

The University of Victoria CRC/CFI Strategic Research Plan Summary 2006-2010

Updated May 2009

Introduction

The University of Victoria (UVic) is one of Canada's most research intensive comprehensive universities. This Strategic Research Plan outlines how the Canada Research Chair (CRC) and Canada Foundation for Innovation (CFI) programs will be used to enhance our capabilities.

Dynamic interdisciplinary connections promote collaboration and exchange among our researchers and with others around the world. Much of our research success can be attributed to the efforts we have devoted to building or supporting these linkages. Currently, UVic has 17 approved interdisciplinary Research Centres. UVic participates in 8 Networks of Centres of Excellence. In addition, provide support for, and participate in, a number of large-scale multi-university consortia such as NEPTUNE, VENUS, the Pacific Institute for Climate Solutions, WestGrid, TRIUMF, Compute Canada, the Canadian Computational Cosmology Collaboration (C4), the Western Canada Universities Marine Sciences Society, and Pacific Institute for Mathematical Sciences, all of which help our researchers to maintain their positions at the cutting edge of their fields.

Objectives

Advancing the state of knowledge and applying it to societal challenges and aspirations are the primary goals of university research. Six objectives express the means through which UVic has been working towards these goals. Taken together, the objectives apply to all of the thematic areas described in this strategic plan. We will:

1. Foster research excellence and enhance UVic's role in the global exchange of knowledge.
2. Promote emerging areas of interdisciplinary research of the highest quality.
3. Optimize faculty renewal by recruiting world-class researchers.
4. Enhance UVic's capacity to educate highly qualified personnel for BC and Canada.
5. Build the infrastructure to support leading-edge research.
6. Contribute to the economic growth and social advancement of BC and Canada through development of the intellectual capital created at the University and via collaboration with various communities through joint research endeavours.

Research Thrusts

The University has identified ten thematic areas in which to develop or maintain excellence.

1. Biomolecular Analysis and Applications to Biotechnology, Health, and the Environment

We are following two directions in biomolecular research: first, the further development of our ability to predict function from structure; and second, application of existing and emerging methodologies to develop useful and interesting new or modified biological molecules.

Biomolecular approaches are essential to genetic counseling, the development of therapeutic agents and diagnostic tests, and the identification of environmental factors contributing to disease risk.

Establishment of the Genome BC/UVic proteomics platform facility at the University in 2002 has added a powerful tool to support health and environmental research. Proteomics technology has also made this area of science economically appealing to companies involved in drug discovery, target identification and validation. Other applications include agriculture; bio-defence; clinical diagnostics; disease prevention; gene therapy and oncology.

The University of Victoria has both established and emerging research strengths in microbial pathogenesis, structure-function relationships of biological macromolecules, vaccine development, molecular and cellular plant biology, cancer biology, immunology, and genetics of environmental mutagenesis and disease. Using biotechnology to provide solutions to health, environmental problems, agriculture and aquaculture is also an area of strength for the University. Individuals recruited become part of networks of research like the Center for Biomedical Research, the Centre for Forest Biology, or the Chemical and Structural Biology Group.

2. *Cognition and Learning*

There are few more promising or important targets for scientific research than understanding how human minds acquire and use knowledge. During the past half century, major research gains have been made across the disciplines of biology, psychology, education, and cognitive science that contribute to our understanding of the basic principles governing the acquisition of new knowledge and skills. Neuroscience is an emerging research focus that links the disciplines of biology and psychology. Our strength in cognitive science and associated educational research involves researchers in our Department of Psychology and Faculty of Education. Researchers in neuropsychology and cognition are examining the biological processes of cognition and the ways these are affected by aging and neurotrauma. The Brain and Cognition Laboratory established in 2003 acts as a cluster for researchers investigating behavioural plasticity, autism, schizophrenia and attention-deficit hyperactivity disorder. Another research focus, computer-assisted learning, ranges from understanding the process of learning theoretically, to developing interactive methodologies for improving the delivery of content through technology. Research on information technology as a tool in teaching and learning is an emerging field that builds on these strengths.

3. *Creative Arts and Culture*

The University of Victoria believes that the creative arts play a vital role in promoting civic engagement and global citizenship in sustainable societies at the local, regional, national and international levels. The arts are a sphere of engagement and the means by which we represent our cultures to others and to the future. Most importantly, it is through the creative arts that we define ourselves in the present. Researchers in History in Art are contributing to our effort to promote and expand the mobilization of research knowledge for societal benefit by engaging the University of Victoria and community in examining the role of art in social transformation. This has been achieved through the organization of community-based conferences, exhibitions, public talks, symposia, art reviews, as well as radio and television broadcasts.

Research in the history of art, and in particular, Modern and Contemporary Art, is increasingly interdisciplinary, entailing re-appraisals of the historical and theoretical criteria for evaluating the field. Researchers in our Department of History in Art are committed to exploring the history of artistic practices within their social and cultural contexts, in historical, modernist and contemporary traditions.

4. *Cultural Knowledge and Indigenous Research*

As Aboriginal populations, environments, and cultural traditions continue to be eroded by the forces of the global economy, the protection of these rich, diverse resources has become critical. Uncovering and preserving unique cultural knowledge and experiences such as language, literature, art, traditional knowledge of ecology and environmental management, and governance requires innovative research that relies on the ability to draw from numerous perspectives. The University of Victoria is exploring the forces that influence the formation of cultural knowledge on a global scale, and also has special interest in the indigenous cultures of British Columbia and Canada. How the literary traditions of Canada's indigenous peoples relate to those of other Aboriginal peoples, and how the wisdom and traditional knowledge of cultural groups can be integrated into Canadian society are current research topics. Approaching from a perspective within the community, as well as from the outside, we are working on finding ways of helping preserve traditional beliefs and values while enhancing the quality of life of indigenous peoples and supporting the capacity for development of indigenous communities.

UVic has a long tradition of interdisciplinary research in First Nations languages and literatures and their preservation. We have been instrumental not only in documenting the linguistic structures and the oral literatures found in BC and the Pacific Northwest, and elsewhere in the world, but in helping maintain the vitality of these cultural treasures. Research and teaching in languages has been fostered by the Humanities Computing and Media Centre, which has an international reputation for excellence. A prominent research theme is social justice encompassing legal, sociological, environmental, governance, policy and other political theory perspectives.

5. *Environment, Oceans, and Climate - Science and Policy*

Global change related to ecology, the environment, and its effect on human affairs, is a theme that calls for the creativity and effort of scholars across the disciplines. Advances in our understanding of how atmospheric, earth, and ocean systems interacted with and influenced the paleo-environment enables us to predict physical outcomes. The ability to track modern changes in the ocean depths using continuous data streams from our coastal and deep ocean observatories (VENUS/NEPTUNE) is yielding new discoveries about the impact of human activities on the ocean environment. The study of the past is integral to and complements this work in that it yields insight into natural boundary conditions while providing data critically needed for model calibration. How we use this scientific knowledge—past, present and future—and integrate it with social and cultural issues concerned with ecological, environmental and community sustainability remains a great challenge. Conducting basic research on ecology and the environment, and translating it into a form that can be understood and used by policy makers, requires an integration of the strengths of many disciplines.

In earth, ocean and atmospheric sciences, our focus is on fundamental interactions in the geosphere, biosphere, oceans and atmosphere. UVic has leaders in research on climate modelling, the biological and physical properties of the ocean, and the earth's crustal processes and properties. In the biological sciences we have strengths in quantitative ecology, forest ecosystems and restoration, and watershed and water resource management. In engineering, a major strength is the development of sustainable energy systems, especially with respect to cryofuels fuel cell systems design and renewable ocean energy. In the social sciences and humanities, studies focus on environmental economics and stewardship, law and ethics, ecological restoration of natural systems, physical and resource geography, geomatics, and ethnobotany.

6. *Global Politics and Economics*

The global change process is being driven by continuing population increase and economic development with its attendant energy demands and impacts on the environment. In addition to associated issues such as global warming, biodiversity and water shortage, globalization is having an impact on society and culture around the world. A key challenge is to learn how to manage increasing interdependence among the world's global institutions. For the future, successful governance will require a complex interplay of geography, politics, economics and society at scales from the local to global.

At UVic, research includes exploring the forces that are precipitating globalization, and identifying its political, social, cultural, economic and environmental implications. Research areas include governance, international law and trade, politics, public management, community-based research, feminist perspectives, cultural, social and political thought, and social policy analysis. The research, which is being carried out in diverse disciplines in the Humanities, Social Sciences, Human and Social Development, Business, and Law, is central to the work of three of our interdisciplinary centres: Global Studies, Asian and Pacific Initiatives, and Dispute Resolution. The Departments of Economics and Political Science and the School of Public Administration have recognized strengths in theoretical and empirical studies of global issues and institutions.

7. *Health and Society*

In recent years, there has been a significant change in our understanding of the factors that determine human health. Greater attention is being paid to a range of social, economic, environmental, and health service factors that interact in complex ways to positively or negatively influence health. These developments have been added to the foundation provided by basic biomedical research. A key concept in this reconceptualization of health is that we can profitably link studies in the natural, applied and social sciences, to shed light on the ways in which health is determined by biological factors, by social factors or the interaction between the two and the pivotal role of policy and practice in designing health care services that promote health and well-being. The creation of the CIHR reflects this shift. UVic is following this direction by developing new models of interaction among researchers from different disciplinary backgrounds who are networked with academics in other parts of the country and internationally, as well as with policy makers, health authorities and consumer organizations. By promoting such wide-reaching linkages, we believe that we will produce scholarship that is not only evidence-based but also transferable to stakeholders developing policies and intervention programs to improve the health of Canadians.

Inter-disciplinary centres and groups involved include: Centre for Aboriginal Health Research, Centre for Addictions Research, Centre on Aging, Centre for Biomedical Research, Centre for Human Movement Analysis, Canadian Council on Learning Health and Learning Centre, Community Health Promotion Centre, Centre for Youth and Society, Population Research Group, Centre for Religion and Society, Knowledge Mobilization Unit and Office of Community-Based Research.

8. *Information Technologies*

Changes in information technologies have profoundly reshaped the ways that people in all walks of life communicate and access information. A key area for research concerns the implications of connecting vast numbers of powerful computers in a world-wide network.

The application of information technology to the acquisition, processing, visualization, distribution and transmission of information is a cornerstone of research and development not only in all areas of science and engineering, but right across campus including the Humanities, Social Sciences and Fine Arts. UVic has expertise in the fundamental IT areas of software engineering, computer engineering, communications, digital signal processing, and technology management. We are applying it in areas such as e-commerce; new media, health informatics; preservation of indigenous languages and culture, and geomatics including remote sensing of earth and the oceans.

9. *Mathematical and Computational Modelling and Design*

Computational modelling brings the power of prediction and control to otherwise descriptive sciences. How can the use of computationally intensive methods, expert systems, and data engineering and mining effectively support interpretation of the data available from the human genome project, the simulation of dynamical non-linear processes, satellite mapping, robotic control and design, and the modelling of economies and environments to inform policy development? Through advances in computing, modelling is leading a revolution in the environmental, biological, and medical sciences to rival its longstanding role in the physical sciences. Research involving modelling demands close collaboration between mathematicians, computer scientists and subject matter specialists.

UVic has particular strengths in mathematical and computational modelling and design. The Department of Mathematics and Statistics is a well recognized leader in operator algebras and dynamical systems, and in close collaboration with Computer Science, works on discrete mathematics and graph theory. Mathematical modelling is a strength in the Department of Economics in the areas of econometrics and economic theory. Virtually all other departments in the sciences and engineering, and several others in the social sciences, have expertise in areas of computational modelling and applied mathematics.

10. *Matter and Energy*

Some of the most profound questions in science concern the nature of matter: What is matter made of? What holds it together? What determines its reactivity: How do properties change under different conditions? Can we control those properties to create new forms of matter and new materials? These questions pertain to systems ranging in scale from the smallest subnuclear dimensions to the macroscopic world of chemistry, to the almost-unimaginably large structures in the universe.

Members of the astrophysics group focus on the properties of extra-terrestrial matter, and are world-renowned for their computational, theoretical and observational work on the formation and evolution of galaxies, stellar structure and evolution, gravitational lensing, binary/multiple stars, and studies of asteroids and comets. The subatomic physics group is investigating the fundamental constituents of matter, and the forces acting on them. The group is taking a leading role in research at premier international accelerator facilities in Canada, Europe, Japan, and the United States, including the ATLAS, BaBar and T2K Collaborations, three of the premier particle physics experiments in the world. In addition to strong linkages between university units, the subatomic physics group relies heavily on infrastructure provided by TRIUMF, and access to the main TRIUMF site.

The development of materials with enhanced performance and lower-cost fabrication for new technology is another focus of this research theme at the University of Victoria. The Centre for Advanced Materials and Related Technology, and several departments in Science and Engineering, are studying materials for uses that include integrated energy research, medical and biomedical

technology, and advanced crystal growth and devices. Nanotechnology is a unifying research theme that is bringing researchers from across the university together to examine matter, energy, and materials.

Energy systems, comprising research in wave energy, cryofuel systems, fuel cell systems and energy systems, are the focus of work done through our Integrated Energy Systems research centre at UVic (IESVic).

CRC/CFI Proposed Allocations

UVic has 37 approved CRC Chairs, planned to be distributed by theme area as follows:

CIHR Tier 1 (1): Theme #1(1)

Tier 2 (4): Theme #1 (2), , Theme #2 (1), Theme #7 (1)

NSERC Tier 1 (10): Theme #5 (4), Theme #8 (3), Theme #9 (1), Theme #10 (2)

Tier 2 (11): Theme #1 (2), Theme #8 (2), Theme #9 (2), Theme #10 (5)

SSHRC Tier 1 (5): Theme #4 (1), Theme #5 (1), Theme #6 (2), Theme #7 (1)

Tier 2 (6): Theme #3 (2), Theme #4 (2), Theme #7 (2)

Assessing Success in Meeting Objectives

The success of the CRC and CFI programs is measured by the following indicators:

- Recruitment and retention of exceptional researchers
- Development and strengthening of identified research programs
- More interdisciplinary, inter-institutional and intersectoral initiatives
- More international and national awards and recognition for faculty members, and invitations to join prestigious learned societies
- More faculty memberships on grant review panels and international editorial boards
- Enhanced quality and quantity in publication records
- Increased participation and success in granting council competitions and other external research funding programs
- Greater involvement in large-scale funding programs with private sector links, such as NCEs, CFI and NSERC-IRCs
- Growth in knowledge mobilization and transfer of intellectual property outside the university
- Growth in postdoctoral and graduate programs that attract top students
- Increases in graduate and postgraduate fellowship awards

Gender Representation in CRC nominations

The University of Victoria has a strong commitment in its faculty hiring to achieve equitable gender representation. The process for nominations for CRC positions makes, explicit that the University's equity policies apply. This has been reinforced by the Vice-President Academic and Vice-President Research in their interactions with the Deans, Chairs and Directors directly responsible for developing nominations. The application of the policies is reflected in efforts made to solicit applications from qualified women, the women candidates that have been short-listed, and the chairs awarded to women.

Planning and Approval Process

The CRC and CFI Strategic Research Plan has been developed through an iterative and collaborative planning and approval process under the leadership of the President, the Vice President Academic and Provost, and the Vice President Research. In 2003, the CRC and CFI plans were combined into a single document. The Deans, in consultation with their faculty colleagues, have made significant contributions to its revision. Chair nominations come from the Faculties. Ultimately, the decision of which CRC nominees to put forward is made by the President and the two Vice Presidents. CFI applications are developed under the direction of an Institutional Planning Committee that is chaired by the Vice President Research.