboration and efficiencies. A special effort will be made to promote knowledge translation so as to empower clinical researchers to partner with the strong core of genomics scientists, and members of the McGill Center of Genomics and Policy (at the MUGQIC).

## 7.3 Computation and Imaging

In recognition of the centrality of computing and information technology to the above priority areas, computational capacity will be a key area for future development and investment as part of the university’s overall IT strategy. In addition, the Faculties will promote as a priority the development of novel approaches and applications of imaging. This initiative will be two-pronged. We will build on the established excellence of the groups at the MNI, to encompass imaging efforts at the Douglas in neuroimaging, and the recent investments in research imaging technology at the MNI and at the RI-MUHC. Innovative research based on this infrastructure and expertise will be supported directly by the CFREF award (Healthy Brains for Healthy Lives) recently received by McGill, including development and implementation of novel strategies for integration of very large health-related datasets (big data). We will also promote the growth of imaging science in the Medical Physics Unit and Biomedical Engineering, and its integration into inter-disciplinary programs in bioengineering. The Faculties will also build on the solid infrastructure in the Department of Anatomy and Cell Biology (FEMR) and the Advanced Bioimaging Facility at the Bellini, to promote the development of advanced microscopies and live-cell imaging. These efforts would also provide a strong basis for growing collaborations with other faculties, notably Engineering and Science.

## 8. Administrative Initiatives

### 8.1 Standing Committee on Research

The Faculties will create a **Standing Committee on Research**. This group will be tasked with a) developing operational frameworks, monitoring progress, and evaluating performance of the strategic initiatives, b) creating tools and mechanisms to consult the community, receive and evaluate suggestions to develop further strategic initiatives, in response to new and emerging priorities, c) organizing annual reviews of the SRP, d) ensuring that all strategic priorities are designed and implemented for maximum knowledge translation and to meet the overarching mission of the Faculties to improve population health and to realize better patient care. Membership of this group will have representation from research and teaching units from the Faculties, as well as affiliated schools and research institutes from teaching hospitals.

## *8.2 Strategic Research Fund*

The Faculties have recognized that fostering truly innovative and transformative research requires development of a new financial framework that involves increased financial resources. To this end, the Faculties have created a Strategic Research Fund (SRF). This fund aims to support a wide array of activities across the Faculty including operating awards to sponsor groundbreaking, high-risk projects that hold the promise of being transformative, as well as timely investments in key infrastructure. The fund will draw from corporate and private philanthropy and from reinvestment of income generated from discoveries and other commercialization activities. The fund recently developed a McGill initiated joint project with financial participation of McGill University (FoM), Université de Sherbrooke (FoM), Genome Québec, and the Fonds de Recherche du Québec, aimed at piloting whole genome sequencing in newborns.

## *8.3 Development of Faculty and Students*

Targeted recruiting of talented young investigators is required to renew and invigorate the Faculties. Emphasis will be given to forming new interdisciplinary groups, and strengthening existing successful groups. The potential for added value in advancing priority research areas will be integrated into the evaluation of groups or centres. For those groups/centres that receive financial support from the Faculties, annual reporting and formal review every three years will be required.

The success of research programs is dependent on the quality of the graduate and post-doctoral students they can attract, and retain. To this end, financial support of graduate students and post-docs in the two Faculties by established funding mechanisms [<http://www.mcgill.ca/medresearch/students-postdocs/graduate/funding>] will be focused on the strategic priorities outlined in this document. Moreover, the Faculties will foster the development of new integrated training programs that cross disciplines, building on successful models such as the Integrated Program in Neuroscience, the Interdepartmental Program in Immunology and Physiology [<http://www.mcgill.ca/microimm/student-affairs/programs/interdepartmental>], and the recently created Quantitative Life Sciences PhD program [<http://www.mcgill.ca/qls/>]. A key goal of the next phase of the SRP will be to enhance the attractiveness of our graduate programs by ensuring that our graduate students receive the best possible educational experience. To achieve this, the Faculties will promote the adoption of continuous quality improvement measures, faculty development for supervisors and work toward better alignment of training programs to the needs of trainees.

Not only must we recruit effectively and strategically, we must ensure that our new faculty members are supported as they set up their laboratories and launch their independent careers. To that end, we must invest in competitive multi-year research start-up funding packages that cover the increased costs of running a cutting-edge laboratory. Moreover, we must put in place an effective and equitable program to ensure that the talented recruits who begin their careers at McGill remain and flourish in our Faculties. In the current funding context, such a program requires significant investment in our existing bridge funding program so that productive laboratories are able to maintain their activities in the face of short-term funding shortfalls. Recruitment and retention will be a key strategic priority of the revised SRP.

### *8.4 Partnerships and Commercialization*

In order to promote translation of research findings into novel therapies and innovative interventions and approaches to care, the Faculties will collaborate with the hospital research institutes and with other stakeholders (VPRI) to promote opportunities for commercialization and partnership with industry. These interactions may involve timely and synergistic collaborations to develop novel technologies, access to unique technology platforms, and training of a highly qualified work force for the industrial sector. Although such interactions will be based on traditional intellectual property-based approach, the Faculties recognize that the paradigm of innovation is becoming more collaborative. The Faculties are also developing new web-based databases with industry-friendly annotation of research activities to increase exposure and contact with industry.

## **9 Evaluation Framework and Metrics**

The performance of the implementation strategies, and their impact on the overarching goals of the SRP, will be monitored using an evaluative framework and associated metrics. The Standing Committee on Research will be tasked with developing an overall evaluative framework for the SRP, its implementation, and outcomes. This will be done in collaboration with experts from the Faculty of Medicine, and other units with expertise in evaluation. The aim will be to produce a set of qualitative and quantitative parameters that will complement standard metrics and will monitor success of the different strategic initiatives.

Standard metrics of research productivity are well known and include the total amounts of research funding acquired by the Faculty under the SRP, the type, number and impact of scholarly publications produced from this work, as well as the different prizes, distinctions, awards and other accolades to individuals and groups involved. Other measures of success will include our ability to attract international recognition and associated partnerships, recruit and retain the very best researchers, and our capacity to train graduate students, post-doctoral fellows, and clinician scientists that will become tomorrow's leaders in all branches in health research. Successful implementation of sustainability initiatives to create, promote and support key technology platforms and cores will also be evaluated.

We will also develop metrics to survey the societal impact of the SRP-associated knowledge translation activities. This will include monitoring knowledge dissemination directed at informing and educating the public of research accomplishments and milestones. We will ask the Institute for Public Health and Public Health Research to develop and implement tools to document impact of SRP related translational research activities on public health, and patient care. Additional aspects of knowledge translation such as intellectual property, research contracts and other economic activity through commercialization of health research products will also be quantified, and analyzed for positive impact.

**Approval Path:**

Presented at Project Renaissance Retreat	20 April 2017
Steering Committee	11 May 2017
Dean's Operations Committee	15 May 2017
Deanery Executive Committee	5 June 2017
Presented at Faculty Council	