S.05-99

SIMON FRASER UNIVERSITY
University Secretariat

MEMORANDUM

To: Senate

From: Alison Watt, Secretary, Senate Committee on Agenda and Rules

Subject: Strategic Research Plan 2005

Date: 30 August, 2005

At its meeting today, the Senate Committee on Agenda and Rules determined that the proposed Strategic Research Plan for Simon Fraser University would be forwarded to Senate for action:

Motion:

That Senate endorse the general principles and direction of the Strategic Research Plan

The Strategic Research Plan will be forwarded to the Board of Governors for information following the Senate action.

Attachment

Alison Watt

c: B. Mario Pinto, Vice-President, Research

SIMON FRASER UNIVERSITY

Senate Committee on University Priorities
Memorandum

TO: Senate

FROM: Bill Krane
Acting Chair, SCUP
Acting Vice President,
Academic

RE: Simon Fraser University
Strategic Research Plan
(SCUP 05-050)

DATE: July 28, 2005

For Information:

Please find attached a copy of Simon Fraser University's Strategic Research Plan 2005-2010, submitted by the Vice-President, Research. The plan was reviewed by the Senate Committee on University Priorities (SCUP) at its July 27, 2005 meeting and subsequently approved. This document is forwarded to Senate for information.

encl.

c. M. Pinto
S. Dench

SCUP 05 - 050

SIMON FRASER UNIVER

MEMORANDUM
OFFICE OF VICE-PRESIDENT, RESEARCH

TO: John Waterhouse
Chair of SCUP

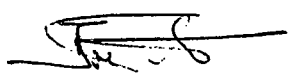
FROM: Dr. B. Mario Pinto
Vice-President, Research

RE: Strategic Research Plan

DATE: July 7/05

Last December I formed a Task Force to develop a Strategic Research Plan (SRP). The Task Force comprised one representative from the Faculties of Applied Sciences, Business Administration, Education, Health Sciences and Science, and two representatives from the Faculty of Arts and Social Sciences. Four additional members were appointed by you and me.

The Task Force generated a first draft of the SRP after consultation with selected researchers, and presented it to the senior academic administrative group (Faculty Deans, Vice-Presidents, and the President) for discussion. A revised draft was prepared, incorporating suggestions from this initial consultative process, and this was made available for general consultation throughout the SFU community, including faculty, staff and student organizations by email exchanges and at three open meetings. Following this consultation phase, a final draft has now been prepared incorporating suggestions from this consultative process. I am now submitting this document to the Senate Committee on University Priorities (SCUP) for approval.



B. Mario Pinto
Vice-President, Research

SIMON FRASER UNIVERSITY

STRATEGIC RESEARCH PLAN
2005-2010

DRAFT
August 2005

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SIMON FRASER UNIVERSITY
STRATEGIC RESEARCH PLAN
2005-2010

"Daring ideas are like chessmen moved forward; they may be beaten, but they may start a winning game."

Goethe

Simon Fraser University opened in September 1965. In less than 40 years, SFU has gained an international reputation for its strengths in the liberal arts and sciences, as well as for its innovative interdisciplinary and professional programs. The advancement of excellence in research is now a defining feature of SFU, with leading individuals and well-recognized groups engaged in a wide variety of key research activities. *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 being internationally renowned for the excellence of our scholarship.*

SFU encompasses six Faculties, with 29 departments and schools on three campuses and over 715 full-time faculty members. Academic programs span a range of disciplines, supporting approximately 25,430 students, including 3,330 at the graduate level. The University attracts over $50M per year in external research funding. We are currently one of the top five universities in Canada with respect to research intensity, as defined by the number of grants per 100 faculty members from the three federal funding agencies.

Knowledge generation and knowledge transfer through research, scholarship, and training are fundamental to the mission of the University. It is imperative to recruit and retain outstanding scholars who will attract highly qualified graduate students and champion bold initiatives, strengthen critical areas of research, develop new areas of excellence in research, and enhance synergies between teaching and research. Graduate student training is essential for the success of university-based research activities and is central to the mission of a research-intensive university. Graduate students are important members of the research community, both as research assistants and independent scholars. Graduate degrees currently comprise 18% of the University total. *Our goal is to increase this ratio to 25% by 2010, by improving rates of completion and time to completion through better funding and supervision practices.* Emphasizing an interdisciplinary, theme-based approach will strengthen graduate research and teaching, while enhancing the learning and research components of the undergraduate university experience. We are determined to augment SFU's talent pool and research infrastructure, thereby contributing to the productivity and international competitiveness of British Columbia and Canada.

As a comprehensive university, SFU champions the liberal arts and sciences and promotes pioneering interdisciplinarity. Our research environment has been developed and is sustained by the creativity and excellence of individual researchers, whose efforts the University will continue to support. We propose to build on our strengths to define particular strategic research directions that will give us a competitive advantage. The Strategic Research Plan (SRP) identifies distinctiveness as well as excellence. In keeping with the character of the University, collaboration and synergy are strongly advocated, while selective investment of resources will be consistent with the advancement of excellence.

Background and Process

In December 2004 the Vice-President, Research convened a Task Force to develop a Strategic Research Plan for the University. The Task Force comprised one representative from each of the Faculties of Applied Sciences, Business Administration, Education, Health Sciences and Science, and two representatives from the Faculty of Arts and Social Sciences. Four additional members were appointed by the Vice-President, Research and the Vice-President, Academic. The Task Force was asked to identify research capacity and areas of strength across the University, with the goal of drafting a new plan. The Task Force generated a first draft of the SRP after consultation with selected researchers, and presented it to the senior academic administrative group (Faculty Deans, Vice-Presidents, Academic and Research, and the President). A revised draft, incorporating suggestions from this initial consultative process, was made available for general consultation throughout the SFU community, including faculty, staff and student organizations. Following the consultation phase, a final draft was prepared for submission to the Senate Committee on University Priorities (SCUP) for approval, Senate for endorsement, and the Board of Governors for information.

Major Objectives of the Strategic Research Plan (SRP)

The SRP guides the University in responding effectively to the changing environment in research opportunities, and provides a platform for our participation in international research-related initiatives. New discoveries in Canada and around the world are being made by interdisciplinary teams of investigators organized to address research questions that are multidimensional and inspired by global societal, environmental, and economic change. Funders of research are restructuring their organizations to respond to these challenges. In Canada, for example, the Medical Research Council has transformed itself into the Canadian Institutes for Health Research (CIHR), and the Social Sciences and Humanities Research Council (SSHRC) is currently engaged in a transformation initiative that seeks to mobilize knowledge and build research capacity through partnerships.

The major objectives of the SRP 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.

Research Environment

We seek to enhance a research environment at SFU that is responsive to new challenges and opportunities. We will define our collective strengths initially through a series of thematically focused meetings to share expertise from across the different sectors of the University. We expect that promising collaborative efforts will be seeded and will continue to develop. Selected

areas will be fostered through further education, for example by inviting internationally renowned academics to SFU for limited periods ranging from one month to one year. These individuals will act as catalysts for further development of strategic initiatives, and serve as mentors for faculty, postdoctoral fellows, and graduate and undergraduate students. We will invest in key faculty positions and in the recruitment of exceptional students. We will be opportunistic, taking full advantage of special situations and resources as they develop. We will host colloquia and conferences to broaden our knowledge of leading-edge research around the world. We will participate actively in global initiatives and build bridges to international partners of exceptional calibre, facilitating faculty, postdoctoral and student exchanges, and supporting student internship programs in partner countries.

In this context, SFU's Centres and Institutes will play a critical role. SFU has 31 Centres and Institutes that fall under the direct authority of individual Deans. There are also ten Centres and Institutes that report to the Vice-President Research, have a University-wide mandate, and represent SFU's activity as part of multi-university consortia. These Centres facilitate collaborative research, especially multi-disciplinary research; undertake specific types of teaching or training programs; facilitate multi-university initiatives, such as Centres of Excellence; and provide specific types of services to the community.

Interplay of Research and Teaching

Investment in research enhances the teaching and learning experience for students, since research discoveries can be incorporated in curriculum topics. Recruitment of stellar faculty who contribute not only to research programs but also to undergraduate and graduate teaching will motivate the next generation of scholars and encourage student participation in research. Such individuals tend to spark students' interests by providing the latest research perspectives, and also attract outstanding undergraduate and graduate students. The top undergraduate students will "set the standard" for their peers, serving as role models, while the graduate students will advance knowledge as research assistants and provide valuable instruction to undergraduates as teaching assistants. Furthermore, research-intensive faculty will provide opportunities for undergraduate and graduate students to explore scholarly research, through study semesters and internships, and through thesis supervision.

Research Themes

The SRP articulates SFU's strengths by identifying integrative strategic research themes that cross disciplinary and administrative boundaries. In naming these themes, we intend to facilitate and encourage both individual initiatives and new collaborations within existing structures. 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 in selected areas on the international scene.

SFU recognizes the contributions of all researchers across the spectrum of scholarly inquiry at, and associated with, the University. We plan to maximize our strengths, building on themes that unify initiatives from the humanities to the sciences and engage our several communities. The strategic research themes encompass both cross-disciplinary teams and disciplinary or individual contributions to our collective achievements. The plan is therefore richly collaborative and boldly cross-disciplinary.

The matrix below summarizes SFU's five strategic research themes. The associated perspectives are intended to illustrate approaches to issues of scholarship within each theme, and transcend the themes. By way of example, with respect to the Health theme, systems might include communities, families, or the pharmaceutical industry. Factors that affect these systems and lead to their evolution could be the subject of scholarly pursuit. Constructs that include the formulation of disease models, social models, models for analyzing data, and policies that affect health care and delivery would also constitute scholarly activity in health. Applications that impinge on scholarship in the field of health might include mobile sensors, diagnostic methods, drug and vaccine therapies, databases, biomaterials, robotic technologies for surgery, and implants for drug delivery or artificial limb control. Research on the social aspects of the introduction of emerging technologies is critical to avoid negative societal reaction, as experienced with the introduction of certain biotechnologies. Finally, globalization will require the study of diseases and health trends that impact populations worldwide.

	PERSPECTIVES			
RESEARCH THEMES	Systems	Constructs	Applications	Globalization
Communication, Computation, and Technology				
Culture, Society, and Human Behaviour				
Economic Organization, Public Policy, and the Global Community				
Environment				
Health				

Priority Areas for Strategic Investment

SFU's research strengths and related initiatives, grouped under the five themes, are described in the Appendix which is an integral part of this document. Through the process of identifying these strengths and existing and potential synergies among them, the Task Force has established within each research theme the following priorities for strategic investment over the next five years. The intention is to encourage and support cross-disciplinary initiatives that build on our strengths and show potential for significant impact and leverage. The context and rationale for each priority area listed below may be found in the Appendix.

Communication, Computation, and Technology

Materials Science and Devices

Materials Science at SFU is internationally recognized. Future efforts in this area will focus on accelerating the design, development, demonstration and delivery of advanced materials and nanoscale devices that can lead to major advances in alternative energy, information and health technologies. An interdisciplinary and collaborative approach by chemists, physicists, engineering scientists, biologists, molecular biologists, and biochemists will permit new materials to be integrated with existing technologies and to create new platform technologies and devices. An essential part of this strategy is participation by SFU in national and international joint ventures to develop and exploit advanced research tools such as synchrotron radiation, neutron scattering, and beams of muons and radioactive nuclei.

Imaging Science

Imaging Science involves the invention and advancement of theoretical constructs and computational algorithms that underpin the analysis, representation, interpretation and synthesis of images. Research areas include computational anatomy, visualization and rendering of large data sets, design of compression and coding schemes for efficient representation, storage and transmission of image and video data.

Collaboration and Visualization

SFU is moving strongly in the direction of collaboration and visualization. Visualization is the interface between the researcher and the problem domain; collaboration provides the mechanism to bring researchers together to solve large, complex problems. Through the establishment of several Centres, combined with a significant high-performance computing and networking infrastructure, SFU is well positioned to perform advanced research.

Emerging Digital Technologies

This rapidly emerging field involves the invention and advancement of techniques for signal processing, data transmission, representation, display, interpretation and synthesis of data and images. Research encompasses a wide range of activities including e-learning, digital games, wireless communications and multimedia research.

Technology and the Arts

Ongoing developments in media and computing technologies link interactive arts and technology with musicians, film-makers, dancers, and other scholars in contemporary arts. In addition to enjoying an international reputation for interdisciplinarity in artistic practice, SFU has a growing number of theorists (many of them recently hired) researching historical and current dimensions of media culture in visual, filmic, aural, print, and digital formats. A coordinated initiative that merges theory and practice in the artistic uses of new technologies and the scholarly analysis of traditional media will build on current strengths and create a distinctive research environment.

Culture, Society and Human Behaviour

First Nations Studies

Research into First Nations issues involves faculty members in education, health, linguistics, archaeology, literature, history, resource management, linguistics, psychology, sociology and anthropology. SFU is conducting essential and leading-edge research on preserving Aboriginal languages, partnering with bands and communities in First Nations education, resource management in Aboriginal communities, and palaeoIndian research. With the recent appointment of a Special Advisor & Director, Aboriginal Affairs, and space to be dedicated

to First Nations studies in the new Arts and Social Sciences Complex, the time is opportune to integrate researchers across the University into a First Nations Research Institute that will enhance SFU's profile in this nationally significant area.

Safety, Security, Criminal Behaviour and Forensic Studies

SFU has significant strength in the analysis of criminal behaviour and forensic studies. The Institute for Canadian Urban Research Studies is one of three main centres for environmental criminology, and is moving in the direction of computational security and safety. The Criminology Research Centre studies youth crime, violence against women, and mental disorders. Related topics are explored by the Mental Health Law and Policy Institute. The Centre for Restorative Justice is unique in Canada, and there are only a handful of such research centres world-wide. An emerging centre of excellence is the Centre for Forensic Studies. This facility, the first of its kind in the world, will link with archaeology and biology. It will have state-of-the-art labs with a focus on forensic science and technology. These groups provide a powerful hub around which crime-related research in other units can be focused.

Communities and Urban Sustainability

The Centre for Research on Immigration and Integration in the Metropolis (RIIM) is part of a Centre of Excellence that studies the economic, social, and political dimensions of immigration to the Vancouver area as a case study in urban development. Cultural researchers are probing key and complex issues of social cohesion, antiracist education, multiculturalism and cultural adaptation, citizenship, diasporic cultures, and nationhood. There are promising possibilities for interdisciplinary research focusing on second-language learning, public education and the well-being of communities.

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. Expertise in these fields is complemented by strengths in computational, experimental, and evolutionary methods, which are reflected in the Centre for Research on Adaptive Behaviour in Economics and the Canada Research Chair in Economic Theory and Evolution. There are also strengths in a number of applied fields including strategic change, corporate governance, and risk management. Further investments will exploit synergies among these areas of excellence.

Public Policy

The recently organized Public Policy Program includes the Centre for Public Policy Research (CPPR) and offers students the Master of Public Policy degree. The CPPR, which is unique in western Canada, has research associates drawn from economics, political science, women's studies, business, education, criminology, resource and environmental management, and communications. It has current or planned strengths in tax policy, aboriginal policy, labour markets, environmental and natural resource policy both in Canada and developing countries, and governance issues in developing countries. Policy-related research is also pursued in the CURA Economic Security Project, the Learning City project, and the Institute of Governance Studies, among other venues. Expansion of the CPPR would complement existing or projected policy research in health sciences, urban studies, international studies, and communications.

The Global Community

SFU has several research groups concerned with international economic relations, transnational organization, and global culture. One group focuses on issues of trade, international finance, and economic development in low-income countries; another investigates the management of global enterprises. The Centre for Global Political Economy addresses the intersection between global and domestic political economy, while the MCRI Globalism Project studies the effects of globalization on people in a range of individual countries. Much research on global institutions could potentially be brought together in the School of International Studies, which will focus on peace and security studies; development, environment, and international economic relations; governance and civil society; and human rights and international law.

Environment

Fisheries and Aquatic Ecosystems

SFU is a major player in research aimed at the understanding and management of fish populations in their marine and freshwater habitats. Multifaceted research at SFU encompasses the genomic analysis of salmon, fish disease prediction and management, socio-economic studies on fishing communities, and coastal tourism. Fish populations are studied, as well as mammals, birds and invertebrates in their marine and coastal habitats. Strategic investment will strengthen the links between basic molecular and applied ecological approaches.

Forestry and Terrestrial Ecosystems

Forestry research at SFU improves our understanding of the forest ecosystem and our ability to respond to the challenges of environmental changes. The most established area is ecosystem-based forest management research, but strong research programs also address forest health at the physiological and genetic levels. Emerging research strengths that will benefit from strategic investment include socio-economic approaches to forestry, and biotechnological research aimed at improving tree health and quality.

Local Impacts of Human and Natural Disturbances

Integrating the social and natural sciences, SFU's research is focused on the study of human development and of natural disturbances on natural and urban environments and communities. Emphasis is placed on the causes of and responses to natural hazards, such as earthquakes and landslides, 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.

Health

Chronic and Infectious Diseases

SFU has outstanding researchers studying both chronic and infectious diseases. Considerable strength exists in the realm of genomics, bioinformatics, and biomolecular interactions, and we are developing strength in proteomics. However, understanding how biomolecules interact and function in the complex setting of living cells and organisms is key for the development of effective translational research. SFU could benefit by adding new researchers to fill this gap between molecules and health; hence, strategic investment is

highly desirable in cell biology, physiology, and systems biology, and their connection to health outcomes within populations.

Human Development and Aging

Research strength in human development and aging exists in both basic biomedical and sociological disciplines. New faculty appointments that bridge basic and applied studies are a priority. Other bridging disciplines such as neurophysiology and neurobiology are under-represented at SFU, and strategic investment in these areas would achieve better integration of the different research approaches. The addition of a Leading Edge Chair in Cognitive Neuroscience in Child Health and Development will solidify cognitive neuroscience as an emerging area of international strength at SFU. Strategic investments that bridge the medical imaging scientists with neuroscientists will position SFU as a world leader in the development and application of imaging technology. Researchers working in the newly established Mathematics Educational Neuroscience Laboratory will carry out ground-breaking research on brain function and problem-solving. The Institute for Research on Early Education and Child Health will generate leading-edge research in early education, child health, psychosocial development, and learning.

Population and Public Health and Health Services

Population and public health is the current focus of the new Faculty of Health Sciences. Related areas of development include a new program in Global Health and another in Public Policy. With respect to health services, SFU has substantial research strengths focused on the intersection of engineering and human health using advanced methods for biomedical engineering. The focus area in Population and Public Health is slated for continued investment in the next few years. Strategic investment directed towards bridging SFU's substantial strengths in biomedical sciences and health services to population and public health will result in a competitive advantage.

Government and Institutional Support

In addition to the support that the federal government provides to the three national granting agencies, it has made a strong commitment to university-based research by investing in the Canada Research Chairs (CRC) program, the Canada Foundation for Innovation (CFI), the Networks of Centres of Excellence, Genome Canada, and the Indirect Costs of Research program. These investments have rejuvenated Canadian research by attracting and focusing the efforts of stellar researchers, providing state-of-the-art infrastructure, and providing critical support to the universities to augment resources for research and technology transfer activities. This investment has significantly enhanced Canada's international competitiveness, and has caused other countries to examine the new Canadian model of research. While this progress is admirable, continued and increased support for discovery research is essential to creating knowledge that is the foundation for translation of ideas to innovation and new ventures.

The provincial government also provides support through the Leading Edge Endowment Fund (LEEF) Leadership Chairs, the BC Knowledge Development Fund (BCKDF), the Double the Opportunity (DTO) Fund, and the Michael Smith Foundation for Health Research (MSFHR).

The CRCs, LEEF, and other prestigious Chairs at SFU serve to seed and catalyze new initiatives as well as 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. We now have an

opportunity to invest strategically from income (approximately $700K per year) generated by the UniverCity Endowment Fund.

Assessment

Input measures, such as increased activities aimed at identifying funding opportunities and maximizing the likelihood of securing funds, must not be confused with output measures. The former initiatives are intended to facilitate scholarly activity and augment the level of scholarship – the defining traits of a research-intensive university. For example, increased funding for graduate students and postdoctoral fellows will lead to increased knowledge transfer to the next generation of scholars, a clear indicator of scholarly activity. Increased exposure to world-renowned visiting scholars will catalyze new scholarly activities and lead to the evolution of ideas.

The inputs are distinct from measures of successful research outputs, which will necessarily be somewhat specific to each discipline with respect to time-honoured facets of scholarship such as publications, training of new scholars, and prominence of our researchers as recipients of awards and other forms of recognition. The nature and quality of these contributions can best be assessed at the departmental or Faculty level, using criteria most appropriate for a particular discipline.

The Office of the Vice-President, Research will undertake an evaluation of research outputs using metrics appropriate to diverse and interdisciplinary activities, as determined in consultation with the Faculty Deans. Tenure and Promotion Committees will provide the relevant data for their units to the respective Dean, who will relay the summary data to the Vice-President, Research. A benchmark assessment will be made upon adoption of the SRP, with a mid-term evaluation after three years and a final evaluation at the end of the five-year implementation period.

Implementation

Strategic investment in the theme areas will be coordinated by the Vice-President, Research, working with the Faculty Deans through the Vice-President, Academic. Investments may take the form of strategic faculty positions, seed funding for workshops, conferences, and distinguished scholar visits, research support for students and research fellows, support of internship programs, and other initiatives as opportunities arise. Initiatives that are demonstrably cross-disciplinary will receive higher priority, since we believe that promising research areas which cross Faculty and departmental boundaries will benefit most from targeted investments coordinated by the Vice-President, Research. In order to initiate these programs, funds will be provided for enabling activities such as the organization of meetings and symposia within each theme. Funds will also be provided for full teaching buyout for one year for at least five individuals to organize activities and champion proposals within each of the five themes. Proposals will be invited for consideration by a selection committee comprising the Vice-Presidents, Research and Academic, and well-recognized researchers from a range of disciplines.

APPENDIX
THEMATIC AREAS OF RESEARCH STRENGTH AT SIMON FRASER UNIVERSITY

1. COMMUNICATION, COMPUTATION AND TECHNOLOGY

SFU has a long history of leading-edge research in communication, computation and advanced technologies. Our expertise spans research issues from theory to applications to policy, with researchers involved from many disciplines. Computing science, communications, engineering science, mathematics and statistics arguably form the core; others strongly tied to these activities include physics, chemistry and chemical biology, molecular biology and biochemistry, interactive arts and technology, economics and criminology. The following sections summarize key areas in which SFU has already built considerable strength, and which form a solid base on which to build future developments.

1.1 Computational Science

Computational science develops and uses sophisticated computational technologies in innovative and widespread applications to provide new techniques and tools for targeting a wide range of issues including computational security and safety. Issues of safety, security and privacy are central to defining the relationship of individuals within their society. Whether it is guaranteeing the safety of the person, the security of information, assessing the risk to the environment, or providing security to organizations, society has an interest in ensuring that advanced technologies are brought to bear in providing safety to its institutions while protecting the privacy of individuals. This research involves system modelling, simulation, verification, imaging, visualization, data mining and warehousing, high performance computing, coding theory, computational number theory, biometrics, bioinformatics, protein modeling, recognition, natural language understanding, adaptive and learning models, and computational linguistics. While aspects of this research are carried out at many universities, bringing together all the requisite aspects in a unified approach has great potential for impact.

1.2 Materials Science and Devices

In recent years, the materials science group at SFU has been extremely successful in acquiring infrastructure and attracting substantial research funding through the Pacific Centre for Advanced Materials and Microstructures (PCAMM) and the Centre for Research in Electronic Materials (CREM). This group of chemists, physicists, and engineering scientists, whose common needs and interests serve to unite them into a heterogeneous yet cohesive unit, has established both a national and an international reputation. Research conducted by this group includes work on electrochemistry, semiconductors, superconductors, piezoelectric and ferroelectric devices, molecular electronics, photolithography, thin films, surface/interface chemistry, molecular magnetic materials, amorphous and low dimensional solids, amorphous, nano, and micro-structured materials, high efficiency thin film solar cells, blue and UV sensitive photodiodes for biomedical applications, liquid crystals and sensors, carbon nanotubes for hydrogen storage, and thin film transistors for flexible imagers and displays.

An emerging area of national and economic significance related to materials science is fuel cell technology. SFU is already a significant player in this initiative, and houses an internationally recognized group of researchers 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.

Another active area of materials research at SFU forms bridges to the Centre for Molecular and Materials Science at TRIUMF (Tri-University Meson Facility), with research foci in environmentally-friendly chemistry, superconductivity, and molecular magnetism. SFU faculty are prominent in the multi-university consortium that is turning a cluster of beam lines and spectrometers into a national user facility for materials science.

Other SFU faculty members are involved in the development of accelerated radioactive beams at TRIUMF. At the new ISAC (Isotope Separator and Accelerator) facility it is possible to study nuclear reactions which otherwise occur only in high temperature stellar environments. The aim is to understand the origin of the elements in the universe. Despite this obviously "pure" science goal, TRIUMF has been remarkably successful at technology transfer, and was the recipient of a 2004 NSERC Synergy Award for Innovation.

Advanced materials research at SFU will be augmented by the creation of a new University centre, 4D Labs. This $35 million research facility, scheduled for completion in September 2006, will provide facilities and research expertise for accelerating the design, development, demonstration and delivery of advanced materials and nanoscale devices that can lead to major advances in alternative energy, information and health technologies. Research at 4D Labs will be interdisciplinary and collaborative, based on building teams united by purpose. 4D Labs will house state-of-the-art analytical and clean room facilities to allow new materials to be integrated with existing silicon technologies and to create new platforms. A visiting scientists' laboratory will facilitate face-to-face collaboration among international researchers, putting SFU on the world map as a leading research institution.

1.3 Imaging Science

Imaging Science involves the invention and advancement of theoretical constructs and computational algorithms that underpin the analysis, representation, interpretation and synthesis of images. Research areas include computational anatomy, visualization and rendering of large data sets, and design of compression and coding schemes for efficient representation, storage and transmission of image and video data. Strong research groups in graphics, vision, coding and algebra, chemistry, and scientific computation form the core of this area at SFU.

1.4 New Media and its Applications

This rapidly emerging field encompasses a wide range of research activities including the following:

- eLearning, with implications for every aspect of the University's mandate. SFU was an early entrant into this burgeoning field, and is considered a leader on the national scene. Major research initiatives are underway in education and computing science, with psychology, statistics, and engineering science planning further involvement. Current projects include SAGE (Simulation and Advanced Gaming Environments) for Learning, ELN (Electronic Library Network), The Learning Kit and the LORNET Research Network, with SFU's eLINC (eLearning Innovation Centre) and LIDC (learning and Instructional Development Centre) playing a major role.

- Digital games are a particular focus in the lower mainland. Education, kinesiology, computing science, engineering science, business and communication are all involved in research related to applications of digital games. Researchers in interactive arts and technology are particularly well positioned in this area. The Games Research Cluster undertakes research related to the design and development of games for research, education and commerce. Other significant players are SAGE, Shared Virtual Environment Lab, Interactivity Lab, InfoNet Media Lab, Electronic Commerce, Communication and Communities Usability Lab, GrUVi Lab, and WestGrid. The extension of digital games to health education is a particularly exciting new direction.

- Wireless research is concentrated in engineering science, with additional expertise in interactive arts and technology, computing science, mathematics and physics. Two laboratories in particular play critical roles: the Communications Networks Lab and the RF/Microwave Mobile Communications Lab.

1.5 Algorithms and Modelling

This is an area where SFU boasts considerable strength, in both computational and mathematical models. The computational algebra research group is a leader in the development of symbolic computation and works closely with Maplesoft, a world leader in symbolic algebra systems. The research group in combinatorial algorithms for networks and other communication models is world-renowned. It also has expertise in the modelling of road and other communication networks. One of Canada's top scientific computation groups is at SFU, as well as an emerging area of research on models for industrial location. Biological modelling is prominent through bioinformatics research in computing science and molecular biology and biochemistry.

1.6 Collaboration and Visualization

Collaboration and visualization are both important enabling technologies for research as well as active areas of research at SFU. Visualization is the interface between the researcher and the problem domain; collaboration provides the mechanism to bring researchers together to solve large, complex problems. SFU is moving strongly in this direction. Through the establishment of laboratories and Centres such as IRMACS (collaboration, visualization, interaction), CoLab (interaction, collaboration), SCIRF (computing, imaging), and the GrUVi (graphics, visualization, usability) Lab, a significant infrastructure has been developed in this area. Combined with a significant high-performance computing and networking infrastructure (HPC@SFU Beowulf and Alpha Clusters, WestGrid, and SFU/TRIUMF involvement in the Atlas Data Hub), this gives SFU a very solid foundation for performing advanced research.

1.7 Political Economy, Policy and Regulation of Global Communication

SFU is particularly well recognized for our research in these areas, which include political economy and policy, broadcast regulation, global media analysis, international communication, and globalization. The Canadian Centre for Studies in Publishing focuses on book and magazine publishing including policy, technology, and industry and cultural dynamics. The Centre for Policy Research on Science and Technology (CPROST) studies the interaction of advances in science and technology, their implementation in the marketplace, and their impacts on communities and individuals.

2. CULTURE, SOCIETY, AND HUMAN BEHAVIOUR

As a comprehensive university, SFU champions the liberal arts and sciences and promotes pioneering interdisciplinarity. We enjoy the presence of hundreds of excellent researchers whose record of awards, grants and publications demonstrates the University's success. In the annual *Maclean's Magazine* rankings, we consistently top the grant success category for the humanities and social sciences among comprehensive universities, and rank within the top ten medical and doctoral universities in this category. A distinguishing feature of SFU research in the social sciences is evidence-based research. Areas in which interdisciplinary innovation is receiving particular attention include, but are not limited to, the following potential targets for strategic development. In all these areas, the challenge is to develop focal points (individuals or institutes) to enable dispersed researchers to cohere in creative research groups that will be distinctive to SFU.

2.1 First Nations Studies

Compared to the visibility of First Nations studies on several other BC campuses, SFU's efforts have, until recently, been somewhat dispersed. Attention is now being given to the recruitment of First Nations students. Assisted by two new CRC positions and the appointment by the Vice-President, Academic of a Special Advisor & Director, Aboriginal Affairs, a newly integrated research initiative is gaining momentum, portions of which will be centred in dedicated quarters in the new Arts and Social Sciences Complex, due to open in 2006. Language preservation, an area where enhanced federal funding is expected, is a major interest of a group of researchers in linguistics. Issues in Aboriginal physical and cultural health, education, and child development concern researchers in sociology and anthropology, education, and psychology. A recently hired faculty member researches First Nations oral and print narratives. SFU's archeologists (including one of Canada's few archeologists of Native origin) are well recognized for their critical analysis of First Nations sites; their work links the historical past to current concerns, as in a recently submitted proposal for a major collaborative research initiative to investigate the intellectual rights issues raised by archeological practice. Researchers in education have partnered with the Stó:lo community to investigate how Web-based writing and teaching tools and sophisticated audio/video Web communication techniques can be exploited to preserve the Halq'eméylem language and teach it to new speakers.

Future developments in this field will relate to the recent appointments of CRCs in First Nations Cultural and Environmental Resource Management and in First Nations History. As well, researchers should be poised to take advantage of all new government initiatives and grant programs in such areas as Aboriginal health, education, and economic self-sufficiency (e.g. tourism). Collaboration with other universities (especially UNBC) will likely be important.

2.2 Arts and Culture in Theory and Practice

SFU boasts an internationally recognized group of poets, as well as artists in dance, music, visual art and film. There is clearly opportunity for research to emerge from a number of interdisciplinary thrusts that explore media and computing technologies. These include interdisciplinary academic programs in interactive arts and technology, as well as groups in psychology and applied science disciplines, working in the areas of soundscape composition,

performance and machine interfaces, imaging technologies, and media ecology. Recent hires in cultural and artistic theory contribute to SFU's growing network of film and visual theorists.

Related to media studies is the interdisciplinary, often highly theoretical field of cultural studies, linking researchers across the University in communication, anthropology, humanities, women's studies, education, French and English. The increasingly swifter and more voluminous movement of human populations around the globe is especially critical to Canada, as evidenced in the research and programming theme of the Institute for the Humanities for 2004-08, which is "Re-Claiming Citizenship." Many cultural theorists in the arts and social sciences are now engaged with issues arising from the globalization of culture, such as social cohesion, cultural adaptation, and tensions between diasporic cultures and paradigms of nationhood. Arts and culture are also major concerns of SFU's Centre for Scottish Studies and the Centre d'études francophones Québec-Pacifique.

In this broad area of growing interest for the many talented scholars recently hired at SFU, a fruitful strategy would be to encourage these individuals to work with one another to develop their own collaborative research groups. Current initiatives include one group examining visual culture (their working title is "Revisioning Culture: Image, Body, Nation"), and another researching post-colonial and diasporic literary and cultural studies. The new CRC in English will provide leadership in this area. The Print Culture group, which studies the production and reception of literary and general texts, is planning to establish a research institute which would include colleagues in history and humanities, with links to researchers in communication and interactive arts and technology.

2.3 Social Justice, Ethics, and Forensic Studies

SFU encompasses a number of research centres and individuals involved in the contemporary and historical study of justice and ethics. In addition to those discussed in Section 5 below, there are the Feminist Institute for Studies on Law and Society; the Institute for Studies in Criminal Justice Policy; the Centre for Education, Law and Society; the Mental Health, Law and Policy Institute, and the International Institute for Criminal Law Reform and Criminal Justice Policy. On a more individual basis, faculty members in philosophy also research ethics, past and present. Researchers in psychology explore culture and human development in a myriad of contemporary domains, including the ways in which social and cultural contexts affect cognition, identity, values, family relations, and individual and social welfare. With the leadership of the CRC in Social Psychology, SFU is poised to emerge as Canada's foremost centre for the study of those factors that underlie individuals' perceptions of, influence over, and interactions with other people. The strength of social psychology at SFU can be found in the diversity of methods, including experimental and correlational approaches, in both laboratory and field settings, and in its focus on basic theoretical research as well as the application of theory to significant social issues. Psychology at SFU demonstrates that a rigorous social science can and should engage questions of basic human processes while also providing insights relevant to the society in which we live.

Also deserving of particular mention is the Centre for Forensic Studies to be housed in the new Arts and Social Sciences Complex. The facility will include state-of-the-art labs and a Level 3 wet prep lab, and will focus on forensic anthropology, entomology, botany, isotope and DNA technology. The Centre will be actively involved in homicide cases, as well as applied forensic research. It will link with forensic practitioners in Canada and around the world, and will be a centre of excellence for research, development and technology. With investigations ranging from single homicides to genocide, the Centre will be the first of its kind in the world.

2.4 Local Communities

Quality of life frequently depends heavily on social, political, and economic factors at the local or regional level. Established or emerging strengths exist at SFU especially in urban studies, criminology, geography, business, sociology, anthropology, and women's studies.

Two main research projects in urban studies are interdisciplinary and potentially cutting-edge internationally. The Learning City project investigates the potential and practice of social learning about urban policies. This involves design, implementation, and research for a new curriculum in sustainable development at the Great Northern Way Campus in cooperation with the Centre for Sustainable Community Development and researchers in education at SFU, together with UBC and BCIT. This project will contribute internationally to the UNESCO Decade of Education for Sustainable Development (2005-2014). The Vancouver Urban Observatory studies indicators of urban change in the context of sustainability. Faculty members are drawn from public policy, political science, geography and criminology, and the Observatory has a partnership with the UN-Habitat Global Urban Observatory.

The Institute for Canadian Urban Research Studies is one of only three centres in the world for environmental criminology. Substantial funding is being sought for a program in computational criminology. The Centre for Restorative Justice is unique in Canada and one of a very few such centres world-wide. Other areas of strength in criminology include youth crime and youth violence; mental disorder and the law; and violence against women and children.

Researchers in geography seek to understand local and community-based aspects of a rapidly changing society, both urban and rural. Major research efforts have focused on community adaptation to restructuring in the forestry and fishing industries. This research has addressed questions of resource dependence and attempts at economic diversification. Topics include community forestry operations, community development corporations, value-added manufacturing, and the promotion of tourism. In the urban context, research has focused on the integration of environment, economy, and society at the local level, and on ways in which local actions can promote sustainable development at the regional and national levels. Researchers in the Institute for Research on Early Education and Child Health are conducting multidisciplinary research that focuses on young children from infancy to eight years of age, the communities in which they live and grow, and the interplay of biology and environmental experiences that influence child health, psychosocial development and learning. The Imaginative Education Research Group has won major funding to research methods for building culturally inclusive schools, particularly in First Nations communities, through imaginative education. Research on Immigration and Integration in the Metropolis (RIIM) is a Network that has received several million dollars in funding from SSHRC. RIIM has relevance for the study of immigration at the urban and regional levels. It is likely that the Public Policy program will build further strength in development policy and international relations over time.

A current business research program on sustainable enterprises has potential for collaboration with the Centre for Sustainable Community Development and with the resource and environmental management program. Relevant strengths in sociology and anthropology include community-based research, urban ethnography, feminism, gender and sexuality, and law and society. Faculty members in political science and women's studies are participants in a large research project studying the social effects of public policies in British Columbia.

A possible strategy for further development would be to expand the urban studies program and build on its current or future geographic connections to SFU's Vancouver, Surrey, and Great Northern Way campuses.

3. ECONOMIC ORGANIZATION, PUBLIC POLICY, AND THE GLOBAL COMMUNITY

This theme covers a vast amount of research territory in the social sciences, business, and other areas. It has been divided into four sub-themes discussed below: individuals and families, firms and markets, governments, and the global community. In each section existing strengths are described and target areas are suggested for development.

3.1 Individuals and Families

The study of human organizations and institutions naturally begins with individuals and families, though much of the research described below cuts across all five levels of analysis. Relevant strengths at SFU can be found in women's studies, gerontology, psychology, sociology and anthropology. A major collaborative research project on globalism focuses in part on changes in family and gender relations through economic and cultural restructuring in Canada, Mexico, Australia, and Norway. Related research involves commodification of immigrant women workers in Canada. Another major project is the community-university research alliance on economic security, which includes work on Asian immigrants in BC and the effects of employment standards changes in BC on children and youths. A CRC focuses on health and sexuality, including homecare for HIV-positive individuals. There is expertise in gerontology on families and aging and on intergenerational relations. Research projects in sociology and anthropology involve immigration of elderly women to Vancouver, and field research on Muslim women in Vancouver (both are supported by the Centre for Research on Immigration and Integration in the Metropolis, described above). Other projects focus on housing and health among low-income women in Vancouver, as well as income assistance reform in BC. It is noteworthy that SFU researchers are project leaders in the MSFHR Network for Women's Health Research.

While there are various institutional ways in which it would be possible to build on the strengths described above, it would make sense to focus specifically on the intersection between the global and local communities and the economic and social status of women, since this is a thread that runs through much of the research summarized here.

3.2 Firms and Markets

Business firms and markets are central to the material prosperity of modern societies. SFU has a number of relevant research foci. Economics has the best group in Canada working on the theory of firm organization, which includes property rights, transaction costs, contract theory, and game-theoretic modeling, and it has emerging strength in theoretical and empirical econometrics. It also has the Centre for Research on Adaptive Behaviour in Economics (CRABE), which uses an eclectic set of research methodologies, including computer simulation and laboratory experimentation with human subjects, to explore learning and evolutionary dynamics in market economies. The activities of CRABE can be expected to link over time with research in the field of evolutionary game theory being carried out by the CRC in Economics and Evolution. Other linkages may involve the Laboratory for Logic and Experimental Philosophy and Vancouver Studies in Cognitive Science.

Several research programs in business are relevant to the sub-theme of firms and markets. A focal point is research on strategic change and performance management, focusing on health care organization, which is led by the Weyerhauser Professor of Change Management. Research on corporate governance and organizational risk management is focused on the determinants of good corporate governance in a Canadian context. There is also a group focused on biotechnology, advanced materials, and information technology firms. Spearheaded by the CRC in Technology and Innovation, the objective is to identify the skills and knowledge needed within emerging technology clusters to ensure the growth of firms. Finally, there is an emerging strength in financial risk management where different types of investment alternatives are examined.

A possible target for development lies at the boundary joining theoretical and empirical analysis of economic organization with the more applied study of business organization, linking existing areas of strength in economics, corporate governance, innovation, risk, and growth. This might involve an endowed Chair, the creation of a Centre for Economic Research, or some related initiative.

3.3 Governments

In the contemporary world, governments have a central place at the local, regional, and national levels. Relevant research strengths at SFU are found especially in political science, public policy and economics. Several political science researchers focus on Canadian and comparative public policy, some of whom are linked with the Master's in Public Policy. SFU also has an Institute of Governance Studies focusing on multilevel governance. A major project is in progress to study the impact of public policies in British Columbia on vulnerable populations, in partnership with the Canadian Centre for Policy Alternatives. The Master's in Public Policy (MPP) program and its associated Centre for Public Policy Research (CPPR) is a recent initiative that brings together faculty with expertise in a range of areas including environmental regulation and tax policy (the latter is the focus of the CRC based in Public Policy). SFU has the best group in Canada in public economics and political economy, with an emphasis on fiscal federalism.

An attractive strategy for further development is to continue building the MPP program and the CPPR, which could serve as a hub for many projects on campus with a policy component. There is also much potential for linking policy research with the proposed themes of health and environment.

3.4 The Global Community

Many global organizations are household names: the United Nations, the World Trade Organization, Amnesty International, Greenpeace, and others come to mind. Issues of global concern include security, economic policy coordination, environmental stewardship, human rights, and poverty reduction. SFU's strengths in this area include the Centre for Global Political Economy, several faculty in development studies, and faculty in the fields of trade, growth, development, and international finance. Researchers in sociology and anthropology are investigating global and local movements as well as globalization and international development. The new International Studies program will bring together faculty in political science, economics, history, geography, and sociology.

A strategy for catalyzing the study of global institutions might involve an investment in the International Studies program with a view to connections with related research activities elsewhere on campus, such as the global dimensions of public health or environmental policy

regarding climate change. Another approach might be to incorporate an emphasis on global institutions into the Public Policy program.

4. ENVIRONMENT

SFU has an excellent record of high-profile research related to the environment. This research is conducted throughout the University, and the research approaches used and topics studied span a range of sectors from theoretical and mechanistic studies to applied management strategies. Mirroring the major natural resources of British Columbia, 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.

4.1 Fisheries and Aquatic Ecosystems

Fisheries research at SFU is aimed at improving the understanding and management of fish populations through research on marine and freshwater systems, including not only fish but also marine mammals, birds, invertebrates, and their habitats. Our excellence is reflected in formal research centres maintained and supported by the University (Centre for Coastal Studies, Centre for Wildlife Ecology, Bamfield Marine Sciences Centre) and the creation of endowed Chairs (CRC in Fisheries Risk Assessment and Management, Tom Buell Leadership Chair in Salmon Conservation). Research projects encompass the genomic analysis of salmon, physiological and toxicological studies of fish fitness, marine habitats, fish disease prediction and management, and socioeconomic studies on fishing communities and coastal tourism.

While our particular strength is the multifaceted approach to fisheries research, it would be especially beneficial to reinforce the critical link between basic molecular and applied ecological approaches, perhaps through a CRC to complement the Chairs in Fisheries Risk Assessment and Management and in Salmon Conservation. In addition, emphasis could be placed on increasing our participation in the Bamfield Marine Sciences Centre (BMSC) and the use of its world-class facilities. BMSC, owned and managed by a consortium of five western Canadian universities, is an excellent example of synergistic research efforts among the major universities of British Columbia and Alberta.

4.2 Forestry and Terrestrial Ecosystems

Forestry research at SFU addresses various aspects of this vital sector of British Columbia's economy. It seeks to improve understanding of the forest ecosystem and to respond to challenges of natural and anthropogenic environmental changes. Strong research programs range from basic molecular approaches to ecosystem-based forest management. Efforts are underway to improve tree quality by classical genetic and biotechnological means with respect to wood quality, disease and pest resistance, and seed germination. Forest health is a function of a broad range of factors which collectively determine the response to stressors such as pathogens, pests, climate change, erosion, and fire. Our activities range from research on forest ecology and management to studies of forestry-based communities.

In response to the rapid progress being made in biotechnological approaches, SFU plans to offer a B.Sc. in Biotechnology with particular emphasis on applications in agriculture and forestry. Faculty members hired for this purpose will certainly strengthen forestry research at SFU, and their emerging research areas will be a very timely and promising target for strategic investment.

4.3 Local Impacts of Human and Natural Disturbances

At SFU, increasing emphasis is placed on studying the impact of human developments and natural disturbances on local communities and ecosystems. Examples for such research range from environmental geosciences to sustainable development strategies. Excavation modelling studies are designed to minimize the impact of mining, and groundwater and geochemical characterizations seek to assess the effects of mining, development, and natural events on the local environment and on the affected communities. The integrated research program in natural hazards is closely related. It involves not only earth scientists studying the risks of earthquakes, landslides, and tsunamis, but also other disciplines including social scientists and communications experts. Conceptually related is the new CRC in Glaciology, which focuses particularly on the impact of global warming and other climate changes on glacier thinning that can lead to loss of water resources, shifting ice-caps and other hazards. In the area of ocean science, SFU has helped to establish the Neptune Canada seafloor observatories, which will be installed west of Vancouver Island over the next five years to monitor simultaneously earthquakes, submarine volcanoes, greenhouse gas cycling, biotic productivity, and deep-sea ecosystems. These continuous observations will allow new researchers at SFU to understand, for example, the complex relationship between the accumulation of tectonic stress and earthquakes, in addition to providing early warning of catastrophic events. Our research is not limited to the physical analysis of such disturbances. Various researchers integrate economic, social and environmental objectives in community development, with the goal of designing policies that minimize negative impacts on ecosystems and urban communities. The Centres for Natural Hazards Research and for Sustainable Community Development here at SFU, as well as the Centre for Interactive Research on Sustainability proposed for the Great Northern Way campus, attest to the importance of this area and suggest that this emerging area of research focus should become a priority for SFU.

5. HEALTH

In its short history, SFU has developed a reputation for excellence and innovation in health research involving faculty from across the spectrum of disciplines and organizational units at the University. With such a wide array of health sciences interests, SFU seeks to strengthen a number of interrelated research areas that impinge directly on human health. We have particular strength in biostatistics, biomedicine and neuroscience, as well as in health policy and cultural and population studies, from basic investigations to clinical applications. The establishment of the Faculty of Health Sciences in 2004 provides a special opportunity for innovative new multidisciplinary research initiatives and graduate programming. Novel research and graduate programs are being developed in population and public health, global health, infectious diseases, aging and chronic illness, and brain function and development. Partnerships between SFU and the hospitals and health authorities in the Lower Mainland will enhance these opportunities, and the Government of BC contribution of $34.5 million towards design and construction of a new Health Sciences building will ensure access to state-of-the-art facilities. The Centre for Population Data Warehousing and Analysis, currently under development, will be a resource to support health research across the University, housing a fully integrated collection of databases including biochemical, genetic, clinical, pharmacological, economic, cultural and behavioural

data. 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.

5.1 Population and Public Health and Health Services

A new Master's program will be offered in population and public health starting in September 2005. This program will focus on factors that influence health and disease, and on developing, implementing and evaluating interventions and policies that may produce changes in health at the individual and population levels. The program will capitalize on SFU's strengths in biostatistics and epidemiology. A related area of development is the new Master's program in Global Health. Marked disparities in health outcomes among countries and regions of the world have been well documented for decades, and the research community at SFU has had a strong international focus since the University opened its doors. Another area of developing strength is public policy; a new Master's of Public Policy has been developed by a core group of researchers interested in public policy and policy-making processes.

SFU also has strength in social and health policy as it relates to gender issues, particularly women and violence; the Institute for Critical Studies in Gender and Health has recently been established. The Gender and Aggression Project, based at SFU and funded by CIHR, brings together researchers from UVic, UBC, York, Université de Montréal and the University of Virginia to study the risk and protective factors related to the etiology and development course of aggression and violence in the lives of girls and young women. Researchers focus on both normative and atypical populations, and share a common goal of developing effective strategies and interventions to promote healthy development.

SFU has substantial research strength focused on the intersection of engineering and human health using advanced methods for biomedical engineering. The interactive environment between fundamental and applied research leads to technical interventions for individual health maintenance and disease/disability prevention that are developed for home, community, health care or workplace settings. SFU has considerable expertise in the following areas central to this research theme: network prototyping and experimentation; wireless and satellite communication; biosensor, sensor, and medical instrumentation; human biology (intelligent processing); and medical imaging.

5.2 Chronic and Infectious Diseases

Under this very broad umbrella, SFU researchers are studying cancer, cardiac disease and diabetes, genetic diseases, and infectious diseases. Common to all these diseases are the strong basic research components that investigate disease at the molecular level, as well as more applied studies at the organism or population levels. In cancer research, we currently have two notable areas of activity: several labs are focused on the basic biomedical mechanisms of cancer pathology, including hormonal response pathways, cellular proliferation, and metastasis; SFU also has a translational research program associated with the BC Cancer Agency, integrating basic research on biomarkers of oral cancers with dentists and oral surgeons.

Cardiac disease, and the associated risk factors, obesity and diabetes, continues to be the number one killer in Canada. SFU has strong research programs in many aspects of these chronic diseases. We have particular strength in molecular cardiac physiology, with a focus on the cellular and molecular mechanisms by which the heart adapts to myriad physiological,

pathological and environmental perturbations. Other basic biomedical research is focused on the regulation of heart rate, with the goal of providing new pharmacological approaches to hypertension and congestive heart disease. At the social level, researchers at SFU are studying the use of the Internet to deliver cardiac rehabilitation programs at a distance. Diseases under scrutiny that are associated with heart disease include diabetes, hypercholesterolemia, obesity, and kidney disease. SFU's research strengths in this area range from population studies to human genetics to cellular pathology. SFU hosts the CIHR Institute for Nutrition, Metabolism and Diabetes.

SFU also has strong research programs in the basic biomedical aspects of several heritable diseases, kidney disease, Bardet-Biedl syndrome, hypercholesterolemia, cardiac disease, diabetes and Niemann Pick Type C disease, including research on the human genome and the genomes of model organisms. SFU is host to a CIHR-funded training program (with UBC and the BC Cancer Agency) in the bioinformatics of health, which involves faculty members in molecular biology, biochemistry and computer science, and is attracting exceptional graduate students. Genomics and bioinformatics provide considerable opportunities for interdisciplinary research related to health.

The area of infectious diseases and immunity is already targeted for further growth. SFU has a CRC in Immunology and Vaccine Development, and plans to hire several faculty members in this area as part of the program development in infectious diseases. This program will involve existing and new researchers who seek to define and identify (diagnose) infectious disease, to characterize its distribution among people (epidemiology), to discover its biological, social and political origins (etiology), and to describe how it causes damage at the level of individuals (pathogenesis) and populations. Our existing strengths focus on HIV, pneumonia, sexually transmitted diseases, and meningitis. Current faculty members working in the field of toxicology will be complemented by new hires.

There is no doubt that the development of new programs in health will dramatically increase our research capacity in chronic and infectious diseases, particularly with respect to diagnosis, epidemiology, etiology, and pathogenesis. SFU already has many outstanding researchers with strengths in identifying the players and defining and quantifying interactions in the central basic biomedical research problem (e.g. biophysics, chemical and structural biology, biochemistry, bioinformatics, molecular biology, and genetics). In order to understand the mechanisms of these diseases, however, we need to consider how such molecules interact and function in the complex setting of living cells. SFU has very few researchers who can fill this gap, which is an essential prerequisite for translational research. Hence, strategic investment could be directed towards increasing our research strength in cell biology, physiology, and systems biology in terms of both faculty positions and infrastructure.

5.3 Human Development and Aging

SFU has a number of researchers involved in the area of human development, with interests in brain development, attachment, language and cognitive skills, socialization, and developmental delay. Several of these researchers are organized under the umbrella of the Consortium for Advancement of Child Health, which provides a vehicle to link developmentally focused research and community organizations that serve children and families, as well as to develop new training opportunities in child health. Another focal point will be the LEEF Chair in Cognitive Neurosciences in Child Health and Development. Together with the CRC in Cognitive Neuroscience, SFU has established an outstanding team of scientists that are poised to take centre stage as a world leader in behavioural neuroscience research, particularly as it pertains to

improving life for children with Down Syndrome and other developmental challenges. Through a partnership with the Down Syndrome Research Foundation in Burnaby, SFU has acquired the very latest in magnetoencephalographic brain-imaging technology. In addition to being the only such system in western Canada, it is the only system in Canada dedicated exclusively to university-based research and the only system in the world targeted for research on developmental disabilities. The Gender and Aggression project is also a youth health issue. On the basic biomedical side, we have substantial strength in research directed at understanding processes important in the development of birth defects such as spina bifida, cleft palate, situs invertus and Kartager's syndrome, among others.

SFU is internationally recognized for research on aging. We have existing strengths in gerontology and in cardiovascular disease including its risk factors, especially obesity. In age-related slow-onset diseases such as kidney disease, which affects one in 600 Canadians, we have strength from pathogenesis to human genetics. Cancer is another age-related disease in which we have considerable strength. Diabetes research is strongly represented at SFU. Research on arthritis, a major cause of disability among seniors, will be a new area of strength at SFU centred around the Chair in Arthritis and Musculoskeletal Research funded by Merck Frosst Canada. There is also an initiative to strengthen research on brain function and development in order to integrate our research on neurodegenerative disorders, brain injury and repair, child development, sleep disorders, dementia and social and health policy. Several neuromuscular diseases are the focus of basic biomedical research at SFU, especially ALS and Huntington's disease. It is significant that SFU researchers are project leaders in the MSFHR Network for Aging Research.

Research strength in human development and aging exists in both basic biomedical and social science disciplines. The new Research Chairs point to areas of growth, and it should be a priority to bridge basic and applied studies. Bridging disciplines such as cellular neurobiology and neurophysiology are underrepresented at SFU. Strategic investment directed towards this discipline would achieve better integration of the different research approaches.