UNIVERSITY OF ALBERTA

Strategic Research Plan
for
Canada Foundation for Innovation and
Canada Research Chairs Program

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1. Context for the Plan

This Strategic Research Plan has been prepared to describe the major directions in which research is moving at the University of Alberta. The document is intended to inform those judging the fit of applications to the Canada Foundation for Innovation (CFI) or to the Canada Research Chairs (CRC) programs within the context of this University.

The Strategic Research Plan should ideally be considered along with a number of other sources of information in order to derive a more complete view of research on this campus. For example, each Faculty of the University of Alberta annually submits a four-year budget plan and Annual Report including Faculty Highlights and Future Directions. These Annual Reports, along with the University Business Plan, the Academic Plan Task Force Report, the Capital Plan, the Long-Range Development Plan, and other information comprise “University of Alberta: A Strategic Profile – Key Strategic Planning Documents” (www.ualberta.ca/ResourcePlanning/green_binder_page.htm). Additionally, the University periodically undertakes a stringent peer-review process to identify “Areas of Established and Emerging Research Excellence” and most recently acknowledged these in 2001 in a publication entitled “Building on Strength” (www.ualberta.ca/vpresearch/).

2. Core Objectives of the University’s Strategic Research Plan

The University of Alberta Strategic Research Plan focuses on several core objectives:

- building on existing research strengths;
- partnering in innovative ways with the Provincial and Federal governments, industry, and others in developing a knowledge-based economy, thereby maximizing benefits from our natural and human resources;
- expanding interdisciplinary links within the University, and with researchers outside the University;
- maintaining the flexibility to respond to new opportunities;
- maximizing the benefits of research through effective technology transfer; and
- expanding graduate and undergraduate programs consistent with research strengths.

a) Building on Recognized Strengths. The University will facilitate research initiatives that reinforce and strengthen publicly identified areas of excellence. In 2001 we concluded, for the third time, a process of identifying research areas at the University of Alberta that are of national and international excellence. Such areas include cardiovascular research, catalytic, interfacial and transport engineering, communications and software engineering, diabetes/islet
transplantation/transplantation, drug discovery and development, ecosystem management, geotechnical and geoenvironmental engineering, infection/immunity (including viral hepatitis), intelligent systems and control, literary histories and technologies, membrane molecular biology/transport/lipids, nanoscience and technology, neuroscience and neuroendocrinology, nutrition and metabolism, printmaking, professional service firm management and the management of professionals, protein structure and function (including genomics and proteomics), resource geoscience, social policy, and transforming research in education. In addition, we will build on emerging strengths in Central and East European studies, comparative experimental linguistics, health law and policy, music in performance, past human biology and behaviour, and plasma science.

b) Partnering Toward a Knowledge-Based Economy. We will work in partnership with governments, industry, and with other universities in Canada and elsewhere on initiatives designed to: (a) increase our knowledge base, (b) encourage the development of knowledge-based industries, (c) improve the productivity and technology of existing and knowledge-intensive resource-based industries, and (d) enhance sustainability and the quality of life. Activity in this area is apparent in the matching funding provided by the Province of Alberta for CFI and Networks of Centres of Excellence (NCE) proposals, in the level of Canadian and international private support attracted by our researchers and through the fund campaign, and in our collaboration with the National Research Council and other agencies and institutions in nanoscience and genomics research.

Increased diversification of the economy includes utilization of knowledge to gain maximum benefit from our natural resources. The eleven NSERC Industrial Chairs established since 1996 reflect existing relationships in support of this activity. We will build on these partnerships.

The University is partnering with other universities and research institutions in areas such as comparative experimental linguistics, environmental research, functional foods, genomics and proteomics, globalism, information and communications, and interfacial and material sciences. Our collaborative approach has already led to a successful joint Alberta initiative in ICT through the formation of the Multimedia Advanced Computational Infrastructure (MACI) and the subsequent WestGrid program, and to national initiatives such as the National High Field NMR Centre (NANUC) at the University of Alberta, the Alberta Synchrotron Institute (ASI) as part of the National Synchrotron Facility (Canadian Light Source – CLS), and the National High Energy Physics Facility (TRIUMF) at the University of British Columbia. Each of these provides critical support to identified areas of excellence at the University of Alberta. We will continue to work with international as well as national partners.

c) Expanding Interdisciplinary Links. We will foster interdisciplinary research, paying particular attention to innovative initiatives that cross conventional discipline borders. The Health Sciences Council brings together six Faculties with research activities in various disciplines relating to the health and life sciences. Other examples include, bio-medical engineering (Faculties of Medicine and Dentistry, Rehabilitation Medicine, and Engineering), health law and health ethics (Faculties of Arts, Law and the Health Sciences Council), knowledge utilization and policy development (Faculties of Nursing and Business),
mathematical biology (Departments of Mathematical and Statistical Sciences, and Biological Sciences), and nanoscience (Faculties of Engineering, Science, and Medicine and Dentistry). A new interdisciplinary science building will facilitate the increased interaction between forefront areas of science. Additional broader interdisciplinary connections are being developed between medical researchers and their colleagues in the social sciences, humanities and fine arts. Research on the North will continue to be pursued across a number of disciplines. These linkages as well as others will grow as we encourage exploration of the social, cultural, economic, educational and political effects of new insights and discoveries in all areas of knowledge. The MCRI project, “Neo-Liberal Globalism and Its Challenges,” and TAPoR (Text Analysis Portal for Research) are two exciting new initiatives in this area.

d) Keeping Flexible. Research fields and the research environment change rapidly, as is shown by the current emphasis on nanoscience, energy, genomics and proteomics research, and ICT. Talented researchers continually develop new areas of enquiry. As we foster excellence, we must, and will, position ourselves to take advantage of emerging opportunities. Humanities computing links our Faculty of Arts with our Faculty of Science. Another example is the creation, with the assistance of the provincial and federal governments, of the Institute for Biomolecular Design (IBD) which brings together researchers from several Faculties in collaborative research projects using centralized equipment.

e) Maximizing Benefits from Technology Transfer. Linking research to economic health and a better quality of life for Canada and the world is an important part of our plan. We continue to expand the NSERC Industrial Chair program and work on similar linkages with governments, the private sector, and other organizations. We will continue to encourage involvement with NCEs and their industrial partners, and will allocate the Canada Research Chairs and University resources to create critical mass in identified areas. Simultaneously, we will commit resources to, and work to attract additional provincial and federal support for, programs that strengthen our technology transfer capabilities. As part of this focus, the University of Alberta will continue to invest in partnerships with governments and key industries, especially in the environmental sectors, ICT, life sciences, material sciences, and natural resources. We continue to support degree and internship programs that enhance technology management, the preparation of highly qualified personnel (HQP), and an understanding of the social, cultural, economic, and political elements of technological change that affect the human condition.

f) Expanding Graduate and Undergraduate Programs Consistent with Research Strengths. Canada must develop HQP with the capacity to understand, utilize, and further develop research results that flow from universities. We are committed to expanding our graduate and undergraduate programs in line with the researchers who will serve as effective instructors and mentors for an increased number of highly qualified students. The education and training of HQP is also a central element of Canada’s Innovation Strategy, and the University of Alberta is committed to increasing its number of PhD graduates.
3. Applying the Core Objectives in Selected Areas

In line with these core objectives, the University will further develop innovative research in the areas of culture and cultures, education/life-long learning, environmental research, information and communication technologies (ICT), life sciences, materials and interfaces, natural resource research, the nature and social implications of work in modern society, pure science, and rethinking quality of life. We explicitly stress that interaction between these areas, and others, is expected and encouraged. Nanotechnology, for example, is a key area that cuts across many disciplines. The National Institute for Nanotechnology (NINT) was established in 2001 as a unique partnership among the National Research Council, the Government of Alberta, and the University of Alberta. NINT will bring together identified strengths from our Faculties of Science, Engineering, Medicine and Dentistry, Law, and Arts.

Culture and Cultures. Research in areas relating to culture and cultures is critical to an increased understanding of the social, historical, economic, political, educational, legal and organizational contexts within which all new scientific knowledge is discovered and applied. Cultural research and scholarship are strong across both disciplinary and Faculty boundaries, and involve collaboration among the Faculties of Arts, Business, Education and Law. Literary histories and technologies, printmaking, professional service firm management, and social policy have all been identified as established areas of research excellence; emerging areas include Central and East European studies, comparative experimental linguistics, health law and policy, and music in performance. The internationalization of business, family enterprise and social entrepreneurship, the importance of literacy for all Canadians, multiculturalism and international education, and Aboriginal law are also key areas. The Prairie Centre of Excellence on Immigration and Integration, funded by SSHRC and Citizenship and Immigration Canada, is an example of a large multi-institutional initiative examining questions of current importance to the country. The Folkways music initiative, in conjunction with e-communications, involving the Faculties of Arts and Business, is poised to make a major contribution to Edmonton’s cultural scene.

Education/Life-Long Learning. Research is vital to the development and improvement of instructional models, approaches and learning environments. This research addresses both the complexity of knowledge accruing from exponential increases in technological and scientific advances, as well as the increasing disparity among individual skills, abilities and language competence of student populations. The research is geared to improve instruction to match student needs particularly in areas such as mathematics and science, those from non-mainstream cultural, linguistic or socio-economic backgrounds, and the needs of students with exceptionalities. The Centre for Research on Literacy, in affiliation with the CLLRNet NCE, supports basic research into the development of language and literacy skills and the programs that strengthen language, communication, and literacy skills of children, youth, and adults.

Through the Community-University Partnership for the Study of Children, Youth and Families (CUP), researchers from the Faculties of Education, Medicine and Dentistry, Nursing, Rehabilitation Medicine, Pharmacy and Pharmaceutical Sciences, Physical Education and
Recreation, and Agriculture and Forestry & Home Economics - in collaboration with school districts, the Capital Health Authority, Alberta Ministries, and service agencies - can pursue research into the broad cultural, familial, health and educational factors that contribute to successful academic outcomes. A Work and Learning Network of researchers from the Faculties of Business, Education, and Extension, in collaboration with provincial governmental agencies and school districts, focuses on professional learning, communities of practice, life-long learning, development of skills for the new economy among new Canadians and an aging workforce, and use of new technologies such as broad band access in the context of strengthening communities across Canada.

**Environmental Research.** A close relationship exists between our strengths in life sciences and in environmental research areas such as water quality, natural resource utilization, climate change, agricultural practices, and the protection of species. Ecosystem management, geotechnical and geoenvironmental engineering, along with environmental biology, are established areas of strength at the University of Alberta. Complementary strength is found in the Departments of Renewable Resources, Public Health Sciences and Earth and Atmospheric Sciences, and in the Faculty of Law. We will maintain and enhance our expertise in water quality, land reclamation and restoration, waste management, sustainable development, and related fields. Major investments have been made to upgrade space for our environmental engineering group. A new Natural Resources Engineering Facility will enable new initiatives of an interdisciplinary nature.

In the Sustainable Forest Management (SFM) NCE, anthropology, sociology and economics all provide valuable contributions to the environmental science and engineering components. Each of these areas is closely linked to key sectors of Alberta’s economy: forestry, oil sands development, and agriculture. The University has made significant investments in this area through SFM. Three NSERC Industrial Research Chairs have attracted significant industry support, one of two prestigious Killam Memorial Research Chairs is allocated to ecology, and a fully endowed chair in wildlife biology has been established.

**Information and Communications Technologies (ICT).** The University of Alberta is placing major emphasis on establishing and maintaining internationally recognized programs in information and communications research. In conjunction with the Province’s ICT strategy to increase graduate and undergraduate programs and to attract outstanding researchers through the iCORE (Informatics Circle of Research Excellence) initiative, investments are being made and will increase in ICT-related fields such as computing science, electrical engineering, computer engineering, physics, and mathematics. This initiative is an integral part of several research programs utilizing massive databases in proteomics, bioinformatics, climate change, resource evaluation and utilization, and industrial design. It also builds on linkages with companies that have strong, long-established ties with the University such as TRLabs, Biotools, Syncrude, and Micralyne Inc. An integrated environment is particularly important for the application of ICT in natural resources, health, and related areas. For example, the University is a leader in the development of ICT to allow collaborative health assessment and treatment monitoring through distance linkages incorporating real-time transfer of voice, data, and video information over a single system.
**Life Sciences.** One major area of focus in the life sciences links molecular research to health. A number of established and emerging initiatives provide opportunities to elucidate life at the molecular level and to apply resulting research advances to specific health challenges. Contributing entities include the Institute for Biomolecular Design, Project CyberCell, the Alberta Network for Proteomics Innovation, the Alberta Cancer Board proteomics project, the strengths of technology development in the Department of Chemistry, the nano-biotechnology initiative, and the computational and bioinformatics platform. Activities in these areas are collaborative and complementary, and also have links to the Institute of Health Economics, small and large “Pharma”, the Genomics: Ethics, Economics, Environment, Law and Society (GELS) research team, the Northern Alberta Clinical Trials and Research Centre, and the Alberta Technology Commercialization Network. A cornerstone of this research focus is the construction of the Health Research Innovation Facility (HRIF) which will house and nurture these multi-disciplinary research approaches.

A second core focus in life sciences is on translational clinical research. This component includes, among others, islet transplantation, viral hepatitis, immunology, structural biology, membrane molecular biology/transport/lipids, neuroscience/neurobiology, cardiovascular studies, pulmonary medicine, rehabilitation, and oncology. These areas each incorporate strong, dynamic groups of basic and clinical scientists involved in research on new treatments for patients with a range of diseases. From the days of JB Collip in the 1920s and his involvement in diabetes research, the University of Alberta has a history of building links that move from basic research to clinical practice. We are committed to maintaining this focus. We have given priority to providing adequate facilities, including a clinical trials center, space in the HRIF, support for CFI applications in coordination with the Alberta Cancer Board and the Capital Health Authority, and in the allocation of Canada Research Chairs. Other prominent areas of life science research focus include health promotion, health law and policy, health economics, health ethics and health issues encountered by special populations and specifically, persons with physical disabilities.

The University’s Faculty of Agriculture and Forestry & Home Economics hosts the only university-based program in Agri-Food in the province. The Department of Agricultural, Food and Nutritional Science within the Faculty integrates basic research in areas such as chemistry, molecular biology, genomics and proteomics with developmental biology, physiology and metabolism. The program works in all areas of the value chain from the sustainable production of animals and crops through value-enhancing technologies for food and non-food products, to human nutrition and the effect of food in promoting health and ameliorating disease. Key infrastructure initiatives to support this growing program include Agri-Food Discovery Place (dedicated to value-added food and non-food product development), the Agri-Food Materials Science Centre of Excellence, and the Agricultural Genomic and Proteomics Centre. As part of a larger ‘Food for Health’ initiative, work is being done by researchers in the Faculties of Medicine and Dentistry, Pharmacy and Pharmaceutical Sciences, and Physical Education and Recreation.
**Materials and Interfaces.** The University has major research strengths in materials and interfacial science and engineering, ranging from expertise in the nature and behavior of substances as diverse as catalysts, soils, construction materials, and biomaterials to the synthesis of new molecules for improved plastics, alloys, electronic components, and fuel cells. Materials and interfacial processes are important to support Canada’s natural resource industries. To develop this base, the University is providing new and continuing faculty with upgraded facilities and instrumentation, especially in science, engineering, and medicine. Interdisciplinary activity in this area is demonstrated by Whitaker Foundation support of programs in biomedical engineering involving researchers from the Faculties of Medicine and Dentistry, Engineering, and Rehabilitation Medicine, and linked with researchers in complementary areas at the University of Calgary. Another is the collaborative work with the University of Calgary to establish joint chairs and programs, with support from Westaim Corporation, in areas of advanced materials and increased support for our Advanced Engineered Materials Centre. These programs will, like others in this plan, produce trained, highly qualified people with specialized knowledge, who are important to the future of Canada.

An important tool for materials research will be the Canadian Light Source, now under construction in Saskatoon. Access to this facility will allow studies of materials as diverse as proteins and alloys; the University has been a leading supporter of this initiative and will use it extensively through the Alberta Synchrotron Institute (ASI).

**Natural Resource Research.** University research assists in the wise use of Canada’s and the world’s renewable and nonrenewable resources. Development of Alberta’s immense and unique oil sands deposits depends on the extraction of bitumen and creation of synthetic crude, the reduction, sequestration, and/or effective use of carbon dioxide, improved land restoration processes, and understanding the impact of oil sands development on animal and plant life. Similar issues apply in the development of Canada’s vast coal and conventional oil and gas resources. Managing the impact of the natural resource sector on water and air quality will continue as a research focus at this University. Advances in materials and ICT research contribute to effective use of natural resources, whether through improved global information systems or understanding of the physical, chemical, or biological surface properties of materials. Supporting the exciting and strategic initiatives in this sector will be the University’s new Natural Resources Engineering Facility (NREF).

Research in the humanities and social sciences addresses the social, cultural, ethical, economic and political aspects of natural resource development in Canada. The SFM NCE has focused interdisciplinary teams of researchers on our boreal forests. Similar teams are required to understand and anticipate the impact of oil and gas, mining, agricultural, and other resource developments. We will develop facilities in Science and Engineering that make possible interdisciplinary work in resource geosciences, integrated landscape management, and chemical biology, and which will strengthen interaction between areas such as geotechnical, geoenvironmental, mining, and water resources engineering.
The Nature and Social Implications of Work in Modern Society. The University of Alberta is located in a province that has heavy investment in natural resources but also a growing knowledge-based economy. Both sectors will be critical in the new millennium and will face considerable challenges as societal norms and aspirations evolve. The University has existing and growing research strengths in several of the social science disciplines relevant to understanding these issues. There are centres of research excellence that focus on the distinctive challenges of governing and managing knowledge workers in various settings, including professional service firms, health and educational organizations, and sectors of the new economy such as biotechnology and software development. These are among the fastest growing sectors of the Canadian economy, and understanding them will be critical to Canada’s future. Other research is looking into the impact on commerce and society of new technologies, internationalization, regulatory change, and the impact that such technologies might have on the functioning of international markets and the competitiveness of Canadian business.

Research into the nature of work and the social implications in the modern economy is of such complexity that projects inevitably require interdisciplinary work, which is a strong feature of the University of Alberta. They are also of such a scale that inter-university collaboration is increasingly the norm. Two recent examples are the Centre for Knowledge Transfer, housed in the Faculty of Nursing, which has seven principals from four universities and four Faculties, and an e-commerce research initiative of the Faculty of Business comprised of a team of researchers from six universities.

Pure Science. In some areas of intellectual endeavor, the University of Alberta has developed and consistently supported strengths that do not fit easily into other categories. These centre on fundamental, curiosity-driven or insight-inspired topics that do not have obvious applications in life. One such field is pure mathematics. In conjunction with the University of Calgary and the Pacific Institute for Mathematical Sciences, the establishment of an international center for mathematical research at the Banff Centre occurred in March 2003. Other areas include sub-atomic and space physics. This is not to say that the work done in these fields may not lead to useful discoveries; it has often done so, but such applications cannot be predicted. Universities have a unique role in supporting these endeavours because of the development of creative thinking and the training of personnel who will contribute to society in new and unknown ways. We will continue to selectively support such areas of excellence jointly with the Canadian Institute for Advanced Research and other interested parties.

Rethinking Quality of Life. With increasing economic and political pressures and health threats influencing daily life, individuals and organizations are seeking ways of maximizing quality of life through social involvement, appreciation of, and participation in, the fine arts and education, preservation of culture, and environmental opportunities for positive health behaviours. The University is proactively supporting multidisciplinary teams based in the social sciences in which research teams are addressing conceptual, substantive and policy issues related to enhancing the quality of life of Canadians. The programs involve consideration of elements such as environmental and community influences on the daily life of persons with disabilities (The Steadward Centre) and Aboriginal persons (ACADRE, Dene Language CURA project). The Hidden Costs/Invisible Contributions MCRI program in the Faculty of Agriculture and
Forestry & Home Economics engages social scientists and humanists from around the world in research on marginalized groups such as older adults and adults with disabilities. Social scientists in the Faculty of Arts are actively involved in the SFM Network where they are engaged in interdisciplinary research with natural scientists to better integrate the environment in the economic system and policy process.

Sport and games is an essential aspect of culture, and it is being explored as a basis for understanding and maintaining minority and Aboriginal cultures and for fostering appreciation and preservation of natural environments in the Faculty of Physical Education and Recreation, in collaboration with researchers in the Faculty of Arts and the Faculty of Agriculture and Forestry & Home Economics. The role of physical activity as a means of increasing social involvement, positive self-perceptions, and preventing and treating the current major health threats to quality of life (cancer, diabetes, obesity and heart disease) are also studied in the Faculty of Physical Education and Recreation in conjunction with the Faculties of Nursing, Medicine and Dentistry, and Agriculture and Forestry & Home Economics, bringing together health and social science researchers in the study and enhancement of quality of life.

4. Assessing Progress and Success

We will continue our regular process of identifying and publishing our areas of research excellence every three years (the most recent process was completed in June 2001.) As part of this process, we identify those factors by which excellence can be measured in each area. The measures may differ between basic and applied research and between disciplinary research areas (eg, in biochemistry and in English). Our assessment includes factors such as: (1) recruitment and retention of outstanding faculty; (2) applications by highly qualified graduate and undergraduate students for admission to programs; (3) awards and recognition to professors and graduate students by their peers; (4) publications and other communications of research results; (5) successful placement of graduates from programs; (6) research funding attracted on a competitive basis; (7) technology transfer and economic benefits through spin-off companies, licensing activities, and links with partners; and, (8) success in all of the foregoing relative to our competitors. The five-year cycle of reviews of our graduate programs and related research, which includes the involvement of external reviewers, provides a further means of assessing progress.

One major objective we have for our CRC allocations is that of providing a gender balance in our awards. To date, eight Chair holders out of 53 are female. We are currently working proactively with our Faculty Deans to increase our number of female CRC holders. We see this as a priority in the development of our University and in the realization of its vision as a leading teaching and research institution serving our greater community.

5. Planning and Approval Process
This plan represents an update to the one submitted in 2001. It is based on our focus on publicly identified areas of established and emerging research excellence, on the strategic plans from Deans and Faculties, and on input from Associate Deans (Research). The resulting revised plan was initially drafted by the Office of the Vice-President (Research), and it was subsequently reviewed and endorsed by the University Research Policy Committee, which is chaired by the Vice-President (Research). The plan was then circulated to the Deans for information, and was approved by the University’s Academic Planning Committee prior to submission.