

UNIVERSITY OF ALBERTA



# BUILDING ON STRENGTH

Areas of Established and Emerging Research Excellence 2001

This document presents the results of the University's third round of identifying areas of established and emerging research excellence, and demonstrates once again that the University of Alberta is prepared to name with boldness and pride its areas of research strength. Selecting the areas that meet the criteria of truly excellent is a daunting task, given the range and extent of outstanding research undertaken at the University.

The identification process followed closely that used in 1994 and 1997. The Vice-President (Research) asked Deans to review a set of criteria for evaluating research in their Faculties' subject areas, and then to identify areas of research that met international standards of quality based on these criteria and supported by objective evidence. Fifty-five five-page submissions were received and reviewed by a small working group, which reported its findings to the University Research Policy Committee (URPC) chaired by the Vice-President (Research). Based on the initial submissions, the working group identified several areas that were clearly excellent, and a number of others where more information was needed to make a definitive assessment. Where some areas of research crossed Faculty boundaries, combined submissions forming larger interdisciplinary areas of strength were requested. The final selection of areas of established and emerging research excellence was based on a careful scrutiny of the second round of detailed submissions. The proposed list was considered, discussed and approved at a full meeting of URPC, and was then presented to Deans' Council before being announced.

It is with great pleasure that we now present the 2001 list of the University of Alberta areas of established and emerging research excellence, along with a general description of each area. Of the eighteen areas of established research excellence identified in 1997, fourteen are on the 2001 list, either individually or in combination with new areas. Six new areas of established research excellence are listed – four of which were on the emerging list in 1997. Of the six areas of emerging research excellence identified in 2001, five are new and one was listed in 1997.

In spite of the challenges of the process, we are confident that the areas selected represent world-class research activities and researchers. We are also struck by the diversity of the areas identified and by the intersecting web of disciplines that make up the University of Alberta. Several areas not in these lists nevertheless include world-class researchers who are individually conducting outstanding research.

## Areas of Established and Emerging Research Excellence

In addition, the University has many researchers whose achievements in their fields are among the best in the world; however, they are not currently associated with a group of colleagues of sufficient size to constitute an area. Many of these researchers are Fellows of the Royal Societies or recipients of national and international awards. We are pleased to recognize their accomplishments in the accompanying document, *Building on Strength: Celebrating Research*. The collective effort of individual faculty members carrying out high-quality research and scholarly activity is the foundation of a truly outstanding research-intensive institution.

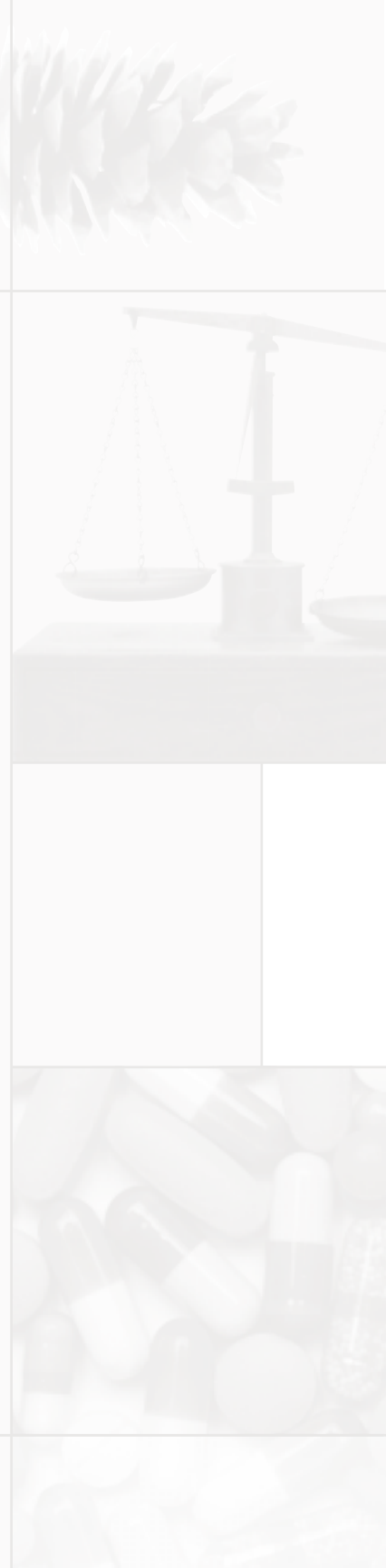
Critical to the success of the research areas and individual researchers identified in these documents are the support staff, research associates and assistants, postdoctoral fellows and graduate students who contribute so much to the exciting and high calibre research conducted at the University of Alberta. It is their dedication, along with the important and valued funding from federal and provincial agencies, foundations, and private sponsors, that is the key to our successful research programs. We acknowledge these contributions gratefully.

President Rod Fraser's bold vision – that the University of Alberta be indisputably recognized, in teaching, research, and community service, nationally and internationally, as one of Canada's finest universities and amongst a handful of the world's best – is being realized as we move into the 21st century. *Building on Strength* captures an important part of this vision by clearly identifying our research strengths by area, and by celebrating the accomplishments of many individual researchers.

I would like to acknowledge with thanks the work of Roger Smith, my predecessor as Vice-President (Research), and Associate Vice-President (Research) Paul Sorenson in leading the process of identifying the University's areas of research excellence in 2001. In addition, the members of the Research Excellence Working Group and of URPC are to be thanked for their work in this process.



R Gary Kachanoski  
Vice-President (Research)



## Table of Contents



### Areas of Established Research Excellence

Cardiovascular Research .....	1
Catalytic, Interfacial and Transport Engineering .....	1
Communications and Software Engineering .....	2
Diabetes/Islet Transplantation/Transplantation .....	3
Drug Discovery and Development .....	3
Ecosystem Management .....	4
Geotechnical and Geoenvironmental Engineering .....	5
Immunity/Infection .....	6
Intelligent Systems and Control .....	6
Literary Histories and Technologies .....	7
Membrane Molecular Biology/Transport/Lipids .....	7
Nanoscience and Technology .....	8
Neuroscience and Neuroendocrinology .....	8
Nutrition and Metabolism .....	9
Printmaking .....	9
Professional Service Firm Management and the Management of Professionals .....	10
Protein Structure and Function .....	11
Resource Geoscience .....	11
Social Policy .....	12
Transforming Research in Education .....	12

### Areas of Emerging Research Excellence

Central and East European Studies .....	15
Comparative Experimental Linguistics .....	15
Health Law and Policy .....	16
Music in Performance .....	17
Past Human Biology and Behaviour .....	17
Plasma Science .....	18

Cardiovascular Research

Cardiovascular disease is a major world-wide health problem, and the number one cause of death and disability in Canada. Researchers in the Faculty of Medicine and Dentistry have provided innovative insights into our understanding of cardiovascular disease, and are developing important approaches to treating heart disease. Over the past two years, group members have brought in more than \$10 million in research funding.

Ongoing clinical studies complement basic research: this ‘bench to bedside’ approach ensures a strong focus on improving patient care, and is a major strength.

Six specialized subgroups carry out cardiovascular research:

The **Cardiovascular Research Group** is internationally recognized for research into the key causes of injury to the blood-deprived heart; designing the best approaches to protecting the heart; and exploring the mechanisms of normal and disordered arteries.

The **Canadian Institutes of Health Research (CIHR) Group on Cardioprotection During and Following Ischemia** is identifying the events that contribute to damage from a heart attack, and developing new strategies to prevent such injuries.

The **Vascular Biology Research Group** is developing ways to prevent, treat or cure disorders of the arteries and blood vessels, and has developed a cutting-edge instrument resource.

The **Virtual Coordinating Centre for Global Collaborative Cardiovascular (VIGOUR) Centre** is a collaboration among hospitals across Canada, and has estab-

lished the University of Alberta as a leading academic national coordinating centre for international cardiovascular research trials.

The **Epidemiology Coordinating and Research (EPICORE) Centre** is a clinical trial and health outcomes research centre. EPICORE leads and coordinates major multi-centre trials.

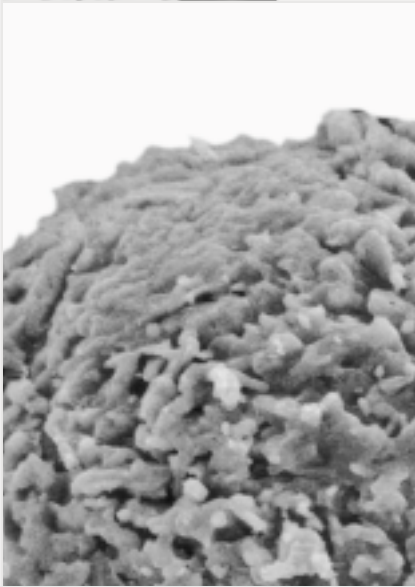
**Cardiovascular surgery research** is a very active area with a vitally important clinical component: the University of Alberta Hospital runs the largest cardiac transplant program in Canada and is the major centre for child heart surgery in western Canada.

*Contact: Associate Dean (Research), Faculty of Medicine and Dentistry*

Catalytic, Interfacial and Transport Engineering

The research done by the Catalytic, Interfacial and Transport Engineering Group spans fluid mechanics, interfacial phenomena, transport phenomena and chemical reactions.

Fluid mechanics is concerned with understanding the motion of fluids when subject to external forces; interfacial and transport phenomena research focuses on the transfer, by the fluids in motion, of chemical species and energy across fluid-fluid and fluid-solid interfaces. Research on catalysis focuses on the importance of interactions among chemical species, especially at interfaces, in regulating the speed of chemical reactions. These phenomena play an important role in many industrial processes. As a result, application areas are diverse, ranging from bitumen and heavy oil recovery to drug delivery systems to pollution control.



The scope of work done by this inter-related research group from the Faculties of Engineering and Science varies from the very fundamental (measurements of interaction forces, direct numerical simulation of multiphase flows) to the very applied (improvement of bitumen extraction and upgrading processes, drug delivery to the lungs). The total annual research funding of members of this group is \$6.3 million. On average, a total of 70 papers per year are published by the group in highly respected, peer-reviewed journals. Members have also received numerous awards from provincial, national and international agencies.

*Contact: Associate Deans (Research), Faculties of Engineering and Science*

### **Communications and Software Engineering**

The modern telecommunications industry depends on a flourishing software environment. Software engineering finds some of its major challenges in the realm of telecommunications systems. The research disciplines of communications and software engineering, therefore, go hand in hand. The synergy between the two has fostered the development of a great number of exciting new communications technologies.

The Communications and Software Engineering Group has many researchers of international stature. For example, both of the NSERC Steacie Fellows currently active in electrical engineering are in this group. In 1999, a group member won the WRG Baker Prize award presented by the Institute of Electrical and Electronics Engineers (IEEE) for the most outstanding paper reporting original research work. This was the first time the prize had been awarded to a

Canadian as the principal researcher and for research done solely in Canada. Current annual research funding for the group exceeds \$3 million.

Activities in communications and software engineering are focused in two areas:

The **Laboratory for Quantitative Software Engineering** is a world-class centre for innovative and applied research in three areas: process and quality, e-collaboration and e-commerce, and software reuse. The lab is renowned for its pioneering and innovative approach of using quantitative and empirical studies in software methodology development. Members are part of ASERC (Alberta Software Engineering Research Consortium) and have established vital and highly productive research collaborative links with many international institutions including Trent Nottingham University in the UK, Tokyo Institute of Technology and the Polish Academy of Sciences.

**TRLabs** was founded in 1986 by members of the Communications Group. It was one of the earliest successful Canadian not-for-profit industry-university-government consortia for pre-competitive collaborative research in telecommunications technology, theory and applications. From its origins in Edmonton with three staff and two industry sponsors, TRLabs has grown to encompass five laboratories with nearly 200 staff, 50 industry sponsors and a total annual budget of \$11 million. A recent evaluation by KPMG lauded TRLabs for excellence as an organization devoted to the conduct of research, graduate training and technology transfer in the Information Communications Technology sector.

*Contact: Associate Dean (Research), Faculty of Engineering*

## Diabetes/Islet Transplantation/ Transplantation

More than two million Canadians have diabetes and suffer from its life-threatening complications such as blindness, kidney disease, nerve damage and amputations, heart disease and stroke. For the past 25 years, researchers in the Faculty of Medicine and Dentistry have been seeking a cure for diabetes. This large group of clinical and basic scientists is an international centre of excellence for diabetes research and transplantation.

**Diabetes.** Leading-edge research is under way on the causes and prevention of the autoimmune response that leads to the destruction of the insulin-producing islet cells and the consequent development of diabetes. The team has identified effective immune intervention approaches to prevent autoimmune diabetes in animals. Research is also focused on using gene therapy to make selected cells (other than islet cells) produce insulin in an appropriate and regulated fashion. This work was recently published in *Science*.

**Islet transplantation.** The Islet Transplantation Group achieved international acclaim in 2000 by improving clinical islet transplantation success from 8 per cent to 100 per cent insulin independence at one year. Experts hailed this success as the most exciting diabetes news in decades. Now known as the "Edmonton Protocol," this achievement has set a new standard for islet transplantation. In the last five years, the group has received external funding of more than \$24 million.

**Transplantation.** The University of Alberta is one of the world's most respected transplantation centres.

Basic science research involves studies of the mechanisms of rejection, immunosuppression and tissue aging. A large number of clinical research projects are under way, particularly in kidney transplantation, as are many multi-centre clinical trials.

The research is pivotal in setting national and international agendas for research and development. The Department of Medicine was chosen as the site for the editorial office of the new *American Journal of Transplantation*, the official journal of both the American Society of Transplantation and the American Society of Transplant Surgeons.

**Contact:** Associate Dean (Research), Faculty of Medicine and Dentistry

## Drug Discovery and Development

A unified approach to research in the area of drug development has created a revolution in the discovery and design of new drugs and in our understanding of the basis for their effectiveness. This new approach has attracted a group of innovative researchers from the Faculties of Science, Pharmacy and Pharmaceutical Sciences, Medicine and Dentistry, and Engineering. Their achievements in drug discovery, medicinal chemistry, biomolecular design and rational drug design have gained international recognition. Powerful computing that allows visualization of molecular interactions plays a key role in this work.

Three research groups, with international reputations for their interactive approaches to problems in drug design, are exploring the area of carbohydrates. The eventual goal of the innovative application of carbohydrate chemistry to problems in biology is the development of drugs for the prevention of bacterial and viral diseases. A major achieve-



4

ment in this area is the success in isolating and stabilizing fifteen enzymes for use in the preparation of hundreds of natural and synthetic drugs.

The development of a valuable new approach to chemical synthesis, using organoselenium chemistry, has enabled the synthesis of cholesterol-lowering agents and anti-tumour drugs.

Research in the chemical details of biological processes has led to new insights into drug action and new approaches to creating medicinally effective drugs. Exploration of ways to improve drug delivery and the safety of anticancer drugs, led to the first description of the Stealth technology and clinical approval of a product for treatment of AIDS-related Kaposi's sarcoma and for ovarian cancer. New, dual-effect compounds to treat congestive heart failure have been designed and are being evaluated for their potential as therapies.

*Contact: Associate Deans (Research), Faculties of Science, Pharmacy and Pharmaceutical Sciences, Medicine and Dentistry, and Engineering*

### Ecosystem Management

One of Canada's greatest challenges in the 21st century will be managing the pressures of a resource-based economy in such a way that landscapes and ecosystems are conserved, and healthy biotic communities and socially and economically healthy human communities are both maintained.

An interdisciplinary group of forty-two researchers is addressing the most pressing issues of ecosystem management. The Sustainable Forest Management Network of Centres of Excellence is integral to this research,

which covers conservation biology; global change in northern and mountain ecosystems; resource management and forest science; resource and environmental economics; and ecology. Strong partnerships have been established with the forestry, oil and gas, mining, and agriculture sectors in support of research, innovation and application.

Examples of specific research projects include:

- An examination of the effectiveness of leaving riparian (near water) forest buffer strips during forest harvesting in maintaining the ecosystems of the boreal mixedwood forests. The work is supported by NSERC, several industry partners and a number of Alberta government departments, and is having a major impact on development of policy and regulations for the management of riparian forest in Alberta.
- A long-term multidisciplinary study to determine the effects of natural and human disturbances (oil and gas extraction, mining, and forest harvesting) on wetlands of the western boreal forest.
- Studies of the impacts of climate change and contamination on mountain ecosystems, including pioneering studies on fisheries management in mountain lakes and nutrient discharges into mountain rivers.
- EMEND (Ecosystem Management Emulating Natural Disturbance). Located in north-west Alberta, this is the largest controlled forestry experiment in the world. The project compares the effects of innovative human-designed harvest and regeneration practices with those of natural disturbances. Forest industries are building the research findings into their management planning.



- Examinations of wildlife and conservation ecology in order to develop an integrated ecosystem management program for northern Alberta.

Researchers in ecosystem management received over 138 national and international awards in the last five years. Research funding for the current year is \$10.3 million. Presently 156 master's students, 93 doctoral students, and 16 postdoctoral fellows are being trained in this area.

*Contact: Associate Deans (Research), Faculty of Agriculture, Forestry and Home Economics, and Faculty of Science*

### Geotechnical and Geoenvironmental Engineering

Geotechnical engineering involves any aspect of engineering relating to soil and rock such as mining, analysis and design of dams, foundations and tunnels, and understanding the behaviour of slopes and groundwater. Geoenvironmental engineering deals with the interactions between wastes and the geosphere including management of solid waste, migration of contaminant through the subsurface and remediation of contaminated sites.

The Geotechnical and Geoenvironmental Engineering Group in the Faculty of Engineering is the largest and strongest group of its kind in Canada and comparable in size to other major research-intensive groups in North America. Annual research funding averages \$2.7 million, with half coming from industry.

The group undertakes research in a number of areas:

**Large earth structures and their foundations.** The largest retaining structures in the world contain the mine tailings from the Alberta oil sands. The group initiated and

managed the Canadian Liquefaction Experiment (CANLEX) Project to evaluate the phenomena of liquefaction of sands. It was awarded the provincial APEGGA Project Award in 1998.

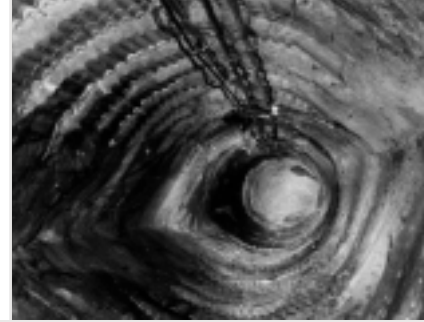
**Cold regions and permafrost engineering.** Infrastructure, pipelines and mines in the Arctic are adversely affected by slope creep and instability, frost heave and thaw settlement. The group's research has led to a comprehensive understanding of these mechanisms and resulted in innovative engineering solutions. Its Geotechnical and Geoenvironmental Cold Region Research Facility is unique in Canada.

**Mine waste technology.** The proposed expansion of existing oil sands mines and the construction of new mines partly hinges on the successful demonstration of new tailings management technology. The group has won two provincial ASTech Oil Sands Research Awards for their work in this area.

**Risk management in resource engineering and natural hazards.** Group members are specialists in the formal treatment of risk management, and led the work on landslides with the 1990-2000 International Decade for Natural Disaster Reduction. The group will host the first workshop and conference on Teaching Geotechnical Risk Engineering in 2002.

Areas of research also include geological disposal of wastes, including greenhouse gas sequestration; assessment and remediation of contaminated sites; characterization of subsurface deposits and earth structures; ground improvement; and modelling of excavations, landslides and pipeline hydrotransport.

*Contact: Associate Dean (Research), Faculty of Engineering*



5



## Immunity/Infection

Bacterial, viral and other parasitic diseases cause enormous suffering and millions of deaths annually, and have huge economic costs. Understanding natural immune responses and developing vaccine-induced immune responses to these and other diseases is critically important to health.

A core group of ten scientists in the Immunology Network within the Faculty of Medicine and Dentistry is exploring the workings of the immune system, its activation and its defences, and working to develop new vaccines and drugs for the treatment of specific infections.

The research areas in immunity include: allergic asthma, immune system responses to viruses, the origin of a form of leukemia, immune system defences to infection, and transplantation antigens. Research on a particular form of leukemia has influenced clinical approaches to the disease.

Areas of research on infection include the regulation of maternal immunity, viral infections, antibiotic resistance, and viral hepatitis. Researchers in viral hepatitis have made major contributions to the study and treatment of this condition, including development of a new antiviral therapy for hepatitis B.

In the last three years, the group has published 139 papers in peer-reviewed publications, and their work has received international recognition. The researchers collaborate extensively with biotechnical and multinational pharmaceutical companies, and hold several patents.

**Contact:** Associate Dean (Research), Faculty of Medicine and Dentistry

## Intelligent Systems and Control

The principal challenge of intelligent systems is based on an assumption that intelligence arises in the context of some distinguishable agent provided with sufficient knowledge to operate effectively in its environment. The key is knowledge, and its articulation in a manner that allows knowledge to be exploited by an artificial agent.

The Intelligent Systems and Control theme involves researchers from the Faculties of Science, Engineering and Arts. Their work spans a wide range of ideas from the development of plausible theories of human cognition through to the engineering of complex adaptive, reactive, reality-augmented environments. The six main research areas are: software and database systems; learning and reasoning; intelligent environmental sensing, virtualized reality and robotic systems; control and optimization; fuzzy and knowledge-based systems; and natural and cognitive sciences.

Over the past five years, the principal investigators have published a total of 178 journal articles, 142 conference publications and presentations, and 17 books and research monographs. During 2000-2001, the group brought in more than \$6.5 million in research funding.

The group has also developed prototype intelligent systems such as applications in forestry, energy, health and the internet. Industrial applications include an automated computer process control system at Syncrude, a remote pipeline monitoring, control and scheduling system at Enbridge, and optimization and robust operation of power systems at TransAlta.

**Contact:** Associate Deans (Research), Faculties of Science, Engineering, and Arts

## Literary Histories and Technologies

Most researchers in the English Department are engaged on projects in literary and cultural history. These encompass a variety of theoretical and methodological approaches. One major area of research is women's writing. This is at the core of the Canada Research Chair recently awarded to pursue research on the relationship between revolution and romanticism in the formation of the modern state. An eleven-volume history of women's writing in English is in progress as well.

Women's writing is also the focus of the Orlando Project, an international undertaking involving scholars from four countries. Funded through the SSHRC Major Collaborative Research Initiatives program and the Canada Foundation for Innovation, the project is producing the first full scholarly history of women's writing in the British Isles. This is in the form of four individually authored volumes of history and a collaboratively authored, deeply tagged electronic textbase.

Faculty members are actively engaged in exploring new technologies for literary research. Technologies they have developed have created structures for writing, encoding and working with basic research material.

The researchers have received national and international recognition and they collaborate with scholars around the world. They lead national and international professional bodies, serve as editors on major publishing projects, edit research journals, advise and assess for academic publishers, and participate by invitation in international conferences. Over the last five years the Department's scholars have published more than twenty books with major publishers.

**Contact:** Associate Dean (Research), Faculty of Arts

## Membrane Molecular Biology/Transport/Lipids

Biological membranes and intracellular organelles are essential for the function of every cell. They play key roles in the entry and exit of molecules, separation of biochemical functions, localization of metabolic processes and communication with the environment outside the cell. Dysfunction in membrane structure, function and protein compartmentalization processes has serious consequences for the normal function of cells and has been implicated in diseases such as Alzheimer's, cystic fibrosis, cancer and arteriosclerosis.

In the Faculty of Medicine and Dentistry nine key researchers lead groups investigating membrane structure and function, and protein targeting and compartmentalization. Their research generates fundamental information about the structure, function and biogenesis of biological membranes and cellular compartments. This work is directly applicable to the diagnosis and treatment of membrane-associated disorders and is stimulating the development of novel therapeutic approaches.

The three research groups studying aspects of biological membranes are: Canadian Institutes of Health Research (CIHR) Molecular Biology of Membrane Proteins Group, CIHR Molecular and Cell Biology of Lipids Group, and the Membrane Transport Group. They are responsible for a number of key achievements in membrane research, including the discovery of a protein translocation system that transports fully folded proteins across biological membranes; the first molecular cloning of a protein that plays a critical role in cardiac development and pathology;

8

development of techniques for manipulating the lipid polar headgroups, fatty acid composition and cholesterol content of membranes; and the first isolation of genes encoding nucleoside transporters.

As a result of their research success, these groups have earned world-wide recognition. In the last five years they have brought in \$49 million in research funding and published more than 1,000 research papers.

*Contact: Associate Dean (Research), Faculty of Medicine and Dentistry*

### Nanoscience and Technology

Nanoscience is the study and development – on a scale of 1/10,000th the diameter of a human hair – of new materials and machines. The ability to build things atom-by-atom or molecule-by-molecule will revolutionize the production of virtually every human-made object. But much work remains to be done on understanding the special rules that control behaviour at this small scale, and integrating these concepts into practical devices.

Researchers from several Faculties are known for their expertise in nanotechnology, microdevice fabrication, high-speed photonics devices and nanoscale physics. Nanoscience expertise was initially centred in electrical and computer engineering, and has expanded to include scientists in physics, chemistry and oncology. Research is taking place on thin film microstructures, ultrafast microscopy, laser-plasma nanolithography processes, nanoscale materials and analysis, and microfluidics systems.

The Nanoscience Group was instrumental in establishing the new \$7-million Nano- and MicroFabrication Facility, the

top facility in Canada for this innovative work. Its principal investigators have also developed some very successful commercial products (SIMBAD, Microfluidics Toolkit), played a key role in start-up companies (Micralyne, BigBangwidth) and collaborate with or receive funding from companies around the world.

The Government of Canada and the Government of Alberta announced in August 2001 the creation of the \$120-million National Institute for Nanotechnology (NINT), which will be located at the University of Alberta.

*Contact: Associate Deans (Research), Faculties of Engineering, Science, and Medicine and Dentistry*

### Neuroscience and Neuroendocrinology

The study of brain function and mental processes, and their associated clinical disorders, has emerged as one of the most prominent disciplines in the biological sciences. Over the past twenty years, a number of excellent neuroscience teaching and research programs have been established primarily in the Faculties of Medicine and Dentistry, Rehabilitation Medicine and Science, and their cumulative significance has been recently recognized in the establishment of the University Centre for Neuroscience. An external review of the Centre's graduate program ranked it in the top 10 per cent in Canada.

There are five main research groups:

The **Rehabilitation Neuroscience Group** is working to understand the nervous control of limb movements. Team members have developed a variety of devices to improve motor function in people with paralysis or amputation. Among these are the WalkAide™, a microprocessor-



controlled artificial leg, and the Bionic Glove™, which helps spinal-injured patients to grasp.

In the **Neurochemical Research Unit** primary areas of interest are depression, schizophrenia, anxiety disorders, stroke, drug metabolism and drug-drug interactions.

Outstanding clinical research and a dedicated MRI centre allow the **Clinical Neuroscience** research team to examine neuronal loss and alterations resulting from neurodegenerative conditions (such as Parkinson's and Alzheimer's) and stroke. A significant number of trials are in progress examining the potential usefulness of neuro-protective agents.

Faculty members in the **Nervous Control of Walking Group** are world experts on general principles of locomotor control. The research is important to facilitating recovery after spinal cord injury, and designing walking robots.

The **Neuroendocrinology Group** explores the complex interactions between neuronal networks and endocrine glands in both central and peripheral nervous systems. Its work focuses on the regulation and action of neuroendocrine signals, and the senior members of the group have pioneered studies in hypothalamo-pituitary function. The group's high calibre research has been published in major journals such as *Nature* and *Neuron*.

*Contact: Associate Deans (Research), Faculties of Medicine and Dentistry, Science, and Rehabilitation Medicine*

**Nutrition and Metabolism**

With a view to optimizing health and quality of life in humans, and growth and reproduction function in animals, researchers in the Nutrition and Metabolism Group, in the

Department of Agricultural, Food and Nutritional Science, focus on digestion, absorption and utilization of energy, protein, fat, carbohydrate, vitamins and minerals in domestic animals. Understanding how nutrition affects metabolism in domestic animals is key to regulating such economically important processes as growth, reproduction and milk production. In humans, an understanding of nutrition and metabolism contributes to human health and disease prevention.

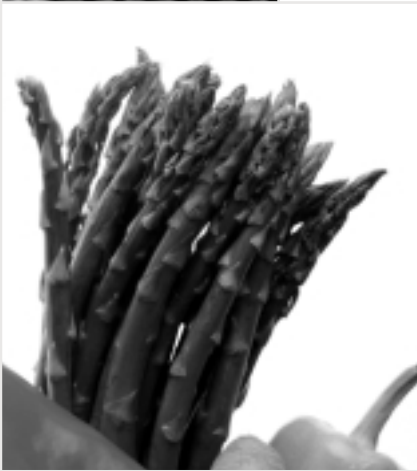
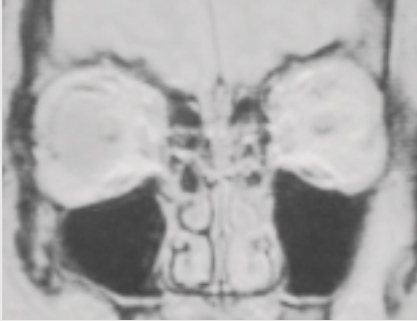
The twelve core members of the group have established international reputations in their fields and received numerous distinguished awards for their research. Within the last five years they have published close to 340 papers and presented 31 invited reviews at international meetings. Over the same period, the group has attracted \$8.5 million in research support.

The group's research extends from genetics to studies of domestic livestock to the development of new strategies in nutrition and health management for humans and animals. Specialized areas of study include: cancer, diabetes, the immune system, the environment, animal reproductive physiology and lactation, nutrition of infants, children and youth, as well as health promotion strategies.

*Contact: Associate Dean (Research), Faculty of Agriculture, Forestry and Home Economics*

**Printmaking**

The Printmaking area of the Department of Art and Design has achieved an international reputation as one of the outstanding places in North America to study graphic art. This reputation is based not only on recognition of the creative work of the Printmaking faculty members and their





Above, Top:  
First Tree, Sean Caulfield,  
mezzotint, etching, 2001, 8"x8 3/4"

Above: Expectancy: Scene 3,  
Sean Caulfield, mezzotint, chine  
colle, 2001, 28"x22"



## Areas of Established Research Excellence

graduate students, but also on the state-of-the-art technical facilities that support their research and creative work.

Over the past five years, the four faculty members have exhibited in 109 major international juried shows around the world, and have won sixteen major international awards. Three faculty members have each received a Canada Council Senior Artist Grant, the most prestigious award for artists in Canada. The fourth faculty member, who won the grand prize in an international Grand Prix exhibition in Japan in 1995, is the holder of a Tier 2 Canada Research Chair in Printmaking.

The creative work of faculty and staff is reviewed in national and international publications. Europe's top magazine on printmaking regularly includes in-depth reviews of the work of Printmaking faculty and graduates. The Visiting Artists program encourages interaction between internationally recognized artists and students and faculty. As well, a special international link has been created with the appointment as adjunct professor of one of Japan's most renowned printmakers. This has established a formal link with Musashino Art University, the prestigious university in Tokyo whose printmaking department he heads.

*Contact: Associate Dean (Research), Faculty of Arts*

### **Professional Service Firm Management and the Management of Professionals**

Professional services are one of the fastest growing sectors in the modern economy. Often these services are provided by professional service firms, many of which are managed as partnerships – an unusual form of governance.

Understanding how professionals are organized and

managed by national and international professional service firms, and by organizations dominated by professionals, is the focus of the four core researchers in the Centre for Professional Service Firm Management in the School of Business. An area of particular research interest is the dynamics and consequences of change at all levels of a firm.

Specific research themes include partnership forms of governance; strategic planning processes; human resource management; knowledge management; marketing and financial control systems; relations with clients; and the processes of investing in new, especially global, markets. These themes are studied in the context of changing economic conditions, and the challenges to traditional conceptions of professionalism and partnership and the appropriate ways of organizing professionals. The researchers are also examining the processes of judgment and decision making by professionals, and are conducting comparative research into the management of professionals in non-professional settings.

The group has earned international recognition and built a network of scholars around the world, with strong links in Australia, the US and the UK. A recent book on the restructuring of the professions, edited with international collaborators, marked a significant point in the development of that field. Projects in progress include: an investigation of changing strategic management practices, including entrepreneurial behaviours (funded by SSHRC), the use of group software as a way of integrating the management systems of accounting firms (funded by the Institute of Chartered Accountants of Alberta), a study of negotiations between auditors and clients over the content of financial reports issued by investors (funded by SSHRC), and an



analysis of how investment banks choose alliance partners.

*Contact: Associate Dean (Research), School of Business*

## Protein Structure and Function

Proteins, 'the building blocks of life,' are ultimately the targets of most biotechnology research, for defects in proteins or their levels of expression account for virtually every known human disease.

Researchers from the Faculties of Science, Medicine and Dentistry, and Pharmacy and Pharmaceutical Sciences are involved in a number of initiatives that play a key role in the development of protein chemistry throughout Canada. Several researchers are members of the Protein Engineering Network of Centres of Excellence (PENCE), a nation-wide network of universities, institutes, government laboratories and industries that is centred at the University of Alberta. PENCE promotes partnerships in the discovery and development of new drugs, vaccines and diagnostics. Researchers benefit from access to the National High Field NMR Centre (NANUC), a premier national 800 MHz facility that is housed at the University of Alberta and serves the needs of the Canadian NMR community.

Researchers are organized into three groups:

The **Canadian Institutes of Health Research (CIHR) Group in Protein Structure and Function** is a major force on the world stage in protein structure and function research. In the past five years, principal investigators published more than 275 articles in prestigious biochemical journals. The group of medical researchers answers fundamental questions in protein chemistry by applying its expertise in a wide variety of techniques to any given biological problem.

**Proteomics research.** This group comprises researchers from the departments of Chemistry and Biological Sciences. The Chemistry Department researchers are developing the tools and methods that will dominate studies on protein expression over the foreseeable future. Researchers use mass spectrometry, laser spectroscopy, miniaturized analysis systems, advanced separation technology and high-resolution microscopy. The Biological Sciences Department has a strong contingent of molecular biologists who conduct research on plant, animal and microbial organisms. Their research affects areas as diverse as biotechnology, systematics and the genetics of inherited diseases and the immune system.

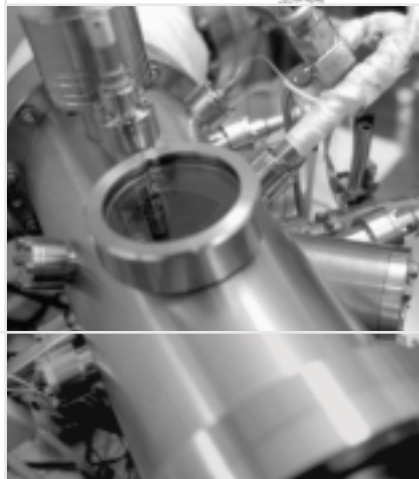
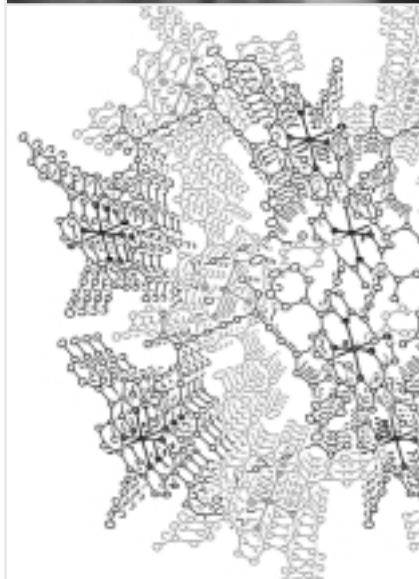
The **Institute for Biomolecular Design (IBD)** represents an interdisciplinary collaborative effort in proteomics – the molecular nature of protein structure and function. It builds on the University of Alberta's internationally recognized strengths in bio-organic chemistry, structural biochemistry, molecular biology and computer science.

*Contact: Associate Deans (Research), Faculties of Science, Medicine and Dentistry, and Pharmacy and Pharmaceutical Sciences*

## Resource Geoscience

Virtually all aspects of the Earth related to natural resource formation, exploration, exploitation and remediation are subjects of resource geoscience research. This group of nationally and internationally recognized scientists in the Faculty of Science has made significant contributions to the Earth Sciences community in two main research areas:

**Hydrocarbons and water.** This research team focuses on oil and gas reservoirs, natural waters and carbon cycling. The researchers address critical issues in sedimentology





12



and diagenesis, stratigraphy, paleontology, fluid flow and the carbon cycle. Individuals in this group interact extensively with industry and have been actively involved in the development of hydrocarbon reservoirs in the Middle East, South America, Europe, Africa, North America and the Far East.

**Geochemical frontiers.** This research team specializes in applying geochemical techniques in order to understand processes and address problems concerning natural resources such as diamonds, gold and copper. The strength and excellence of this team lies in its ability to integrate a broad spectrum of geochemical techniques, develop new technology, and apply existing technology in innovative ways.

Members have won numerous national and international awards, sit on the editorial boards of national and international journals, and are nominated to grant adjudication committees. Current annual research funding for the group is \$1.4 million.

*Contact: Associate Dean (Research), Faculty of Science*

### Social Policy

The Department of Sociology's research programs on population health, work and education, and globalization and social policy are recognized as among the most vigorous and innovative in Canada. Their common goal is the critical assessment of social, trade and industrial policies. The research has had a strong influence on public policy at provincial and national levels.

Three streams of research are currently undertaken: population health, family and aging; work and education;

and the impact of globalization trends on national and provincial policy. The Population Research Laboratory, a social science research centre with 35 years of experience in survey and demographic research, is an integral component of the research.

Major recent research projects undertaken include a study of neo-liberal globalism and its challengers, and an investigation of the social and economic dimensions of an aging population, both supported by the SSHRC Major Collaborative Research Initiatives program. SSHRC, along with the Alberta government, has also supported a continuing, fourteen-year longitudinal study of school-work transition. The Alberta Heritage Foundation for Medical Research funded a study of the integration experiences of immigrant and refugee children, and an investigation of the use of health services by residents of continuing care facilities. A study of the experiences of Kosovar refugees in Canada was funded by Citizenship and Immigration Canada.

Department scholars have published ten books within the last five years, and scores of journal articles. Researchers are involved in collaborations nationally and with scholars in Germany and the UK, and participate on government advisory committees, in research think-tanks and on editorial boards.

*Contact: Associate Dean (Research), Faculty of Arts*

### Transforming Research in Education

The main focus of this research group in the Faculty of Education is on transforming the way research in education is conducted. Using qualitative approaches, the researchers



## Areas of Established Research Excellence

have pioneered the development of theoretical bases and research methodologies for analyzing and interpreting data based on the experiences and reflections of teachers and learners. This linking of human science research methods with teacher practice has resulted in cutting-edge changes to research in education. The findings are influencing the way teachers are educated in the English-speaking world today and, through translation, in other countries as well.

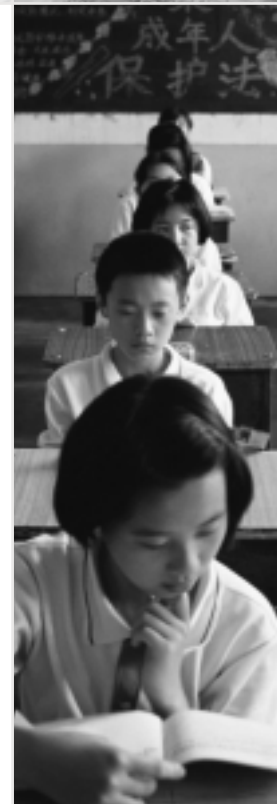
The eight core researchers in this group have earned national and international recognition for their work in developing and applying human research models in their areas of special interest. These include teacher education, curriculum theory, literacy, science education, globalization and postmodern pedagogy, and peace education.

Major research projects in the last five years include an examination of science education and curriculum reform

supported by funding from the Imperial Oil Charitable Foundation; and a study of literacy among children, in collaboration with the Canadian Language and Literacy Research Network, and supported by the Canadian Institutes of Health Research, NSERC and SSHRC. The South African Teacher Development Project is supported by the Canadian International Development Agency.

Within the last three years, the group has published 23 books, 37 book chapters, 32 refereed articles, and presented their research at 134 scholarly conferences. They have attracted more than \$17 million in funding. Their collaborative arrangements include community and school partners as well as faculty in Canada, Holland, Japan, China, Germany, New Zealand, Australia, Great Britain and South Korea.

**Contact:** *Associate Dean (Research), Faculty of Education*





Areas of Emerging Research Excellence



## Central and East European Studies

The focus of research in Central and East European Studies (CEES) is the history, culture, literature and linguistics of Ukraine, Russia, Belarus and the Central European republics (especially the Czech Republic and Austria). Six historians in the Department of History and Classics and the Canadian Institute of Ukrainian Studies (CIUS) work on Ukraine, making the University of Alberta the major resource centre on Ukraine outside that country.

The Department of Modern Languages and Cultural Studies is Canada's leader in Ukrainian literature and language studies. It also houses the only endowed chair in Ukrainian Folklore and Culture in the world. It has launched a major initiative to develop Ukrainian computer-mediated learning programs, and is also establishing a position in Polish. Scholars in the Department of History and Classics are experts in Russian, Ukrainian and Belarusian history. The Canadian Centre for Austrian and Central European Studies is a major hub for cooperative work among other Canadian universities, as well as the embassies of Austria, Czech Republic, Hungary, Poland, Slovakia and Slovenia.

The twenty-one faculty members in this area draw on significant print resources in the University library and CIUS, including outstanding archival holdings and folklore archives. Over the past five years members have published eight books, one book translation, close to fifty major articles and many shorter articles, encyclopedia entries, translations and reviews. One of the most important scholarly achievements is the ongoing translation of the ten-volume *History of Ukraine-Rus'*. The English language five-volume *Encyclopedia of Ukraine* is another landmark achievement

constantly being improved and updated. Canada's leading Slavic scholarly journal, *Canadian Slavonic Papers*, is edited and published by CEES researchers.

Members of the group have received significant national and international recognition, as well as research funding. They have delivered papers and seminars in North America, Ukraine, Europe and Asia, and have organized national and international conferences. They serve as editors and co-editors of book series, and as members of editorial boards of national and international journals, and on adjudicating committees of national granting agencies. They collaborate with researchers in the USA, Russia, Ukraine, Belarus and Germany, and are involved in publishing ventures with partners in Ukraine.

The international reputation of the group is attracting a large enrolment of graduate students from many countries including Canada, Ukraine, USA, Russia, Poland, Japan, Korea and Montenegro.

**Contact:** *Associate Dean (Research), Faculty of Arts, and the Director, Canadian Institute of Ukrainian Studies*

## Comparative Experimental Linguistics

Complex computations are involved in the apparently effortless and subconscious processes of speaking and understanding speech. The goal of the researchers in the Comparative Experimental Linguistics Group is to understand how these processes are performed. The aim is to resolve the central question: What is involved in understanding language and speaking it?

The nine members of this integrated research group are developing empirical lines of inquiry that reach across

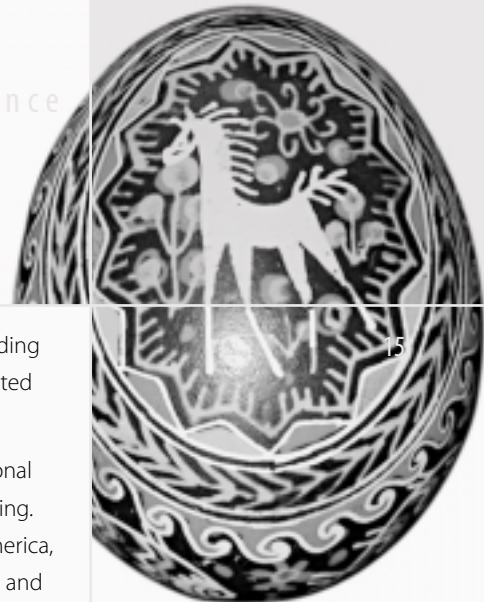


Photo courtesy Museums and Collections Services

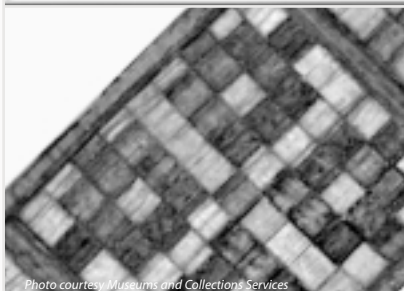
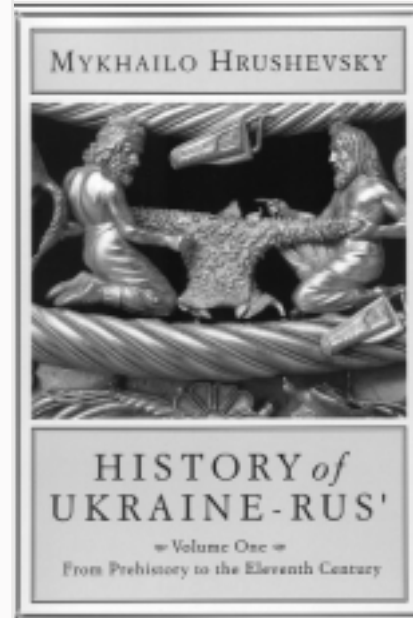


Photo courtesy Museums and Collections Services



language, domain and speaker populations – an approach unique in Canada. The unit has been a centre of innovation in the development of laboratory methods, in modelling language processing and representation, and in expanding comparative experimental linguistics to new languages and populations. Areas of research include experimental phonetics, morphology, language revitalization and Amerindian languages, bilingual language acquisition, and the interface between phonology and phonetics.

The group has received \$2.3 million in national and international research grants in the last five years. Members have achieved national and international reputations in their fields. In the last five years they have published 63 articles in peer-reviewed journals, 40 chapters in books and 38 refereed proceedings, and made 208 conference presentations. Members serve as co-editors of international journals and have co-edited four special journal issues in the last four years.

Collaborative research networks include active working groups in six universities in Canada, four in North America and ten in Europe as well as collaborators in China, Taiwan, Australia and New Zealand.

*Contact: Associate Dean (Research), Faculty of Arts*

### Health Law and Policy

The rapid pace of scientific discovery in many areas of health care, coupled with the severe measures taken to contain costs, has created a changing landscape in health care that challenges traditional legal approaches to managing the system.

Law is integral to some very specific aspects of the health

care system. It governs relationships between providers and consumers of health care, regulates funding and accessibility, and shapes the research environment that creates health products, technologies and services. It also establishes and monitors the institutions that deliver health care services.

The six members of the Health Law and Policy Group have earned international reputations as leaders in the study of health law. Much of the research for which they have received recognition concerns genetics and biotechnology. Members of the collaborative group have participated in regional, national and international policy development. They have been invited to present their work to government and academic meetings throughout the world including Japan, France, Italy, the UK and the United States. They have published numerous leading monographs and articles in peer-reviewed publications, and have been commissioned to write research and position papers for WHO, Industry Canada, Health Canada, and the Canadian Genome Analysis and Technology Program. Members are also closely involved in the analysis of health reform issues in Canada.

The collaborative team have written or edited the five leading Canadian textbooks on health law. Two of Canada's leading health law journals are published in the Faculty of Law, including the only peer-reviewed health law journal in Canada.

The group has ties to researchers throughout the world and has been involved in projects with universities or research institutes in the US and the UK as well as in Canada.

*Contact: Associate Dean (Research), Faculty of Law*



## Music in Performance

Music performance by university-based musicians is both renowned and diverse. Its range includes unaccompanied solo or orchestral performance; collaboration with advanced students or world-famous professional musicians; and presentation in a provincial town or on a world stage. It may focus on little-known classical literature, music so new the ink is hardly dry, or the best known music of the Western European canon. This contrast between local and international, new and old, characterizes exciting university-based music performance.

There are ten internationally acclaimed musical performers or conductors in the Department of Music. These musicians present a total of more than eighty performances a year, spanning the range from solo recital through chamber music to orchestral and choral performances, often with orchestras and choirs from across the country and around the world. Solo recitals in the University's Convocation Hall are increasingly recorded by CBC for subsequent broadcast nationally. Last year University of Alberta musicians appeared at international venues fifteen times as recitalists or featured soloists with large ensembles.

The musicians perform with ensembles of various sizes, including the relatively new combination of piano and organ, and a piano trio. Choral conductors work with student groups as well as with community choruses, and choirs have won national and international awards in major competitions. Through involvement in festival adjudications, master classes and workshops nationally and internationally, faculty members further contribute to the cultural life of the community. Production of some

twenty CD recordings over the last five years, and publication of several music education books, testify to the wide recognition of the work of performers and conductors.

The Department's reputation attracts graduate students from around the world – Asia, Australia, Europe and the UK – as well as from Canada.

**Contact:** *Associate Dean (Research) Faculty of Arts*

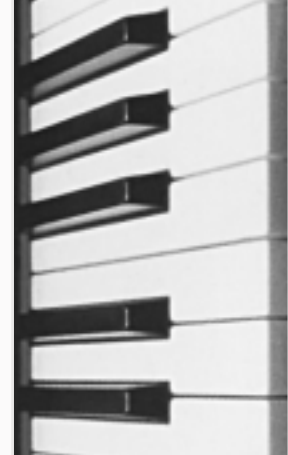
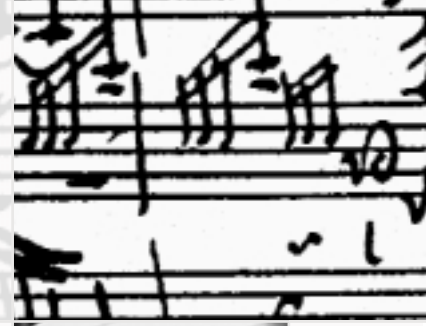
## Past Human Biology and Behaviour

One of the critical subjects in anthropology is the study of the biological and social-cultural evolution of humans. Members of the Past Human Biology and Behaviour Group carry out this research by linking biological and cultural approaches, in order to gain a better picture of human past.

A critical question being investigated both by biological anthropologists and archaeologists in the group is the degree to which environmental, population, or cultural change (or a combination of these) accounts for key transitions in human biology and behaviour. The goal is to find out what happened and why.

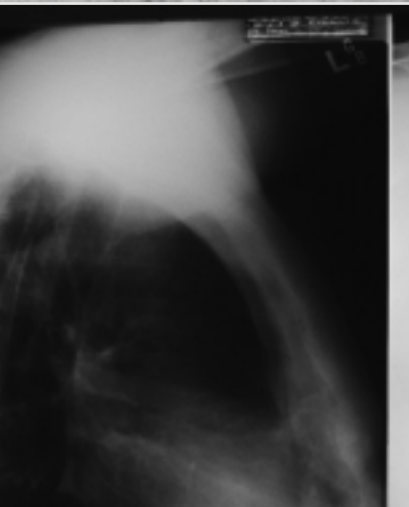
Field research is a primary component of the group's work. Current field sites are in Canada, Siberia, Mexico, Tanzania, Egypt, Italy, Iceland and Greenland. Group members collaborate extensively with researchers in these countries and elsewhere. A particular example is the archaeological project in the Lake Baikal area of Siberia, where researchers are investigating change and continuity in the hunter-gatherer culture of the Middle Holocene period.

The group is well known for its strength in biological anthropology and archaeology. This recognition is reflected in its funding – every member of the group has acquired



17





federal research grants in the past five years. In that time, they have published a total of 52 peer-reviewed articles or book chapters. As well, they act as consultants to government organizations, First Nations, law enforcement agencies and film makers.

Some twenty former graduate students hold tenured or tenure-track positions in universities in Canada and the US. Many others serve in government posts or are engaged in cultural resource management.

*Contact: Associate Dean (Research), Faculty of Arts*

### Plasma Science

Most of the observable matter in the universe is in the plasma (ionized) state. This includes stars, galaxies, our sun, the solar wind, the magnetosphere and the upper atmosphere. Plasma science affects our daily life in many ways. Plasma processing of materials, the technology of lighting and lasers, and plasma for pollution control are important to the electronic, information technology and environment industries. Four decades of studies in plasma science have led to the demonstration of controlled thermonuclear fusion in the laboratory. The long-term challenge lies in the construction of a fusion reactor that will provide an abundant and environmentally safe energy source.

A core group of researchers in the Faculties of Science and Engineering conducts basic and applied studies in plasma physics. The group's current annual funding is \$2.8 million. Five main research areas are: substorms and auroral arc formation, modelling of complex plasma systems using high performance computers, transport in fusion plasmas, forefront x-ray sources and applications, and plasma applications and materials processing.

The group has developed the most complete description of wave processes forming auroral arcs, electric fields and particle acceleration in the auroral accelerator and have been invited to describe their work at numerous international meetings. They have also made many important contributions both in algorithm development and adaptation to parallel computing architectures. These techniques will have a major impact in the areas of controlled fusion research and the influence of space weather on satellites and electrical power systems on Earth. Their nonlocal transport model of controlled thermonuclear fusion is still the most complete description of an electron transport, which is valid over the entire range of particle collisionality.

*Contact: Associate Deans (Research), Faculties of Science and Engineering*



**Members of the University Research Policy Committee and the Research Excellence Working Group:**

Naomi Agard, Terry Allen, Carl Betke, Jeanette Buckingham, Michael Byrne, Mark Dale, Ted DeCoste, Pat Demers, Steve Dew, Mike Enzle, Herb Freedman, Bill Graham, Andy Greenshaw, Royston Greenwood, Neil Hepburn, John Holmes, Mo Jamali, Harvey Krahn, John Langdon, Nancy Lovell, Bill McBlain, Colleen Mead, Don Philippon, Art Quinney, Peter Robertson, Wendy Rodgers, Esmond Sanders, Roger Smith, Paul Sorenson, Joel Weiner, Brad Wuetherick, Francis Yeh, Carolyn Yewchuk, Kory Zwack

Produced by the Office of the Vice-President (Research)  
University of Alberta  
Edmonton, Canada T6G 2J9

(780) 492-5353  
[www.ualberta.ca/vpresearch](http://www.ualberta.ca/vpresearch)

**Writing/Editing:**  
Connie Bryson and Anne Le Rougetel

**Design:**  
Jennifer Windsor, Creative Services, University of Alberta

**Printing:**  
Quality Color Press Inc.

© University of Alberta 2001

