



The advancement of excellence in research is a defining feature of SFU, with leading individuals and well-recognized groups engaged in a wide variety of key research activities. We are recognized for our high level of peer-reviewed scholarly output and our excellence in technology transfer. Our significant growth in research output is matched by an astounding 126% growth in research input between 2002 and 2007. We attracted \$86 million in research funding in 2008, putting us into the top-20 group of Canadian post-secondary institutions on this measure. We have been awarded more than 40 Canada Research Chairs in areas that complement our strategic research goals, including both Tier 1 Chairs for outstanding researchers who are world leaders in their fields, and Tier 2 Chairs for exceptional emerging researchers with the potential to lead in their field. SFU has 39 Royal Society of Canada Fellows, distinguished Canadian scholars who are selected by their peers for outstanding contributions to the natural and social sciences, the arts, and the humanities. *Our goal is to be the most research-intensive comprehensive university in Canada, competing effectively in defined areas with the top tier institutions in the country, and internationally renowned for the excellence of our scholarship.*

MAJOR OBJECTIVES

The SRP is intended to serve as a road map for establishing the focus, infrastructure, and capability that is necessary to improve the research performance of the University. Its major objectives are to:

- Maximize opportunities for discovery and innovation;
- Promote internationally competitive research and scholarship;
- Cultivate excellence through selective investment in emerging areas of research;
- Facilitate collaborations across disciplinary and institutional boundaries;
- Recruit and retain outstanding students, research fellows, and faculty;
- Encourage effective communication and dissemination of research results;
- Optimize use of our research and scholarship resources;
- Recognize the full value of intellectual property;
- Achieve thematic coherence in the expression of SFU's research interests;
- Engage all our communities for the benefit of society.

STRATEGIC RESEARCH THEMES

The SRP articulates SFU's strengths by identifying integrative strategic research themes that cross disciplinary and administrative boundaries. In defining these themes, we intend to facilitate and encourage both individual initiatives and new collaborations within existing structures. Through the process of identifying our research strengths and existing and potential synergies among them, we intend to encourage and support cross-disciplinary initiatives that build on our strengths and show potential for significant impact and leverage. Excellence in research and strategic investment of resources aligned with this thematic approach will give SFU a distinctive edge and comparative advantage, leading to our goal of being the most research-intensive comprehensive university in Canada and competing effectively on the international scene. The strategic research themes encompass both cross-disciplinary teams and disciplinary or individual contributions to our collective achievements. They are consistent with the sub-priorities of the S&T Strategy of Canada. Please refer to the [SFU Strategic Research Plan 2010-15](#) for details on each of the following themes and sub-themes.

Origins

The Nature, Origin, and Fate of the Universe. Answering questions about the nature, origin, and fate of the universe is at the origin of most fields of scientific research. This theme brings together the many disciplines that are occupied with these fundamental research questions, especially mathematics, physics, chemistry, biology and medicine. A particular focus is SFU's role in ATLAS, the world's largest particle physics experiment to reconstruct the first seconds of the universe.

The RNA World and Molecular Evolution. Several SFU researchers are active in unraveling the puzzle of how life might have emerged. Understanding how changes in molecular building blocks alter their structure, dynamics and function is the

foundation for the science of molecular evolution. Such understanding is required for the design of antibacterial and antiviral drugs against which pathogens cannot develop resistance. Correlating the molecular foundations of evolution at the organismal and societal levels requires an interdisciplinary effort between SFU's molecular and biological scientists, mathematicians and computational scientists, behavioural ecologists and psychologists, and other social scientists.

Biodiversity. Understanding and conserving biodiversity are now widely recognized as crucial for human wellbeing. Several research groups at SFU, including those in wildlife and behavioural ecology and salmon conservation, are focusing on the ecology, evolution, and conservation of biodiversity. There is complementary strength in applied research on the ecology and conservation of forests and fisheries. SFU's strengths in present-day biodiversity research are complemented by expertise in past biodiversity and human-environment interaction. Over the next five years, we will focus on ensuring that the benefits of SFU's ability to combine research and training on past, present and future biodiversity are fully realized.

Human Evolution. In recent years, a number of disciplines have experienced a significant growth of interest in the application of Darwinian theory to questions concerning humans, and it is now clear that evolution provides a powerful framework for understanding not only our genes and anatomy, but also our cognition and behaviour. Interest in Darwin's impact on economic behaviour, social history, and subsequent cultural conditions continues to intensify. SFU will exploit the research and training synergies created by its combination of an unusually diverse group of human evolution researchers and first-rate research facilities.

The Development of Human Thought, Culture, and Institutions. SFU researchers explore culture and human development in a variety of contemporary domains, including the links between social and cultural contexts that affect cognition, identity, values, family relations, artistic and literary creativity, and individual and social welfare. Broad areas of expertise include anthropology, business, English, first nations studies, history, humanities, international studies, literary studies, philosophy, political science, psychology, sociology, and women's studies. SFU's strengths can be found in the diversity of research methods used in both laboratory and field settings, and in its focus on both basic theoretical research and the application of theory to significant social issues.

Communication, Computation, and Technology

SFU expertise spans research issues from theory to applications to policy, with researchers from many disciplines involved, including chemistry and chemical biology, communications, computing science, criminology, economics, engineering science, interactive arts and technology mathematics, molecular biology and biochemistry, physics, psychology, and statistics.

Materials Science and Engineering. SFU materials science research spans the spectrum from curiosity-driven research leading to the discovery of new materials and new materials properties, to more applied research culminating in applications-driven engineering and development. An interdisciplinary and collaborative approach by biochemists, biologists, chemists, engineering scientists, molecular biologists, and physicists will permit new materials to be integrated with existing technologies to create novel platforms and devices. An essential part of our strategy is participation in national and international joint ventures such as the Tri-University Meson Facility (TRIUMF) and Canadian Light Source (CLS).

Intelligent Systems and Computer-Aided Design. Intelligent systems research is inherently interdisciplinary and has its foundation in computer science, computer and software engineering, electrical engineering, and mechanical engineering. Research foci include artificial intelligence, data mining, intelligent data processing, the semantic web, computer-aided vision, sensors and sensor networks, robotics, mechatronic systems, microelectronics, embedded computing and systems, and advanced instrumentation. Computer-Aided Design explores the use of unified constraint and simulation-based modeling that enables designers to create designs adapted to context and to the physical forces; and constraints and simulation to establish a new design space in which histories enhance the ability to explore new alternatives for designs.

Automotive Technologies. Mechatronics is the integration of mechanical, electronic, control, software, and computer engineering for the development of advanced electromechanical products and systems for a wide range of industrial applications. Research topics include next generation engine mounts, vibration-based energy harvesting, airbags, and intelligent systems for autonomous vehicles. Researchers complement these efforts with expertise in polymer/electrochemistry, modelling structures and processes in fuel cells, bio-fuel cells, and novel methods for preparing proton-conducting membranes. This group has strong connections with the NRC Institute for Fuel Cell Innovation, and

will develop collaboratively the next generation of nanostructured materials for fuel cell applications.

Imaging Science and Visual Analytics. Investigation into the visual presentation of data and relationships is fundamental to this field, as is the study of how human beings perceive and use visualizations for communication, analysis and decision-making. The foundations of imaging research include modeling, signal detection and processing, mathematics, statistics, data processing and storage, animation, language analysis, cognition and perception. Building on these foundations is research on human-computer interaction, reasoning, transformation and dynamic visualization. Key applications of the research include medical imaging, visual analytics, data mining, business intelligence, finance, manufacturing, transportation, public safety, health and the environment.

Information, Communication, and New Media Technologies. Areas of excellence are multimedia, wireless communications, RF/microwave communications, network systems and modeling, algorithms, information retrieval and web-based systems, natural language, and games, animation and new media. Research strengths also exist in the areas of the IT sector of the economy, and life and mission-critical ICT for disaster management and public safety, coastal surveillance, and disaster relief. Business researchers study knowledge, innovation and technology, with particular expertise in project management. ICT provides a necessary substrate for many areas of research, and SFU has and will continue to build strong links between ICT and the disciplines that use ICT in research.

Communication, Collaboration, and Computation. SFU has expertise in communication, collaboration and computation, including computational security and safety. This subtheme builds on extensive expertise in combinatorial algorithm development and qualitative and quantitative modeling of complex social systems using advanced mathematical, statistical, and computational methods. SFU is a leader in the development and deployment of collaborative technologies in the support of research at the national level, such as that offered by the Interdisciplinary Research in the Mathematical and Computational Sciences (IRMACS) Centre.

Technology and the Arts. Developments in media and computing technologies link interactive arts and technology with musicians, filmmakers, dancers, and other scholars. SFU researchers study historical and current dimensions of media culture in visual, filmic, aural, print, and digital formats. Research foci include the study and design of interactive media technologies, virtual environments, and expressive systems; the development of computational systems that produce or simulate creativity, and the construction of cognitive models of human creativity and creative expression; and the study of human-centered media and communication systems for museums. A coordinated initiative that merges theory and practice in the artistic uses of new technologies and the scholarly analysis of traditional media builds on current strengths.

Culture, Society, and Human Behaviour

As a comprehensive university, SFU champions the liberal arts and sciences and promotes pioneering interdisciplinarity. In all these areas, the challenge is to develop focal points (individuals or groups) to enable dispersed researchers to cohere in creative research groups that will be distinctive to SFU.

Research in the Humanities. Philosophers, historians, classicists, literary critics and linguists investigate and describe the ever-changing realities of contemporary life, and teach us how to question and critique the political, social, sexual, economic, and historical frameworks within which we all live and work as world citizens. Scholars of English study the entire spectrum of literary and textual activity, from the genesis of a writer's creative spark through the various stages of a manuscript's development and dissemination. Scholars of history, whose research strengths are social history and cultural history, grapple with knowledge others often recognize only dimly or in passing: that the future was created yesterday. Specific research specialties share themes that overlap time and region: such as indigenous peoples; law and society; and medicine and science.

Foundations of Ethical Evaluation and Ethical Implications of Research. SFU possesses a broad range of research expertise both in the foundations of ethics and in applied ethics; this expertise can be found in areas including archaeology, business, criminology, education, environmental sciences, health sciences, philosophy, political science, and public policy. All research, from the fundamental discoveries of science to the development of new technologies, policies, strategies, and new ways of understanding, stand to have a significant impact on the way we lead our lives. SFU researchers take a leadership role in ensuring that research has a positive impact on human welfare, by pursuing the systematic

investigation of our moral beliefs, from their philosophical foundations to their applications in the forms of general principles, to public policy issues arising in the Canadian context.

Aboriginal Studies. Research into Aboriginal issues involves anthropology, archaeology, economics, education, health, history, linguistics, literature, psychology, resource management, and sociology. Research foci include examining contemporary urban and rural issues in the Aboriginal community, preserving Aboriginal languages, partnering with bands and communities in Aboriginal education, examining classroom climate issues for Aboriginal/minority students, resource management in Aboriginal communities, barriers to Aboriginal labour market success, archaeological research, and rise of Aboriginal and Métis writers and artists. We are recognized for our critical analysis of issues dealing with Aboriginal sites, as in a collaborative research initiative to investigate the intellectual rights issues raised by archeological practice.

International Studies. Research in this area includes international studies and international policy, advanced by new endowed research chairs in religion and cultural change, and international law and human security. The Human Security Report project analyses global and regional trends in political violence and their causes and consequences, and has put SFU on the map internationally as a resource for governments and nongovernmental organizations alike. The new Centre for the Comparative Study of Muslim Societies and Cultures represents another interdisciplinary collaboration that has few Canadian counterparts. The World Literature program is focusing on the way aesthetic forms and topoi pass from one culture or time to another, most often in defiance of political and social boundaries.

Safety, Security, Criminal Behaviour Assessment and Treatment, and Forensic Studies. SFU has significant strength in the analysis of criminal behaviour and forensic studies, with a number of research centres and institutes and a LEEF Chair in the Reduction of Youth Violence providing a powerful hub around which crime-related research in other units can be focused. Another focus builds on SFU's existing strengths in security and health research to establish new capabilities in public safety, security, and health science. SFU researchers are developing strengths in other aspects of security, such as polymer chemistry, microelectronics, optics and nano-fabrication of new materials for new high-tech security technologies. The Human Security Report Project researches global and regional trends in political violence and their causes and consequences; SFU researchers are also studying ways to increase the safety, health and welfare of employees.

Evolution, Cognition, and Culture. SFU is in an excellent position to become a world leader in an interdisciplinary plan to integrate the sciences, social sciences and humanities. Researchers in archaeology, biological sciences, business administration, linguistics, and psychology, including the CRCs in Human Evolutionary Studies and Management of Technology, are using phylogenetic methods from biology to understand the evolution of a range of social and cultural phenomena. Researchers in English are working in biosemiotics, focusing on the wide variety of forms of communication in biological systems; research in psychology focuses on the development of communication in infancy. Through participation in the Centre for the Evolution of Cultural Diversity, SFU is poised to bring focus to this area in an international context.

Urban Communities. SFU has research strengths from urban design and planning to the study of the individual resident, including the social, artistic, and environmental aspects of urban life. Specific strengths exist in the areas of urban studies, geography, computing science, mathematics, criminology, computing science, economics, and forensic psychology. Researchers are probing issues of social cohesion, antiracist education, violence in society, multiculturalism and cultural adaptation, citizenship, diasporic cultures, and nationhood. There are promising possibilities for research on second-language learning, public education and the wellbeing of communities. The CTEF-funded "Modelling of Complex Social Systems" program brings together extensive expertise under the unifying theme of modelling the complex dynamics that drive the linked epidemiologies of crime, disease, homelessness and other social ills in urban neighborhoods.

Intervention Impact Assessment. Funding for most forms of service delivery, including educational and social programs, is increasingly linked to the ability of the service provider to demonstrate results. Despite the increased attention being paid to "accountability", the mechanisms, tools and practices for effective impact assessment remain blunt instruments. An interdisciplinary approach harnessing the research approaches of economists, sociologists, psychologists and educators, would provide a framework for significant advances. SFU researchers currently possess great strengths in each of these areas, and are in an excellent position to develop more sophisticated research methods for impact assessment and to apply those methods to a wide range of social interventions. By doing so, SFU can capitalize on its acknowledged strength and leadership in the social sciences and humanities, and position itself at the forefront of an emerging research need.

Economic Organization, Public Policy, and the Global Community

Economic Organization. SFU has significant strengths in the theoretical analysis of firm organization, law and economics, public economics, the study of economic institutions, and econometric analysis, complemented by strengths in computational, experimental, and evolutionary methods which are reflected in the Centre for Research on Adaptive Behaviour in Economics and the CRC in Economic Theory and Evolution. There are also strengths in a number of applied fields including strategic change, corporate governance, capital and risk management, biotechnology management, art management, and the environmental, ethical, and sustainable management of organizations. Current efforts include concentrations in the CMA Centre for Strategic Change and Performance Measurement, the Centre for Corporate Governance and Risk Management, and the Global Asset and Wealth Management Centre.

Public Policy. The role of the public sector in our economic and social lives has increased as our private wealth has grown over the past decades. This has spurred research on how policy is formed, what policies are good and in what contexts, and on the unintended consequences of policy decisions. Such research is carried out in economics and the Public Policy Program, for example, the Centre for Public Policy Research that complements existing or projected policy research in health sciences, urban studies, international studies, and communications. Other examples include the CURA Economic Security Project, the Learning City project, the Institute of Governance Studies, and the Mental Health Law and Policy Institute, among other venues.

The Global Community and Emerging Markets. SFU has several research groups concerned with international economic relations, transnational organization, and global culture, including the Centre for Global Workforce Strategy, the Jack Austin Centre for Asia Pacific Business Studies, the Centre for Global Political Economy, the Global Asset and Wealth Management Centre, and the MCRI Globalism Project. One research area focuses on issues of trade, international finance, and economic development in low-income countries; another investigates the management of global enterprises. Researchers are examining issues of knowledge, innovation and technology, including the formation, operation and growth of biotechnology firms and the IT sector. Research on global institutions focuses on peace and security studies; development, environment, and international economic relations; governance and civil society; human rights and international law.

The Creative Economy. The Creative Economy, defined to include the whole of the creative chain for core cultural goods and services, including their creation, production, manufacturing, distribution, and support, has emerged as both a substantial and an expanding sector of the Canadian economy. The creative economy also generates the social capital that is fundamental to social cohesion. Understanding the nature and dynamics of the creative economy is critical to Canada's social, cultural and economic future, and SFU's strengths in the contemporary and interactive arts, literary and publishing studies, and technology position it to play a leading role in research in this area.

Environment, Resources, and Conservation

SFU has an excellent record of research related to the environment, spanning a range of sectors from theoretical and mechanistic studies to applied management strategies. Research clusters at SFU focus on the relationships between economic development, conservation and biodiversity in terrestrial and aquatic ecosystems, as well as on natural hazard prediction and prevention. Our research includes not only chemical, molecular biological, toxicological, physiological, and behavioural studies, but also risk assessment, management, and historic and economic considerations. The ultimate goal of this multifaceted approach is to provide a sound basis for sustainable development and the responsible use of our natural resources.

Planning, Development, Management, and Sustainability. SFU will pursue research in areas related to the development, planning, management, and sustainability of human settlements and the impact of human and natural disturbances on environments and communities. Foci include governance and equity issues; spatial and labor market dynamics; consumption patterns; industrial restructuring; ecological, economic and social sustainability; sustainable development policy; sustainability and quality of life indicators, assessment and evaluation; public space and urban/regional livability; health care and access; property rights and spatial inequities; local economic development; the development of mathematical tools in resource allocation and management; and global environmental issues. SFU research integrating the social and natural sciences focuses on the impacts of human development and natural disturbances on natural and urban environments and communities. Emphasis is placed on the causes of and responses to natural hazards, and on sustainable development

strategies that integrate economic, social, and environmental objectives. Research on both geoscientific and biological phenomena in the ocean environment is integrated within the SFU-supported Neptune Canada project. Research in environmental education and education for sustainable development will be key to understanding human interactions with the environment.

Ecosystems and Resources. Environmental research has broadened to encompass concerns such as species at risk, biodiversity, sustainability and endangered habitats. SFU researchers, including those in the Centre for Wildlife Ecology (CWE) and the Cooperative Resource Management Institute (CRMI), conduct basic and applied research in wildlife, fisheries and forest ecology and provide knowledge and personnel that will help meet the challenges of conservation. Aquatic and fisheries research is aimed at the understanding and management of fish populations in their marine and freshwater habitats, as well as the broader management of the coastal zone, and ecosystem science. SFU research related to terrestrial ecosystems includes ecological, institutional and economic approaches to the conservation of ecosystem services, biodiversity conservation and invasive species, and ecosystem-based forest management and industrial forestry issues. Energy and materials management is also emphasized, through developing and applying sustainable policy models that are both technologically explicit and behaviourally realistic. SFU researchers also study the modern and ancient geological environments, natural hazards, and geological resources. SFU has a strong spatial research emphasis in health and environment, including optimal location of health services and population health. This concentration is augmented with visualization approaches, such as multi-dimensional geovisualization and geospatial interface research. Modeling of complex spatial environmental systems, land use, land cover and urban growth continue to be important activities, together with modeling of dynamic spatial phenomena in forestry and landscape ecology.

Climate Change Solutions. As a founding member of the Pacific Institute for Climate Solutions (PICS), SFU researchers are well positioned to contribute to the development of innovative climate change solutions, seek new opportunities for positive adaptation to climate change solutions, and lead the way to a vibrant low-carbon economy in BC and globally. Researchers involved with SFU's Adaptation to Climate Change Team (ACT) are studying critical climate change impact topics and producing policy recommendations for adaptation: biodiversity, extreme weather, energy, water security, crop and food supply, population displacement, health risks, new technologies, and sea level rise. Researchers in SFU's CTEF-funded "Climate Change Impacts Research Consortium" are taking a risk-based approach to the study of the secondary effects of climate change on human and ecosystem health.

Alternative (Green/Clean) Energy Technology. SFU is well positioned to become a leader in green energy technology research. Interdisciplinary initiatives in this area will focus on energy production, distribution, and utilization, along with related manufacturing technology and green IT. Current research includes fuel cell materials, design and diagnostics, energy management and harvesting, new generation fuel injectors for hydrogen technology, green IT technology, green computing, smart grids and smart houses. Another key area of research involves investigating human-centered sustainable systems at the intersection of conservation, sustainable design, alternative energy production and social behaviour around our ecological footprint. The rise of ubiquitous computing, smart environments and the widespread use of mobile devices offers an opportunity to enable occupants to dynamically interact with building technologies through digital media.

Aboriginal Communities and the Environment. We have substantial research strengths in applications of resource management and resource planning to Aboriginal communities, with a particular focus on Aboriginal and place-based community co-management, forest management, fisheries and aquatic management, protected areas and heritage planning, and strategic land-use planning. Other areas include heritage tourism, coastal zone management and planning, geographic information science, and community planning and development. We will continue to develop our strengths in issues related to resource and environmental management and planning by Aboriginal people on their traditional lands. These activities will draw on our existing strengths in management and planning, and analytical tools such as geographic information systems, and on existing strengths in Aboriginal resource management practices and traditional ecological knowledge. We will also develop our engagement with Aboriginal peoples, both in a research context and an educational context.

Health and Biomedical Sciences

Research at SFU aims to describe human health in its full context, including the diverse impacts that social inequities have on health. We have strength in genomics, bioinformatics, and health informatics, biostatistics, biomedical sciences,

neuroscience, medicinal chemistry and drug development, biomedical devices, biomedical imaging, mental health and addictions, as well as in health policy and cultural and population studies. Novel research and programs have or are being developed in population and public health, global health, infectious diseases, aging and chronic illness, and brain function and development. SFU is a leader in the secure analysis of sensitive data, such as that available under Population Data BC. Our goal is to develop interdisciplinary collaborations and partnerships that bridge the biomedical, clinical, and social sciences and involve the wider community, building on SFU's tradition of innovative and effective outreach.

Genomics, Bioinformatics, Health Informatics, and Biomedical Technologies. Genomic sciences are redefining the research landscape of the fundamental life and biomedical sciences and their applications, and the concept of personalized medicine is being realized based on the application of genomics to the diagnosis and treatment of patients. SFU has expertise in genomics, bioinformatics, and data mining, and is playing a leading role in the formation of a regional Genome Sciences Institute. SFU also has strengths in biomedical technologies and medical imaging, radiopharmaceuticals, computational anatomy, bio-sensors, biomedical optics, signal processing, biomechanics, assistive technologies, haptics, micro/nanotechnologies for medical applications, micro-fluidics, biochips, bioinformatics, computational biology, health informatics, and chronic disease management. Research involves computer scientists, engineers, interactive arts researchers, biomedical scientists, kinesiologists and psychologists working with clinicians to develop new tools and products. The combined effort will address issues of human health, ranging from molecular, cellular, and systems biology to population health and modeling.

GE3LS Analysis. The consequences of scientific and technological innovation are significant, especially when it comes to genomics and its Ethical, Economic, Environmental, Legal, and Social aspects (GE3LS). Research will inform legislation to control innovative growing practices in agriculture, and economic and environmental practices in fisheries and forestry. Genomics research has economic and social implications in such many applications including bee colony collapse, bioremediation for industrial waste, and diagnostic tools for disease and mental disorders. As whole genomes of organisms become known there will arise issues of intellectual property and ownership and usage of such information. How society deals with such a brave new world will be the focus of research in this subtheme.

Chronic and Infectious Diseases. Strength exists in genomics, bioinformatics, biomolecular interactions, psychological and psychiatric disorders, and we are developing strength in proteomics and metabolomics. Two CTEF-funded teams are capitalizing on SFU's unique strengths to discover and test potential new therapeutic targets, and to take novel molecules and nanomaterials from the chemistry lab into the clinical setting and develop strategies for medical imaging, diagnostics, surgery, and drug delivery. The drug development pipeline from genomics input to pharmaceutical output is well represented at SFU—an important node of the Centre for Drug Research and Development. Additional strengths exist in virtual reality therapy and training, visualizations and accessible tools for managing pain over time, and the extension of these tools to the community. Strategic research that bridges nutrition, biomedical and behavioural science would complement existing strengths. Collaborations in this area require support of a wide range of technologies including biomarkers, transgenic animals, nanotechnology, novel imaging and visualization modalities, province-wide comprehensive data and geographic information systems, and complex social modeling.

Human Development and Aging. Strength in human development and aging exists in basic biomedical, population, and social sciences, including the areas of children's social, emotional, and mental health, brain development, brain function and problem-solving, mammalian developmental biology, birth defects, molecular-genetics, epigenetics of cellular differentiation, children's health policy, adolescent mental health, health behaviour and risk, youth crime and violence, gender and aggression, and longitudinal studies on aging. The broad field of neuroscience offers an exciting area for strategic investment, especially in areas focusing on aging and degenerative diseases of the nervous system and its connection to behavior and health. SFU strength exists in clinical psychology, neurobiology of addiction and of age-related degenerative disease, and psychological mechanisms underlying youth aggression. SFU will apply its combined strength in imaging, neuroscience, genetics, epigenetics, and cellular physiology to the study of development and aging.

Population and Public Health and Health Services. Expansion of population sciences and public health practice across areas of shared research focus, such as in infectious diseases and global health, mental health, environmental, occupational health

and earth systems, and Aboriginal health and the impact of social disparities on health could increase synergies in emerging areas of cross-disciplinary strength at SFU. Bridging SFU's substantial strengths in biomedical sciences and health services to population and public health would result in a competitive advantage. Such an approach would build on newly established research strengths focused on population level interventions and health policy sciences. Continued growth to support this subtheme would include bridging areas in social inequities of health, global and Aboriginal health, ethics, health economics and health policy including new health services models, intervention trials and uptake of best practices in primary health care. Growth of research strength in environmental and occupational health would include a focus on molecular toxicology, genomics, proteomics, and metabolomics that study the cellular and molecular responses to drugs and to xenobiotics associated with environmental exposures, and would include the development and use of biomarkers, medical imaging, and basic neuroscience.

Health Systems. Foci include comparative studies of international primary health care systems, explorations of the cost effectiveness of chronic disease prevention and management approaches, estimates of health resource needs and mix of specialists, organizational studies of inter-professional training and practice structures, performance outcomes of innovations in primary care practice and incentive structures, organizational studies of leadership and processes in health system change management, forecasts of health care needs and health system responses, assessments of the impact of primary care interventions on indicators of population health, community assessments of the social determinants associated with chronic disease distribution, and the issues of health equity, social justice, and ethics in health care. The resulting research outcomes will provide objective information to aid decision-making by Canadian governments, as well as an opportunity for global outreach.

Pedagogy

Pedagogy stresses the mutually constitutive and intersecting activities of scholarship, teaching, and engagement. Research in this theme is conceptualized as a framework of four essential components: understanding, research use, knowledge mobilization, and reciprocity. Future research vitality lies in actively inter-relating these four framework components, and these components individually and together represent significant foci for emerging scholarship.

Foundations for Success. Research in this sub-theme seeks to better understand the impacts of foundational educational programs in academic literacy, mathematics, and technical literacy on success in academe and the workplace. SFU researchers are exploring the professional development of teachers; designing and teaching writing-intensive, quantitative and breadth courses, and Masters and Ph.D. programs in mathematics education; examining the role of technology in teaching, collaborative group teaching and problem solving; virtual worlds for course delivery; understanding mathematical cognition and learning; and examining how the rapid evolution and revolutions in technologies affect education and people's readiness for new jobs.

Education and Human Development. Education is central to focusing and fostering human growth and development. These terms are used in a broad sense, to encompass: acquiring knowledge, developing skills, becoming prepared to apply and transfer achievements, exploring and articulating attitudes, generating and controlling motivation, and nurturing a positive sense of self in a context of connection to others. SFU pursues this research across the lifespan from early childhood through later adulthood in a variety of settings within and beyond schools. Research in this subtheme will enable us to better understand how development happens, to identify factors affecting it, and to determine how to best intervene for the benefit of individuals and their social groups.

Education for Diverse Populations. SFU has significant expertise in second language acquisition and pedagogy, civics (in a broad sense grounded in ethical and moral considerations), issues in international education, and working in close and productive partnership in multi-cultural or cross-cultural contexts, such as the Metropolis British Columbia Centre of Excellence for Research on Immigration and Diversity, the Imaginative Education Research Group and its "Building Culturally Inclusive Schools" project, the CTEF-funded research team "Education Systems and Outcomes in Diverse Communities," and the Centre for Research on Early Child Health and Education. SFU research has also led to advances in our understanding of multicultural practices, philosophies of language, and the roles that language and culture play in pedagogical practice; and in the development and testing of innovations in the uses of media, technology, and pedagogical methods to support education for diverse populations. SFU researchers are also focusing on ways to increase the participation and success rates of Aboriginal peoples at all levels of education, building on an almost 40-year tradition of

engagement with Aboriginal communities in teacher education, Masters' programs and other credit- and non-credit ventures. Critical components of this research agenda include the further development and refinement of respectful and culturally appropriate research methodologies, the development, implementation and assessment of new pedagogical strategies, and the incorporation and mobilization of Aboriginal knowledge and philosophies into the mainstream educational system.

New Models for the Delivery of Medical Education. Alternative models of medical education are necessary to better manage Canada's health care system. SFU will explore a system of integrated care, built around integrated clinical disciplines that reflect patient care needs such as mental health, developmental health, acute care, chronic disease management, rehabilitation, and palliation. A program based on preventive medicine, generalist training, primary care, community health, and innovative practice models such as integrated diagnostic services for primary care physicians could be developed. Activities would also build on the current pedagogical strengths of SFU in e-health and health promotion, nutrition and metabolism, virology, immunology, physiology, genetics, epigenetics, epidemiology, biostatistics, demography, mathematical modeling, virtual reality, social and policy science, and ethics, as well as molecular biology and biochemistry, chemical biology, biological physics, cognitive (neuro) sciences, biomedical engineering, and imaging sciences.

Technology and Education. SFU is poised to take a leadership role in the research domain to understand the pedagogical basis of online and blended learning. A necessary component of this research focuses on transformative tools that help learners study and learn more effectively; however, research also extends to the people and settings under which technology is used. The goal in this area of research is to enhance the human interactions that are the foundation of education. Important topics include mechanisms of learning, models of teaching, designs for curricula, policy assessment and development, leadership, and professional conduct in technologically enhanced teaching and learning. Major research initiatives are underway in education, communication, and computing science, with psychology, statistics, and engineering science planning further involvement. Current projects build on a distinguished record of accomplishment in educational technology.

Education for Sustainable Development. Along with a sense of justice, responsibility, exploration and dialogue, education for sustainable development aims to move us to adopt behaviours and practices that enable all to live a full life without being deprived of basics. Sustainability education is a process of creating a space for inquiry, dialogue, reflection, and action about the concept and goals of sustainable development. The research agenda includes the development, monitoring, and evaluation of environmental learning initiatives and the ongoing identification of sustainability indicators and evaluation tools. Such work includes developing and validating instruments for measuring learning environments in community or ESD oriented programs, creating rich descriptions of how these learning environments are characterized quantitatively and qualitatively, and how they differ from other educational settings, and developing, implementing and testing a variety of program interventions in these learning environments while accounting for variations in learning, teacher engagement and other effects.

CANADA RESEARCH CHAIRS

The Canada Research Chairs (CRCs) and other prestigious Chairs at SFU serve to seed and catalyze new initiatives as well as to strengthen existing programs. We recognize the future value of further investment in selected areas that complement the resources of the Chairs. To this end, SFU has been highly proactive in providing or seeking matching funds for some of these initiatives.

Currently, SFU has been allocated 45 CRC Chairs: 18 Tier I Chairs valued at \$200K each and 27 Tier II Chairs valued at \$100K each. CRCs at SFU were phased in and have grown from 33 in 2005/06 to over 40 in 2009/10. We have now reached our full complement, subject to biennial readjustments.

CRCs should primarily serve the strategic research priorities of the University as specified in the [SFU Strategic Research Plan 2010-15](#) and be used to attract and retain outstanding researchers. The Vice-Presidents Academic and Research make decisions about CRC allocations jointly, after consultation with the Faculty Deans. We strive to increase the representation

of females in Chair appointments.

The following table shows the CRC appointments by funding agency, indicating where they fit within the seven thematic areas under the Plan. It does not include Chair positions that are vacant and which await nomination.

Research Themes	NSERC		SSHRC		CIHR		Total		
	Tier (1 or 2)	1	2	1	2	1	2	1	2
Origins		0.5	2	0	0.5	0	0	0.5	2.5
Communications, Computation & Technology		5	5	1	0.5	0	1	6	6.5
Culture, Society and Human Behaviour		0	0	0	3	0	0	0	3
Economic Organization, Public Policy, and the Global Community		0	0	2	2	0	0	2	2
Environment, Resources and Conservation		2	3.5	0	0	0	0.5	2	4
Health and Biomedical Sciences		1.5	3.5	0	1	1	1.5	2.5	6
Pedagogy		0	1	2	0	0	0	2	1
Total by Tier		9	15	5	7	1	3	15	25
Total by Chair Type		24		12		4		40	

IMPACT OF THE STRATEGIC RESEARCH PLAN

We will undertake a periodic evaluation of research outputs using metrics appropriate to the diverse individual and interdisciplinary activities, as determined in consultation with the Faculty Deans. These data could include publications, conference proceedings, books, monographs, patents, government and public panel contributions, workshops, policy papers, performances, exhibitions, other forms of research, and awards and distinctions. This task is most readily accomplished by soliciting data from faculty through the Deans' offices once a year at the time of review of faculty for progress through the ranks. A common framework for reporting will establish a baseline from which we can gauge advancement in a particular discipline. Measures of output will also be obtained through the use of bibliometric analysis tools such as Thomson-Reuters' *InCites* using data from *Web of Science*, or Elsevier's *SciVal* that produces graphical representations of an institution's research performance using data from *Scopus*. Annual data from ReSearch Infosource and CAUBO will be used to evaluate SFU's research performance relative to other Canadian universities, including measures of research income, publication intensity, and publication impact. Data to evaluate the growth of SFU's internationalization efforts as they pertain to research will also be solicited, for example, the number of international research grants, the number of publications co-authored with international scholars, the number of international graduate students and visiting international faculty engaged in research at SFU, and the number of international awards received by SFU faculty and students. Together, these data will be used to monitor our progress towards achieving the objectives of this Plan, and to evaluate our overall research performance and research capacity.