



**Concordia University's
CRC and CFI Strategic Research Plan: 2013-2018**

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Objectives

The *2013-18 Strategic Research Plan* is a blueprint for the future growth and intensification of research activity at Concordia. It guides strategic level resource allocation and institutional decision-making with regard to Canada Research Chair nominations, CFI investments, and other major funding and recruitment initiatives. The first part of the *Plan* gives an overview of our research and research-creation activity and situates Concordia in the Québec, Canadian and international research landscapes. Second, the *Plan* provides a summary of Concordia's major areas of research strength and priority. Third, the *Plan* identifies five-year directions and goals for growth in research capacity, intensity and knowledge mobilization. Finally, the *Plan* provides an overview of Concordia's institutional support mechanisms designed to foster research output and fulfill the obligations of the CRC-CFI programs. During the life of the *Plan*, Concordia will leverage its unique role in the social, cultural and economic fabrics of Montréal, Québec and Canada to enhance our strategic leadership in key areas of research and research-creation. The university will capitalize on emerging partnerships and seize novel opportunities to extend the impact of work that further enhances our reputation as one of Canada's most innovative and creative universities.

Research and Research-Creation at Concordia

Concordia University's research profile grew dramatically under the auspices of our *2008-2012 Strategic Research Plan*. The university is now in the upper echelon of Canadian universities in many areas of fundamental and applied research, artistic and creative production, graduate and postdoctoral training. As of 2013, Concordia has a combined targeted and flexible allocation of 28 Canada Research Chairs, all currently filled, or in the process of being recruited, from outside the university; 49 Concordia University Research Chairs recognized internally for research excellence, and funded to build research capacity within Concordia; 3 NSERC Industrial Research Chairs in engineering, partnered with major Québec companies; 1 research Chair in the sociology of gambling funded by the prestigious *Actions concertées* program of the *Fonds de recherche Québec-Société et Culture*; and 17 endowed and special professorships in business-related fields, as well as human rights and preventive health. We support 18 university research units, most of which group inter- or transdisciplinary clusters of research excellence and house specialized infrastructure. Three major natural science, engineering and health science research facilities were opened during the period of the *2008-2012 Strategic Research Plan*, as well as the new John Molson School of Business building. Many of these capital investments were supported by Knowledge Infrastructure Program (KIP) and CFI infrastructure funding amounting to \$95.9 M, and major operating grants in research areas such as genomics, games, sustainable buildings, behavioral neurobiology and clinical psychology.

Located in the heart of Montréal, Concordia is a dynamic, forward-looking comprehensive university. Currently Québec's fourth-largest university in student numbers, Concordia has one of the most culturally diverse graduate and undergraduate student populations in Canada, with

45,000 students including 7,300 at the graduate level. Our researchers and creative artists are housed in four Faculties (Arts and Science, Engineering and Computer Science, Fine Arts and the John Molson School of Business). Together with eight other universities, Concordia is a key player in making Montréal one of North America's leading higher education hubs. Highly cosmopolitan, Montréal is internationally recognized as a vibrant node of arts and culture and is one of only two North American members of the UNESCO Creative Cities Network. Designated by UNESCO as a *City of Design*, Montréal is also home to world-renowned private-sector innovation leaders in areas such as gaming, new media and entertainment in addition to being one of the world's leading centres of aerospace and clinical research. Québec is also a model of research-intensive public sector industries such as *Hydro-Québec*, and community financing entities such as *Caisse Desjardins*. In addition to training highly qualified personnel to be employed in these sectors, Concordia researchers partner with the private, public and not-for-profit sectors on a multitude of exciting research collaborations and training initiatives. The bold research and creative activity at Concordia epitomizes the energy, dynamism and diversity of the city that surrounds our two campuses.

According to several well-recognized external indicators, the scope and quality of our research and research-creation communities are impressively rich and varied. The *Higher Education Strategy Associates* 2012 field-normalized academic rankings indicate that, in terms of research impact and productivity, Concordia is 9th amongst Canadian universities in social science and humanities, and 20th in science and engineering. As documented by *Research Infosource*, Concordia's sponsored research income has climbed from \$35.6M in 2008 to more than \$42M in 2012, a growth of more than 15% notwithstanding compressions to many traditional sources of government funding for research. Concordia is recognized as an institutional leader in four of the six research fields identified as areas of Canadian international leadership in the report prepared for the Government of Canada by the Council of Canadian Academies Expert Panel on *The State of Science and Technology in Canada, 2012*. These include: historical studies; information and communication technologies; psychology and cognitive sciences; and visual and performing arts. Recently recognized as one of the world's 'Top 100 Under 50' universities in the *Times Higher Education* rankings, Concordia is acknowledged internationally for its global outlook, particularly for "diversity on campus and how much [our] academics collaborate with international colleagues on research projects." According to the highly respected rankings done by *The Economist*, Concordia's John Molson School of Business is home to one of the world's top 100 MBA programs. And of course, Concordia faculty and students are renowned nationally and internationally for their exceptional contributions to the visual and literary arts. Few, if any universities in Canada, consistently produce so many nominees and winners of high profile awards recognizing artistic and creative excellence, such as the Oscars® of the American Academy of Motion Picture Arts and Sciences, *Les prix Jutra*s in Cinéma québécois, Emmy® and Tony® awards for television and theater, Grammy® and Juno awards in music, Governor General's Awards in Arts, Canada Book Prizes, and the Man Booker International Prize for fiction.

A comprehensive list of our major research strengths follows, but a few examples will illustrate some of the distinctive ways that Concordia excels in research and research-creation. We are the only university in Québec without a medical school to host a *Fonds de Recherche Québec-Santé* group, the Center for Studies in Behavioral Neurobiology (CSBN): in a city renowned for neuroscience, our researchers make a major and unique contribution to the fundamental science of understanding the brain and to training research personnel of exceptional quality. We are home to the Centre for Zero Energy Building Studies (CZEBS), leading an NSERC Strategic Research Network of university and industry researchers developing cost-effective, net-zero energy buildings that produce as much energy as they use. The Centre for Structural and Functional Genomics (CSFG) counts a number of Canada Research Chairs among its members and hosts multiple, large-scale industry and public sector partnered research programs that are unique in Canada. With funding from Genome Canada and Genome Québec, the CSFG is a world leader in research directed towards developing the future natural resource-based bioeconomy. In partnership with the Government of Québec, our Centre for the Study of Learning and Performance (CSLP) is a major contributor to the research and design of bilingual (English and French) educational technology designed to address issues of literacy and numeracy in childhood. Internationally, the CSLP leads a SSHRC-funded partnership with the Aga Khan Academies in Kenya to provide teacher training and digital learning toolkits that will help to address the literacy challenge which has been identified as a national priority. Concordia's Centre for Technoculture, Arts and Games (TAG), home to the country's first Tier 1 Canada Research Chair in Games Studies and Design, brings together researchers from the social sciences, humanities, games industries, fine arts and engineering to collaborate on research-creation in game studies and design, digital culture and interactive art. The TAG Centre researchers also lead the award-winning *Skins Aboriginal Storytelling and Video Games Design* workshops geared toward First Peoples youth in nearby communities. Together, Concordia's unique cluster of CRCs in Games, Feminist Media Studies, Public History, Inter-X Art Practice and Theory, New Media, Post-Conflict Memory, Ethnography and Museology put our university in the vanguard of the digital arts and humanities. These areas of research have been developed through targeted investments in faculty recruitment, strategic chair appointments, and major support for research centres and infrastructure.

Because of Concordia's commitment to prioritize major infrastructure investments in research, the overwhelming majority of our researchers, graduate students and postdoctoral fellows now work in buildings, labs and other facilities that are less than a decade old and housed in prime locations in central Montréal. The Centre for Structural and Functional Genomics (2011) features a truly innovative use of research space designed to promote the centre's intrinsic values of inclusiveness, co-operation and inter-disciplinarity. The PERFORM (Prevention, Evaluation, Rehabilitation and Formation/training) Centre (2011), is a state-of-the-art preventive health research facility equipped with a conditioning floor, perturbation table, metabolic kitchen, imaging suite, nutrition suite, clinical analysis suite, cardio-pulmonary evaluation suite, aqua fitness pool and athletic therapy clinic. PERFORM brings together under one roof researchers, students and community partners from across campus, across Québec and beyond to examine and apply the science of healthy living. These expansions of our research infrastructure footprints

were preceded by an earlier round of building construction including the John Molson School of Business (2009); Engineering, Computer Science and Visual Arts Integrated Complex (2005); and, Richard J. Renaud Science Complex (2003). The Hexagram Institute, founded in 2001 as a major CFI project and sustained by additional CFI funding in 2010, is the largest arts and design based new media lab in Canada and is recognized internationally as the Canadian pole for interdisciplinary research in new media art, design, and interactive performance and technologies. Additional extensive repurposing and modernization of buildings on both campuses has consolidated many of Concordia's social sciences, humanities and fine arts departments, bringing researchers and students together and promoting the cross-fertilization of disciplines and ideas. The university has also made substantial investments in those library holdings that are key components of a thriving research ecosystem, such as electronic resources and research archives.

In conjunction with its 2008-2012 *Strategic Research Plan*, Concordia substantially increased its commitments to graduate students and postdoctoral fellows, resulting in the ability to better attract and retain top research trainees from around the world, including Vanier scholars, Marie-Curie and Banting Postdoctoral Fellows. These trainees contribute greatly to enhancing our university's research output and academic excellence. With more than 100 graduate programs in the sciences engineering, social sciences, business, humanities and fine arts, Concordia has one of the largest cohorts of graduate students among Canada's comprehensive universities. Our PhD in Humanities and Individualized (INDI) Master's and PhD programs are among the most established and highly-regarded multidisciplinary programs in Canada, and Concordia is the first university in Canada to offer Erasmus Mundus Master's and PhD programs (in Algebra, Geometry and Number Theory, ALGANT). The success of Concordia's graduate students and postdoctoral fellows is further enhanced by our comprehensive graduate and professional skills development program, *GradProSkills*, which includes second language training in French, and is recognized nationally and internationally as a flagship for such programs. Hands-on research experience is also increasingly integrated into many undergraduate programs, providing training to students who go on to graduate studies or to have research careers in the private or public sectors. This includes a number of very successful co-op programs, some of which are unique in Montréal, as well as training initiatives such as the Concordia Institute of Aerospace Design and Innovation (CIADI). In 2012-13, a group of undergraduate students in Engineering and Computer Science won the prestigious *Canadian Satellite Design Challenge* and will soon launch their satellite into space to collect data on the South Atlantic Anomaly.

Major Research Strengths

With established and emerging strengths in fundamental, applied and participatory action research, Concordia is generating foundational knowledge, nurturing discoveries, fostering innovation and making evidence-based contributions that respond to the needs of society, including the growing imperatives of adaptability and sustainability as experienced by people, communities, markets, industries, institutions and countries around the world. Our research and research-creation activity spans a wide range of disciplines and fields, utilizing an impressive

diversity of methodological approaches. Table 1 below identifies 2 major research clusters, 6 unifying themes and 17 unique domains of excellence for which Concordia is widely recognized. These areas of excellence characterize Concordia’s important contributions to multidisciplinary research, creative activity, knowledge mobilization, and innovation. We will continue to prioritize these areas in further developing our research and research-creation capacity.

TABLE 1
Major Research Clusters, Unifying Themes and Domains of Excellence

THE PERSON AND SOCIETY	TECHNOLOGY, INDUSTRY AND THE ENVIRONMENT
<p>Development and Well-being of the Person across the Lifespan</p> <ul style="list-style-type: none"> » Learning, development and cognitive science » Public and population health » Fundamental science in health research 	<p>Enabling Technologies and their Basic Foundations</p> <ul style="list-style-type: none"> » Fundamental science » Information technologies and computation » Telecommunications
<p>Culture, History and Identity</p> <ul style="list-style-type: none"> » Creative expression and production » Media, communications gender and sexuality » People, places and heritage 	<p>Advanced Materials and Technology</p> <ul style="list-style-type: none"> » Composites, aerospace, transportation and manufacturing » Nano/Microtechnology
<p>Human Systems and Organization</p> <ul style="list-style-type: none"> » Corporate enterprise and entrepreneurship » Social organization and resource planning » Social and economic systems 	<p>Energy, Environment and Biotechnologies</p> <ul style="list-style-type: none"> » Environmental science and engineering » Energy and sustainable technologies » Omics and related biotechnologies

The **PERSON AND SOCIETY** cluster encompasses leading research expertise on the lives and well-being of people as individuals and members of society; and, as the inheritors and creators of cultures, identities and systems of social and economic organization and interaction. The three themes in this cluster are marked by their groundbreaking use of digital technology and cross-disciplinary approaches to address the many social, cultural, health, and economic challenges and opportunities of contemporary life. The researchers in this cluster hail largely from the fine arts, humanities, business, social and life sciences.

Development and Well-Being of the Person across the Lifespan

Human well-being and quality of life is predicated upon a balance of such factors as health, the ability to learn and the ability to function in society. These factors, as they apply across the human lifespan, are important to us as individuals and as members of a global information-driven society facing unprecedented population expansion and transformation. Concordia is well-recognized as a research leader in fields such as behavioural neurobiology and appetitive motivation, child and learning studies, communications, community development, creative writing, gender and sexuality studies, cognitive science, ethnography, curating, mass atrocity and human rights, and oral and public history. Concordia researchers are also making influential contributions to fundamental sciences underlying today's health issues, and to increasing our understanding of the social contexts of health and related public policy issues. The recent opening of PERFORM, a major new facility dedicated to preventive health research, builds on Concordia's expertise in exercise science, behavioural psychology and related disciplines.

Learning, development and cognitive science

As the global economy becomes more knowledge-oriented and technologically advanced, we face an increasingly urgent demand for a better-educated workforce with the necessary skills to thrive in this environment. Concordia has a critical mass of nationally and internationally recognized research in related areas such as literacy, numeracy and educational technology and tools in the study of learning and performance, at school and in the workplace. In another domain, researchers in psychology are exploring the processes that underlie development from infancy through old age and examining the social and familial determinants and psychosocial risks related to cognitive development and competence among individuals across society, including at-risk populations. Topics under investigation include language acquisition, early childhood education, assessment and therapeutic tools.

Public and population health

Improving population and public health is a major priority for many governments, including Québec and the rest of Canada. A handful of behaviours, such as physical inactivity, poor eating habits, poor sleep and tobacco use, are well-documented for leading to development of widespread diseases such as obesity, diabetes and cardiopulmonary disease. Preventing such disease states is a societal challenge that requires new knowledge, approaches, and policies that inform, sensitize and provide support for people on their journeys towards healthier life choices. At Concordia, particular focus is placed on evidence-based preventive health research on conditioning, nutritional choice and lifestyle modifications. Similarly, research into the cognitive, behavioural and social determinants and clinical treatment of psychological disorders, including socio-psychological aspects of poor health, sexually transmitted diseases and addictive behaviour are key areas of focus, as is the impact of creative arts therapies on individuals dealing with emotional and psychological difficulties.

Fundamental science in health research

Advances in human health research are often built upon fundamental work done in molecular and cellular biology, chemistry and biochemistry, biophysical sciences, computational sciences

and neuroscience. At Concordia, research activities in these areas centre around such topics as the aging process, neuromuscular physiology, diagnostic approaches to human diseases and disorders, and design and development of nanoscale materials. Studies in neuroscience not only expand our understanding of how the brain functions, but also lead to breakthrough discoveries in such areas as behaviour, drug dependence, appetite and obesity.

Culture, History and Identity

Understanding human diversity and identity, and the many expressions thereof, are critical in a multicultural, fast-changing, increasingly virtual world. The impact of cross-border or inter-regional population mobility has immense repercussions on social and political structures, and for the development of services and policies. New information and communication technologies in particular are profoundly transforming our lives, continuously reshaping how we interact and express ourselves, as well as how we represent, understand and negotiate contemporary life. Concordia is a leader in transdisciplinary research and research-creation that explores modes of expression, cultural production, context and analysis, and is highly recognized for the impact of its work in gender and sexuality studies. The scope of our research in these areas is equally marked by a commitment to community engagement and partnership activities that foster the co-construction of knowledge, both at Concordia and beyond our doorstep.

Creative expression and production

Concordia's established leadership in studio and performing arts, cinema, design, exhibition programming and curating, and creative writing remains strong, with Concordia-trained graduates being recognized at the highest levels of literary achievement, performance, analysis and production. Concordia hosts the largest and most comprehensive Studio Arts program in Canada, which has an international reputation for excellence in research, training, production and experimentation. As co-founder of Hexagram, Concordia's Centre for research-creation in Media Arts and Technologies, the university also attracts first-class artist-researchers in the fields of new media, computational design, gaming, interactive textiles, sound, movement and performing arts from around the world. The university is strongly committed to supporting research-creation and the building of hybrid research models that integrate artistic practice with critical, theoretical and historical inquiry. Through its international reach in the areas of creative expression and production, Concordia plays a significant role in enhancing Québec's and Canada's global prominence in the field of cultural and artistic innovation.

Media, communications, gender and sexuality

Concordia has a long-established reputation for professional production facilities, excellence in journalism, communication studies and art history, as well as women's studies and film studies. Areas of strength include feature and documentary film and television production, alternative and community-based art productions, historical and critical studies of media, technology and digital culture. Contemporary culture has been, and continues to be, shaped by changing dynamics of gender and sexuality, foundations of human identity. Concordia's avant-garde work in these areas continues to be a focus of activity. Key areas of examination include such critical

social phenomena as AIDS/HIV prevention, feminism and post colonialism, the sex trade industry, gender identity and sexuality, as well as LGBTQ (lesbian, gay, bisexual, trans and queer) representation in history and across cultures.

People, places and heritage

With the advent of globalization, large-scale human mobility, global mass media and the transnational flow of commodities and culture, people's lives are being transformed around the world. This has implications for such phenomena as nationalism, population displacement, emigration and immigration, social and political unrest, social inclusion, and the challenges that arise with social pluralism. Researchers at Concordia are examining the social, historical, political, artistic and cultural contexts and contributions of different people across place and time. In addition to traditional approaches to scholarship, researchers in this domain are incorporating advanced technologies to break new ground in research methodologies, collaboration, public dialogue, co-production of knowledge, analysis, policy development and representation. The use and development of advanced oral history and exhibition technologies such as digitization tools, multi-media content and searchable archives, accessible through open-source web-based software, are opening new possibilities for collaboration within academe and with the public. Concordia's digital humanities platforms bring together researchers from an extensive range of disciplines as well as filmmakers, artists and community partners. The university's cohort of genocide scholars is spearheading research that seeks to build our collective capacity to prevent mass atrocity through research, knowledge dissemination and recommendations for policy and decision-makers, as well as for actors in civil society and news media.

Human Systems and Organization

Many of our perceptions, institutions, cultural and philosophical traditions are shaped by large-scale interactions, forces, beliefs and systems that cross political, cultural and geographic boundaries. Our day-to-day lives are highly influenced by where we live, the languages we hear and speak, the economic conditions under which we live, the cultural influences we are exposed to and the work we do. Deepening our understanding of globalization and diversity is key to shaping a balanced approach to the complex and challenging issues facing humankind in the 21st century. In addition to social and geographically determined influences, national and transnational business and economic forces, and systems of governance affect our well-being and prosperity across many domains of our lives.

Corporate enterprise and entrepreneurship

Concordia's business faculty cohort uses its corporate and organizational expertise to conduct research on entrepreneurship and family business, human interactions at the workplace, absenteeism and presenteeism, marketing communications, retail marketing, consumer behaviour, business process innovations, management and leadership. Other scholarly foci include sensory-based marketing research as well as ethics and governance in public and private institutions. Strong links with the local business community as well as international partners

underscore a common vision of building capacity in business leadership and responsible global citizenry.

Social organization and resource planning

The university's research focus on social organization explores alternative economic development strategies within community-based and collective enterprise, with the aim of reducing poverty. Sustainable enterprise initiatives concentrate on guiding organizations toward holistic sustainable strategies that are rooted in innovation and enterprise development. Researchers from the fields of urban and regional studies are studying the implications of land-use and impacts on society. Other research in this area includes topics such as political economy, community economic development, public affairs, rural economy and urban planning.

Social and economic systems

An important dimension of economic stability and social well-being is the network of economic systems, financial resources and transactions that underpin the sustainable functioning of households, firms and governments locally, nationally and internationally. Research on financial markets, derivatives, management information systems, financial planning, investment and risk management, as well as econometrics are important foci of Concordia's business and economics faculty cohorts. Questions at the interface of social and economic policy are another area of investigation, including such topics as the impact of changing population demographics and demographic structures, public policy and public administration.

Sustainability is a major focus of the **TECHNOLOGY, INDUSTRY AND THE ENVIRONMENT** cluster where researchers are examining some of the most pressing environmental concerns of our time, including the impact of human activity, geopolitical trends, environmental risk factors and resource scarcity. In response, Concordia researchers are seeking new society-wide ways of decreasing our environmental footprint and reconceiving and redesigning the energy systems we use, the items we manufacture and the buildings we live in. Most of the researchers in this cluster are from disciplines within engineering and the sciences.

Enabling Technologies and their Basic Foundations

Many of the most transformative incremental and breakthrough advances shaping society today are dependent on research and development done in the area of enabling technologies and their foundational precursors. In the basic sciences, we have significant strengths within areas of: cell and molecular biology and biophysics; neurosciences; the interface between chemistry and biology; theoretical and computational approaches; pure and applied mathematics; and community and behavioral ecologies. Concordia also excels in information and communication technologies including wireless communications and networks, information technology (IT) security, and computational interactive media. Developments in many of these areas will be key in supporting technology-based approaches to building sustainable systems.

Fundamental science

Fundamental science research keeps new ideas and discoveries flowing. Progress in almost any field, including applied science and technology, business, health and environment invariably depends on understanding its fundamental underpinnings. Concordia's researchers play key roles in the pursuit of new knowledge in nanoscience and nanotechnology, biophysics, mathematical and computational sciences, molecular modeling and chemical biology, producing varieties of outputs such as theories, formulae, data sets and models that drive cutting edge science in all disciplines. Fundamental science research that transcends traditional disciplinary boundaries will be a key to further development of enabling technologies and tools for next-generation industries.

Information technologies and computation

Information technology and computation touch almost every aspect of modern society. At Concordia, areas of recognized strength include intelligent control systems, IT security, cryptography, artificial intelligence and pattern recognition, speech processing, hardware design and verification, and software engineering and management. Discoveries in these areas have the potential to lead to applications in industrial automation, automotive and aircraft electronics, airport, border and banking security, computing and next generation telecommunication networks.

Telecommunications

Telecommunications research at Concordia covers physical layer communications, network architectures and protocols and end-user applications. Areas of research strength include fibre-optic, satellite and broadband communications, wireless communications, coding/decoding, electromagnetics, signal processing, protocols and end-user service engineering. Discoveries in these areas will shape the future generation of communication networks.

Advanced Materials and Technology

Concordia houses world-class research programs in the areas of advanced materials, nanotechnology, system design, manufacturing and transportation. Extensive partner-driven research is conducted in the areas of materials and composites, polymers, coatings, micro-electro-mechanical systems (MEMS), thermo-fluid and computational fluid dynamics (CFD) and laser metrics – particularly as they apply to such manufacturing and transportation industries as aerospace and vehicle engineering. New sectoral applications are now emerging to include pharmaceuticals, medical devices and environmental technologies.

Composites, aerospace, transportation and manufacturing

Concordia is recognized as a leader in the research areas of advanced composite materials for a wide variety of industrial applications and manufacturing systems. Researchers in this area are internationally-established leaders with unique expertise in the mixing of composite structures to develop new engineering materials structures as well as expertise in coating techniques. Automated fibre placement technologies research and development is an area of intensification

with applications in the automated manufacture of primary aerospace structures. Another strength is the interrelationship between properties and structure of materials (metals, polymers and ceramics) and how these properties and structures can be manipulated with a view to developing techniques for producing surfaces with unique properties. The university also has an established critical mass in research concerning all aspects of product conceptual design, control theories, advanced transport systems and highway safety. Quality and lean production systems research is continuing in close collaboration with the aerospace industry.

Nano/Microtechnology

Researchers have successfully combined their varied expertise in advanced vehicle engineering, mechanical, electrical, and software engineering and have developed significant strengths in the cross-disciplinary area of micro-electro-mechanical systems (MEMS). Cutting edge research is also being conducted in optical MEMS, microfabrication, sensor technology, laser metrics, and development and testing of micro and nano-devices. The applications of microfluidics are among the greatest engineering challenges being faced today and have potential applications in drug discovery, medicine, genetics and proteomics research, and manufacturing processes.

Nanoscience researchers at Concordia are working at the confluence of chemistry, biochemistry and physics with foci in multiple areas of nanotechnology research.

Energy, Environment and Biotechnologies

The global imperative to meet the challenges of environmental destabilization begins with a recognition that human well-being depends on maintaining environmental quality and adopting sustainable systems. Concordia's strengths in this area have been developed in multiple research areas related to environmental science and engineering, energy and biotechnologies. This includes scientific assessments of human impact on the environment, implications for policies and actions regarding resource efficiency and sustainable consumption and production, as well as understanding how to adapt to climate change. On the applied side, Concordia researchers are focusing on: the development of alternative, renewable and sustainable sources of energy; energy-efficient building and construction technology; and bioproduct development and other applications of "omics" based biotechnologies.

Environmental science and engineering

Concordia researchers are conducting fundamental and applied research to understand the major environmental issues and the effects of human activity on the environment, adopting integrative cross-disciplinary approaches to the study of these issues in support of adaptability and sustainability, and related standards and policy issues. The focus of the university's environmental work includes research into biodiversity, climate science, environmental impact assessment and resource management, as well as soil and groundwater contamination and waste disposal.

Energy and sustainable technologies

Research into clean energy, energy efficiency and renewable sources of energy (e.g., solar, wind, biomass) constitute the foundation of our approaches to the development of energy generation, storage and transmission capability with minimum environmental impact. Concordia has a long and rich history in the area of residential and commercial building environments and infrastructure. As a result of more than three decades of innovative and dedicated research, Concordia faculty have built a unique hub for research expertise in building envelope performance, materials, structures, system services automation, air quality and thermal comfort, energy systems in buildings and use of solar technologies. Research has evolved to focus on minimizing the environmental impact of buildings over their lifetimes, particularly within urban settings. This solid base in building studies has made it possible to become a leading force in developing energy efficient buildings that are more comfortable, healthier, safer and more responsive to the needs of their inhabitants and users.

Omics and related biotechnologies

Through its expertise in structural and functional genomics, Concordia has established ongoing research programs in molecular ecology, comparative genomics, transcriptomics and proteomics, bioinformatics and related technologies and numerous industry-based partnerships in the area of bioproduct research and development. Innovative work on microbial genomics and enzymes is directed towards development of more sustainable industrial processes and products, such as chemical-free bleaching for wood pulp, biological factories for pharmaceuticals, and the production of biofuels. Engineering of biological systems (i.e., synthetic biology) is a pioneering area of research with potential applications in environmental protection, new energy sources, human health, and agriculture and agribusiness.

Goals and Directions

Over the next five years, our *2013-2018 Strategic Research Plan* will provide the framework and direction to shape and evaluate our continued development of research capacity, as well as our reputation for creativity and innovation. The CRC and CFI programs represent critical public investments in our university. Our CRCs will be selected not only by virtue of their individual accomplishments, but also specifically to intensify priority areas of research and research-creation at Concordia, build and expand successful groups, and develop a robust program of graduate and postdoctoral mentorship and training. Likewise, the CFI projects we advance will build up unique infrastructure platforms, spaces and instrumentation that facilitate innovation and creativity. In short, we will continue to ensure that these valued public investments deepen our research profile and differentiate our university's contributions to the advancement of knowledge and greater good of Canadian society, and that will position Concordia for success in the global context of 2020 and beyond.

Aligned with current trends, and in anticipation of a rapidly changing worldwide context for research activity, Concordia will vigorously pursue new inter-sectoral and international research partnership opportunities that will enrich our capacity and enlarge the impact of our work

globally. Key factors in expanding our impact are the successful communication of research and the mobilization of knowledge across sectors and boundaries that are social, disciplinary, cultural, hierarchical, virtual and spatial. Increasingly, innovative research hinges on the ability to find and navigate intersections of knowledge, the willingness to experiment and break down dichotomies between fundamental and applied, arts and technology, campus and community, while forging sustainable linkages between humanities, social science, management, science, engineering, and other partners in society. Concordia, more than most universities, inhabits these productive conceptual, intellectual and physical spaces that transcend conventional barriers and nurture innovation, creativity and professional training for the next economy.

Like other major universities, we partly measure our success in fostering research and research-creation by increasing and diversifying our external funding from all sources, by garnering major prizes and recognition awards, by publications in high-impact journals or with leading presses, or exhibitions at high-profile juried competitions. These are all tangible measures of performance. However, as the CRC and CFI programs underscore, universities are incubators of knowledge, creativity and innovation and at Concordia we also measure our success by how good we are at utilizing those privileged public resources to accomplish five things: 1) Fostering the conditions for innovation; 2) Attracting talented people; 3) Creating and optimizing state-of-the-art spaces for research and research-creation; 4) Preparing the next generation of talent; and 5) Connecting our research and research-creation activities and outcomes with the wider world.

Fostering the conditions for innovation

Because the worlds of research, higher education, innovation and creativity are changing at an astonishing pace, our *2013-18 Strategic Research Plan* is designed to be supple enough to anticipate and capitalize on unique opportunities to enhance, extend or diversify our major research strengths. In particular, we will be motivated by opportunities to make strategic hires and support infrastructure projects that better integrate our current areas of thematically-linked strength. We will also pursue strategic directions that will enable emerging and novel research programs to achieve greater levels of productivity, impact and international recognition.

One area where we intend to promote productive linkages involves the steadily-increasing number of research units and researchers from across the university that are involved in alternative energy research, including wind, water, solar energy and biomass conversion. This work is complemented by research around questions of sustainability in areas such as climate change, smart buildings, environmental resource assessment and management, waste management, small, medium and large business sustainability, community development and social innovation. Nanoscience and advanced materials research is another cross-university focus, with a variety of research groups in both engineering and the sciences, and potential applications across a wide range of fields ranging from aerospace to the health sciences. Research in information and related technologies is well-advanced in areas such as cybersecurity, digital media technologies, high-performance computing, telecommunications networks and bioinformatics. These research areas, where we have been building critical mass and

expertise, extend into all areas of society. Further development around these themes will offer exciting opportunities for unique discoveries that will benefit society, and for training of highly qualified personnel, but also for critical analysis of their impacts on society and implications for public policy. Similarly, Concordia will continue to boost its cross-disciplinary leadership in experimental media and digital humanities, by continuing to evolve new zones of interaction that transcend traditional arts and design disciplines to include cutting-edge research, innovation and development in science, engineering, technology and business.

Beyond consolidating our leadership in established domains of excellence, our *2013-18 Strategic Research Plan* will target new positioning opportunities for Concordia in transdisciplinary health research. With the opening of the PERFORM Centre in fall 2011, Concordia has a strategic new resource that will help vault us into the vanguard of transdisciplinary, inter-sectoral research on primary and secondary preventive health and individualized medicine in Canada. For the first time in its history, Concordia is in a position to target health-related hires across the university ranging from public policy and health economics, to medical physics, biostatistics and biomechanics, neuroscience, exercise physiology and human development. In contrast to the diagnostic and cure-driven medical research traditionally carried out by university hospitals, Concordia can be a showcase for the unique contribution that comprehensive universities make to the well-being of all Canadians.

We are also well positioned to build a leadership profile in the field of First Peoples studies where we occupy a unique niche as the only university in Québec, and one of few east of Ontario, with approved programs and an emerging cohort of researchers focused on issues of aboriginal youth and the impact of development on northern communities. Similarly, there is potential for Concordia to become a fulcrum for research in the cross-disciplinary field of synthetic biology where there is a need to position Canada in a rapidly evolving international research context.

Research and higher education are undergoing a highly transformative period that is increasingly boundary-less in both geo-political and sectoral terms. The nature of contemporary research problems, the range of expertise, and the scale of instrumentation and funding resources required to address them demands greater emphasis on partnerships and mobility of researchers and trainees. Concordia researchers across all our domains of research strength are already highly networked with an impressive diversity of collaborators in industry, government, community and the not-for-profit sector, in Québec, Canada and abroad. A priority for this *Strategic Research Plan* is to deepen and further extend those partnerships both on a project and program basis. Similarly, a goal of this *Plan* will be to ensure that Concordia exercises greater leadership in large-scale, inter-institutional research initiatives, some of which are also inter-sectoral, such as National Centres of Excellence, or the various *Regroupements stratégiques* and *Groupes de recherche* programs supported by the *Fonds de Recherche Québec*.

Building partnerships likewise means capitalizing to the maximum extent on the potential fit between Concordia research and research-creation expertise and the Government of Canada's *Science and Technology Strategy*, the *Politique nationale de la recherche et de l'innovation* of the

Government of Québec, the European Commission growth strategy, *Europe 2020*, and public funding initiatives in the United States with respect to health, science and the humanities.

In addition to promoting great research by creating new synergies across fields, disciplines and boundaries, driving creativity and innovation requires forward-thinking intellectual property policies, expertise to identify and facilitate opportunities for collaborations with private and public-sector partners; and mechanisms to help realize the commercial, open-source and public-use potentials of our researchers' discoveries, inventions and findings. We are committed to further developing these competencies in delivering on the promise of our *2013-18 Strategic Research Plan*.

Attracting Talented People

Concordia University has a total targeted and flexible allocation of 28 Canada Research Chairs, of which 23 were filled as of the March 2013 award announcement. As per the CRC program processes, the remaining Chairs are in different phases of recruitment and nomination. The vast majority (19) of our CRCs are Tier 2 because Concordia has deliberately targeted early career researchers working in new fields in order to best position Concordia as a university leading new directions in research. Our institutional selection process ensures that all anticipated vacancies are flagged in advance and that designated areas for replacement are targeted in order that positions are filled in good time.

To maximize the future impact of our CRC quotas, we will target and cluster nominations in research areas where Concordia is, or aspires to become, a national leader. As has been our practice in the past, Concordia University will capitalize on the prestige of the CRC program exclusively to recruit new faculty, nationally and internationally, to our university, thereby attracting 'some of the world's most accomplished and promising minds' to Canada.

We will continue to allocate new CRC positions through a transparent and competitive internal process that is regarded as a best practice nationally. All chairholders are expected to play a critical leadership role by building research capacity, recruiting talented students, training highly qualified personnel, and developing productive synergies through their activities in centres, institutes, labs, partnerships, networks or alliances. To ensure that these expectations are fulfilled, we require departments, research centres and Faculties to submit letters of intent that clearly demonstrate the strategic relevance and importance of the proposed research chair positions to the university's research plan. In addition, all chairholders are subject to internal performance review requirements. The deployment of CRCs also takes into account the existing gender imbalance and the need to recruit other targeted groups.

To ensure that CRCs have the time and resources to fully develop their research programs, Concordia, perhaps uniquely among Canadian universities, allocates 45% of CRC program funding to directly support the research activities of its Chairs in addition to providing them with two course releases per academic year.

Taking into account current nominations and anticipated vacancies as some Tier 2 CRC positions reach the limit of their eligibility, we expect, over the life of the *2013-18 Plan*, to recruit no fewer than 5 Tier 1 and 10 Tier 2 CRCs currently allocated to SSHRC and NSERC fields. We also intend to increase our allotment of CIHR chairs through our strategic development of health-related research. In 2013-14, during the first wave of nominations under the *2013-18 Plan*, the university is recruiting 3 Tier 1 NSERC Chairs in the fields of microbial genomics, environmental chemistry, and sustainable industrial and mine waste management, and 2 SSHRC Tier 2 chairs in the fields of visual heritage and digital archives, and poetics.

The table below identifies by strategic research theme, agency and tier all of Concordia's CRCs as of the March 2013 award announcement. To broaden the picture, the table also identifies internal Concordia University Research Chairs and Distinguished Professorships according to the same rubric, as well as the number of women and men holding these appointments. As of March 2013, 5 of Concordia's 23 CRCs are held by women, including 1 of 4 at the Tier 1 level, and 4 of 19 at Tier 2. Although the university made significant progress in recruiting female candidates (5 of 12 new CRCs) under the auspices of the *2008-12 Strategic Research Plan*, it remains a priority to work in future to correct the existing imbalance--which is also present among internally awarded chairholders and special professorships—in order to better reflect the overall distribution of faculty at Concordia.

Attracting talented people is key to creating an enriched research environment in which leadership, knowledge mobilization, spirit of discovery, knowledge translation and openness to the future go hand-in-hand.

TABLE 2
Research Chairs by Theme and Agency

Research Theme	Canada Research Chairs				Concordia University Research Chairs				Other Chairs		Total by Theme			
	Agency	Tier 1		Tier 2		Tier 1		Tier 2		M	F	M	F	Total
		M	F	M	F	M	F	M	F					
1. Development and Well-Being of the Person Across the Lifespan	CIHR			3	1	4	3	1	1	0	2	12	8	20
	NSERC	1		2										
	SSHRC			1	1									
	TOTAL	1	0	6	2									
2. Culture, History and Identity	CIHR					2	2	3	3	4	1	12	9	21
	NSERC													
	SSHRC		1	3	2									
	TOTAL	0	1	3	2									
3. Human Systems and Organization	CIHR					4	0	1	2	7	3	14	5	19
	NSERC													
	SSHRC			2										
	TOTAL	0	0	2	0									
4. Enabling Technologies and their Basic Foundations	CIHR					5	1	6	0	1	0	14	1	15
	NSERC	1		1										
	SSHRC													
	TOTAL	1	0	1	0									
5. Advanced Materials and Technology	CIHR					4	0	1	1	1	0	8	1	9
	NSERC	1		1										
	SSHRC													
	TOTAL	1	0	1	0									
6. Energy, Environment and Biotechnologies	CIHR					2	1	2	0	1	0	7	1	8
	NSERC			2										
	SSHRC													
	TOTAL	0	0	2	0									
Total by Chair Type		3	1	15	4	21	7	14	7	14	6	67	25	92

Creating and optimizing state-of-the-art spaces for research and research-creation

Concordia’s approach to the various CFI programs and competitions targets projects that are most closely aligned with the university’s 6 main research themes. Major CFI competitions, such as the *New Initiatives Fund* and the *Leading Edge Fund*, are managed at the university level. In order to maintain focus on strategic priorities, the process begins with an internal call for letters of intent from researchers and concludes with consultations between the four Faculties and the Vice-President, Research and Graduate Studies to select the projects that best match Concordia’s strategic priorities. We will also focus our CFI envelope on unique infrastructure projects that complement and augment our existing physical resources and facilitate innovation, research and development by ensuring maximized use of platforms, facilities and equipment by researchers in multiple disciplines and sectors. We will continue to develop state-of-the-art infrastructure to create innovative spaces and install unique instrumentation that is vital to attracting top researchers, graduate students and postdoctoral fellows from around the globe.

Our CFI project development and management directions are also framed in relation to a rolling five-year plan for major capital projects focused on research infrastructure that all Québec-based

universities are obligated to develop for the Government of Québec. Because of its importance to the overall development of institutional space at Concordia, the *Plan quinquennale de développement des infrastructures de recherche* is framed through consultations between the Office of the Vice-President, Research and Graduate Studies, the Faculties, and the Office of the Vice-President, Services, which is responsible for construction, renovation and facilities management projects.

Consistent with the Faculties' hiring priorities, the *Leaders Opportunity Fund* competition is managed at the Faculty level and oriented toward assisting newly hired faculty members, especially new CRCs, to establish state-of-the-art facilities to support their research initiatives.

Preparing the next generation of talent

Equipping students to enter the workforce competitively and confidently is a critical element in any strategic plan for research development along with an investment in graduate education and postdoctoral training. We will prioritize new graduate program development in novel areas of research, such as the PhD in Information Systems Engineering and the Master of/Magisteriate in Design. Unique programs in Québec and Canada, they will accept their first cohorts of students in 2013-14. Our unique Individualized Studies (INDI) Master's and PhD programs will serve as incubators of distinctive cross-departmental and cross-Faculty graduate training opportunities in areas such as food studies, sustainability, exercise physiology, games studies and synthetic biology.

In recognition of the premium placed on global skills development, we will facilitate graduate mobility within Canada and abroad, expand our highly successful *GradProSkills* training program, capitalize fully on internship and other opportunities made possible through *Mitacs*, NSERC Create and other training grant programs, and increase our postdoctoral fellows population in an expanded range of fields. In order to prepare future undergraduate students for graduate studies and careers in research, we will put renewed emphasis on providing support to undergraduate research initiatives, including international student exchanges and summer undergraduate research awards.

Connecting our research and research-creation with the wider world

To better fulfill the public role and mission of our university's research enterprise we will pursue imaginative and effective forms of knowledge mobilization that best link our work to society at large. As a university with a proud history of successful campus-community collaborations, Concordia is well positioned for further accomplishments in this area. Our scientists, engineers and management faculty work closely with industry and government partners to develop new systems, tools and technologies to best meet society's needs. Our business faculty and social scientists are collaborating with community partners in such areas as community economic development and public policy where Concordia is a leader in social innovation. Similarly, the Concordia-based Montreal Institute for Genocide and Human Rights Studies is recognized for its contributions to international public policy, notably the 'Will to Intervene' project. These and

many other types of knowledge mobilization, knowledge translation and communication activities connect us to the wider world.

Beyond the technical and policy domains, our CRC-led, CFI funded Centre for Oral History and Digital Storytelling is a model of such engagement and the commitment to ground knowledge in the 'shared authority' between scholars and the public. Because Concordia is home to one of Canada's foremost journalism programs (both graduate and undergraduate), which includes research expertise in science journalism, our university is poised to become the benchmark for mobilizing accessible, intelligent, investigative knowledge about rapidly evolving areas of research such as nanoscience and nanotechnology, synthetic biology and preventive health.

Concordia is also a leader among North American universities in its institutional commitment to open access, as reflected by our institutional repository, *Spectrum*, our Open Access Author Fund, and a Senate mandate, the first at a Canadian university, requiring faculty to make peer-reviewed journal articles available through open access repositories. We are also innovators in the increasingly complex and creative, multi-media world of research communication, as exemplified by our unique and widely-praised knowledge dissemination platform, *research@concordia*. Sponsored by our Office of Research, the *research@concordia* website is a made-at-Concordia portal into the university's research landscape. The site is driven by key words, clear research questions and links that show the interconnecting world of people, ideas and research activity all across Concordia. Visit: <http://www.concordia.ca/explore/>.

Research Support and Development at Concordia

In addition to supporting the objectives of the *2013-18 Plan* through continued capital and resource investments in our libraries, data collection and information technology systems that support our rapidly evolving institutional research ecosystem, the university, under the auspices of the Office of the Vice-President, Research and Graduate Studies, manages a comprehensive package of internal research support programs, including the Concordia University Research Chairs program, the Research Unit program, an envelope of funding programs called *Mobilizing Knowledge*, and the Strategic International Partnership Seed Funding Program.

Concordia University Research Chairs program

In 2001, the university created the Concordia University Research Chair program to complement the CRC program, which is targeted to attracting faculty outside Concordia, by supporting current faculty members. As of March 2013, there were 49 CURCs spread across all four faculties and designated as Tier 1 or Tier 2 per the guidelines of the CRC program. CURCs receive multi-year direct research funding and course release from the university. The awarding of CURCs is aligned with the university's Strategic Research Plan and follows an institution-wide competitive process similar to that used for targeting CRC hires. To coincide with the *2013-18 Plan*, the structure of the CURC program is undergoing an internal review that aims, at steady state, to support a larger number (65) of outstanding Concordia-based researchers, including mid-career researchers who often do not easily fit into the existing Tier 1 and Tier 2 model.

Mobilizing Knowledge: A Plan for Supporting Research Development at Concordia University

The programs described in *Mobilizing Knowledge* (2007) continue to be central to Concordia's strategic approach to stimulating the development of policies and structures that aim to increase the university's external research funding, partnerships, leadership and international activities, as well as industry-sponsored research. The internal funding programs outlined below are complementary, designed to provide researchers with opportunities to enhance and extend their research activities, and leverage external funding.

CATALYST programs provide competition-based funding to individual researchers or teams, as well as start-up funding for new researchers to seed or accelerate research projects or programs with the goal of securing external funding.

EXCELLENCE programs are designed to encourage established researchers to participate in major high-profile competitions and assume leadership roles in inter-institutional research initiatives. Smaller scale high quality projects with significant leveraging potential are also supported through this funding envelope. The objective of these programs is to increase the number of high profile research awards hosted by Concordia research teams.

POSITIONING and SUSTAINABILITY programs provide basic funding for established and emerging university-recognized research units such as centres, platforms and networks. The envelope also supports competition-based awards for Facilities Optimization, which allows individuals and teams to optimize research infrastructure by upgrading existing equipment and systems or adding complementary small components or pieces. The envelope also provides funding that enables Concordia researchers to participate in external research centres, in particular the numerous inter-institutional *Regroupements stratégiques*, *Centres*, and *Groupes de recherche*, which are funded by the *Fonds de recherche Québec* in *Nature et technologies*, *Société et culture* and *Santé*. In addition, funding is provided to support Concordia's membership in several Government of Québec sponsored research consortia involving industry and university partners.

The *VALORISATION* envelope provides funds for the evaluation, protection and commercialization of technologies deemed to have strong commercial potential or strategic significance. In addition, support is available for pre-commercialization proof of concept studies, prototyping and the further development of early stage technologies with strong commercial potential.

The *OUTREACH* program provides competition-based funding to support events such as workshops, seminars, conferences, exhibitions, performances and lectures that stem from, and give visibility to, research and creative activity undertaken at Concordia University. The program provides scholarly publication support and other aids to the dissemination of research and creative accomplishments.

It is important to note that this *Strategic Research Plan* encompasses many – but certainly not all – of Concordia’s research activities. Concordia dedicates significant resources to promote research on all fronts, a commitment that is expressed in a variety of ways. Strategically, as described in this *Plan*, Concordia has identified thematic areas in which we currently expect to maintain or build critical mass and strategic-level capacity through CFI support and the deployment of CRCs. In addition to these strategic foci, Concordia is committed to many other areas of expertise that are widely recognized and valued within the university and by the external community. All of these knowledge areas are important to the fulfillment of Concordia’s mission and are supported in their many forms by initiatives in curriculum development, industry partnerships, international collaborations, knowledge transfer, community engagement and the recruitment and training of highly qualified personnel.

Planning and Approval Process

The *CRC and CFI Strategic Research Plan* was developed through an iterative and collaborative planning process under the leadership of the Vice-President, Research and Graduate Studies in consultation with all Faculties and Concordia’s Senate Research Committee and Faculty Councils. The *Plan* was then approved by Senate and endorsed by the President.