Small Equipment Grants Program Research Outcomes

2006

Annual Report

January 2007

C O N T E N T S

2006 Annual Report

Alberta Advanced Education and Technology

Small Equipment Grants Program

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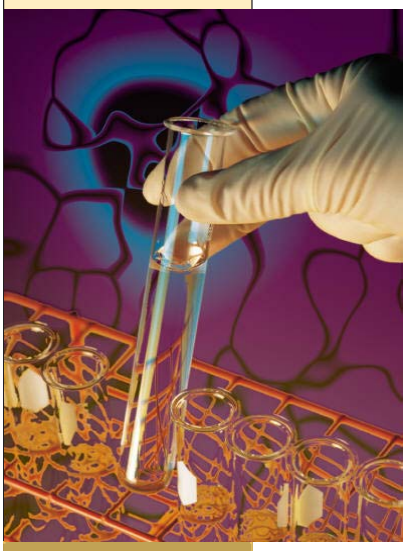


Introduction

People are the most critical factor in successful innovation systems since they are the key drivers behind all aspects of innovation performance. Alberta's ability to attract investment and to capitalize on new technology is in large part dependent on positioning excellent people – researchers, technicians, managers and entrepreneurs – across all aspects of the innovation system.

One of Advanced Education and Technology's primary goals is to: "Build research capacity in areas of strategic priority." In order to realize this goal, Advanced Education and Technology has developed key strategies that focus on investing in people, research infrastructure and strategic initiatives. These strategies are designed to support people by providing them with the leading-edge tools and equipment they require to pursue their research and innovative ideas. The strategies are also designed to leverage research funding, encourage partner investments and foster innovation.

Essentially, building research capacity is providing "people support". Support for both the recruitment and retention of talented researchers and the renewal and expansion of research infrastructure are mutually reinforcing factors which ensure overall research excellence and capacity building in our institutions.

The Alberta Small Equipment Grants Program (SEGP) was developed to address the recruitment of emerging talent and leading researchers to Alberta. SEGP provides start-up equipment support to first-time Alberta academic appointments whose research is highly aligned with Alberta's strategic priority areas of Life Sciences, Energy, and Information and Communications Technology.

Following on the highlighted projects (pages 3 to 11), this report provides details on SEGP's competitive process, and a comprehensive listing of projects and strategic investments (pages 15 to 26).

History of Small Equipment Grants in Alberta

From 2000 to 2004 small equipment grant requests were considered through the Alberta Science and Research Investments Program (ASRIP) and the Strategic Research Initiatives (SRI) funding mechanisms. Proposals were accepted from new recruits to Alberta universities, after submission to the Canada Foundation for Innovation's (CFI's) New Opportunities Program.

In 2005, this same funding approach was formalized in the new Small Equipment Grants Program (SEGP).

As with the earlier initiatives in supporting small equipment grants, development of the SEGP as a key mechanism for supporting the full range of recruitment priorities of high quality researchers not only maximizes leverage of federal funding but also bolsters the strategic priorities of Alberta.

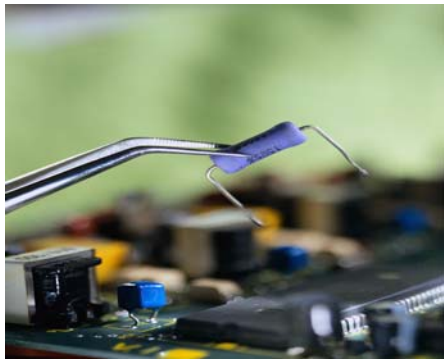
Alberta's research institutions are focused on attracting and retaining the best researchers in Alberta, and Advanced Education and Technology shares this focus. By attracting these highly qualified people with equipment and facilities, the SEGP is creating a climate that builds synergy and collaboration among our leading researchers and providing state-of-the-art training opportunities for graduate students – the next generation of high quality innovators.

SEGP: Research Outcomes

This annual outcomes report highlights selected SEGP investments that have supported successes in providing research infrastructure, recruiting top quality researchers and leveraging research funding. The report outlines the SEGP's cumulative investments through funding competitions held between 2000 and 2006.

During this period, the SEGP strategically invested over $15.5 million in 93 key projects that have significantly increased research capacity in Alberta. The total value of these projects was nearly $51.4 million with the remainder of the funding coming from the federal government, the private sector, and non-Alberta government sources.

Since 2000, SEGP has invested $15.5 million in targeted research projects



01-038 ***'Magnetic Resonance Imaging for the Assessment of Stroke and Other Neurological Diseases'***

Dr. Christian Beaulieu, Department of Biomedical Engineering

Institution: *University of Alberta*

Lead Scientists: *Dr. Christian Beaulieu*

Funding Partners: *Canada Foundation for Innovation, Alberta Heritage Foundation for Medical Research*

SEGP Funding: *$355,000*

Total Project Cost: *$728,438*

SEGP funding helped purchase a research-dedicated magnetic resonance imaging (MRI) scanner that is twice as powerful as a conventional clinical MRI scanner. The research that will result from the infrastructure will focus on the development and application of advanced MRI techniques for the early detection of brain injury resulting from a stroke or other neurological disease. The stronger field allows Dr. Beaulieu to visualize brain injury that is otherwise not detectable.

In addition to providing clinically relevant information, MRI can be used for basic research and thus can improve our understanding of the disturbances caused by, and evolution of, various neurological diseases such as stroke. Stroke, either due to a blockage or rupture of a blood vessel in the brain, is the third leading cause of death and the number one cause of adult disability in Canada. Despite the prevalence and severity of the disease, it is only within the last few years that the first and only approved drug for acute stroke, (i.e. tissue plasminogen activator - tPA , also known as "clot buster") was approved. While there is much excitement in the stroke community about this new therapy, this new drug can be used safely in only a subgroup of patients. Identifying those patients that stand the best chance of benefiting or identifying those patients for whom the drug may be fatal are two situations in which new MRI techniques may have an impact. The new MRI will also monitor the efficacy of 'clotbusters' and evaluate new drug therapies under development. Furthermore, there is much to learn on how the brain responds to and recovers from stroke.

Understanding the evolution and treatment of strokes

The research projects using this equipment range from physics and engineering to biology and medicine. This multi-disciplinary research, exposes students to sophisticated hardware, MRI pulse programming, technique development, data acquisition, image post-processing, data analysis, and application of their developments to a particular physiological problem or disease.

In the clinical studies, there are close collaborations between the research scientists in Dr. Beaulieu's group and clinicians in Neurology and Radiology.

Dr. Beaulieu's lab is part of the In Vivo NMR Facility and utilizes a research-dedicated, state-of-the-art 3T MRI magnet. In the near future, two additional, well-equipped magnets are to be purchased and will expand their research capabilities enormously (a 1 .5T magnet, routine clinical field strength and a 4.7T magnet, the latter being the most powerful field in Canada). The current construction of a new emergency wing in the University of Alberta Hospital will bring the three research MRI units together, creating a unique MRI research center.

The major benefits of the research to Canada will be primarily in highly skilled job creation/training, health care and patient outcomes, and basic knowledge about the human body and disease. Many multi-disciplinary projects on ambulatory patients, primarily with neurological (e.g. Parkinson's Disease, amyotrophic lateral sclerosis, epilepsy) and psychiatric illness (e.g., panic disorder, bipolar disorder, schizophrenia), have been initiated in the new facility, as well as studies on patients with acute conditions, such as stroke.

Since the beginning of the project, 26 postdoctoral fellows and graduate students have used the equipment as a key resource in their research projects. Of these, 16 were recruited to the University of Alberta from other institutions, in part, because of the new facilities.

01-159 ***'Molecular Biology Infrastructure and Cell/Tissue Culture Facilities for Novel BioChemical Engineering Research'***

Neurodegenerative disorders, such as Parkinson's disease, affect millions of people in North America alone. These diseases are treated (vs. cured) at considerable cost, while the transplantation of neural tissue derived from neural stem cells could potentially offer a cure that could save lives. The equipment acquired through this grant is essential for innovative research on the cutting edge of biochemical engineering in animal cell biotechnology.

The long-term benefit to Canada in developing Biochemical Engineering research and facilities is significant. This emerging area has applications in health care, pharmaceuticals, and tissue engineering. One example of a socially relevant, and potentially profitable, project is the neural stem cell project. Neurodegenerative disorders, such as Parkinson's disease, carry a significant social and financial cost. Many of these diseases are caused by the death of specific groups of cells within certain regions of the central nervous system. Until now, a viable cure for these diseases was not available. The transplantation of neural tissue derived from neural stem cells is a potential cure. Curing neurodegenerative disorders would not only dramatically improve the quality of life for millions of individuals around the globe, but over the long term would save billions of dollars in healthcare costs. Researchers in Canada and around the world would use the techniques developed in the new facility. The development of new media and bioreactor protocols for growing neural stem cells has been initiated using this new equipment.

Curing Parkinson's Disease with Gene Therapy

This facility has enabled researchers from medicine, engineering, and the life sciences to collaborate on projects overlapping each discipline. Biochemical and Biomedical Engineering (including genetic engineering, tissue engineering, and bioprocess engineering) are multidisciplinary fields, where it is essential to have an understanding of engineering, biochemistry, genetics and biology in order to excel. Collaborations are a natural extension of this characteristic of biotechnology.

The Pharmaceutical Production Research Facility (PPRF) formed with the help of this funding, is capable of supporting many different long-term projects under one roof. The extensive scale-up capabilities and added analysis equipment have made this a leading-edge bioengineering facility, creating an opportunity for Canada to become a leader in biomedical and biochemical engineering research. This infrastructure also complements the existing BioMedical Engineering Program and has encouraged more collaboration with faculty members from the Faculties of Engineering, Medicine and Kinesiology (currently involved with the BioMedical Engineering Program).

Examples of the inter-disciplinary projects this equipment is being used for include the development of bioreactor protocols for the expansion of mammalian stem cells and the production of human therapeutic proteins from the U of C's newly patented, gene expression system, all of which have potential impact on treatment of neurodegenerative diseases.

The molecular biology work accomplished at this facility has been presented at many international conferences, and 9 students and graduate students have greatly benefited from the infrastructure. It is worth emphasizing that the majority of the above work would not have been possible without this infrastructure.

Dr. Michael Kallos, Department Chemical & Petroleum Engineering (Photo courtesy of Wendy Paramchuk)

Institution: *University of Calgary*

Lead Scientist: *Dr. Michael Kallos*

Funding Partners: *Canada Foundation for Innovation, Alberta Heritage Foundation for Medical Research*

SEGP Funding: *$255,700*

Total Project Cost: *$522,427*

02-115 ***'Establishment of a High-Performance Real-Time Digital Signal, Image and Video Processing Laboratory'***

Dr. Wael Badawy, Department of Electrical Engineering

Dr. Badawy, a professor in the Department of Electrical and Computer Engineering, is in Calgary as a result of provincial government funding for the expansion of Alberta's ICT programs. With the infrastructure provided by the SEGP grant and other funding sources, Dr. Badawy is involved in the field of microelectronics, a key ICT research area in Alberta.

The goal of Dr. Badawy's research is to improve video processing for a wide-range of applications. Specifically, he is researching and developing algorithms that will allow video signals to be compressed and processed in a more efficient manner.

Compressed Video Standards for Faster Communications

In addition to provincial funding, Dr. Badawy used his Petro-Canada Young Innovator Award to develop a system-on-a-chip (SOC) platform for efficiently compressing video. With the new technology, a single SOC might contain sub-components for computer processing, memory, graphics processing and wireless communications.

The move towards SOC technology will require a significant paradigm shift from conventional approaches in system design. Specifically, limitations in bandwidth and battery life are challenges which researchers hope to overcome.

This research has the potential to be applied in the areas such as: digital video and multimedia products (e.g., videophones), biomedical research (e.g., cell motion tracking) and real-time surveillance and monitoring systems (e.g., oil and gas pipeline leak detection).

Dr. Badawy is collaborating with the University of Calgary's Departments of Surgery and Kinesiology to apply novel signal processing techniques to the vibroarthrogram (VAG), which measures the vibrations over a joint (in this case the knee), as it moves. It has been suggested that these signals, which can be acquired non-invasively, may be used in the diagnosis of several joint pathologies.

Very-large-scale integration (VLSI) is the process of creating integrated circuits by combining thousands of transistor-based circuits into a single chip. The server acquired through SEGP funds supports the research of 12 professors in the area of VLSI and microelectronics and more than 100 of their students. Two of the workstations are currently used in the Secure SOC lab where students are working on developing SOC technology. The laboratory is equipped with highly secure intellectual property IP cores that are comparable to an industry setting.

The laboratory has attracted 6 scholarship funded students, and 2 M.Sc. and 4 Ph.D. students.

The equipment supports and expands Alberta's collaborations and visibility in the international ICT arena. At least 13 national and international technical awards have been received by the researchers and students using the equipment provided by the SEGP grant and other funding sources. New collaborations and research projects have resulted in work with Xilinx, CoWare, City of Calgary, MentorGraphix and several local companies. A spin-off company Smart Camera Technologies Inc., was incorporated in March 2003 as a result of the laboratory.

Institution: *University of Calgary*

Lead Scientist: *Dr. Wael Badawy*

Funding Partners: *Canada Foundation for Innovation*

SEGP Funding: *$131,870*

Total Project Cost: *$347,938*

02-119 ***'Foothills Climate Array: Observations and Modelling of Regional Meteorologic Processes and Mesoscale Climate Variability'***

A dense network of backcountry weather stations have been established in the complex terrain of the southern Alberta foothills, providing an unprecedented amount of detail regarding regional-scale meteorological variability. This is improving the basic understanding of the way in which surface environments (e.g., glacier vs. alpine vs. forest vs. prairie vs. city) and topographic conditions (elevation, slope, aspect) impact local and regional weather conditions. The array will be in place until 2012, and the eight year study is expected to inform climate change impact studies for southern Alberta and contribute to scientific understanding of mountain weather and climate.

The more immediate goals of this project lie in improving weather forecasts, climate change impact studies, and ecological sustainability in southern Alberta.

Two M.Sc. students are working with the project and it has just leveraged the recruitment of an exceptional Research Associate from the University of Wisconsin, Dr Amanda Adams. She is working on mesoscale meteorological modeling of southwestern Alberta to complement the data with atmospheric dynamics and physical process insights. This will evolve into a comprehensive climate change impact study for Alberta, and it is anticipated that a faculty position at the Univesity of Calgary will be created to continue research in mesoscale meteorological modeling.

The SEGP funded equipment has also led to training of highly qualified personnel.

A Comprehensive Climate Change Study for Alberta

Since the beginning of the project, 11 undergraduate and graduate students have used the infrastructure as a key resource in their research projects.

Environment Canada and Alberta Environment have been made aware of these research activities. Dr. Marshall has had several meetings with the Meteorological Service of Canada to discuss the application of detailed precipitation measurements in calibration/validation of Doppler radar precipitation forecasts.

The data will also be provided to Alberta Sustainable Resource Development and Banff National Park in the hope that it will be useful for ecological studies in the mountain parks. Additional ecological applications are being explored with Dr. Dan Johnson, a Canada Research Chair in environmental science at the University of Lethbridge.

Dr. Marshall met with the Ontario Weather Network, a private company which monitors weather conditions for the Ontario farm insurance industry and a variety of other organizations (e.g. highways, Canadian Pacific Railway). The Ontario Weather Network may see this project as a bridge for possible commercialization opportunities in Alberta, which indicates that this type of detailed meteorological monitoring may have industrial potential.

Dr. Shawn Marshall, Department of Geography (Photo courtesy of Dave Burgess, University of Alberta)

Institution: *University of Calgary*

Lead Scientist: *Dr. Shawn Marshall*

Funding Partners: *Canada Foundation for Innovation, Canadian Foundation for Climate and Atmosheric Sciences*

SEGP Funding: *$234,002*

Total Project Cost: *$632,960*

02-110 ***'2-Photon/Confocal Microscopy in Voltage-Clamped Respiratory Neurons'***

Dr. Klaus Ballanyi, Departments of Physiology & Pediatrics

Institution: *University of Alberta*

Lead Scientists: *Dr. Klaus Ballanyi*

Funding Partners: *Canada Foundation for Innovation, Alberta Heritage Foundation for Medical Research, University of Alberta*

SEGP Funding: *$518,620*

Total Project Cost: *$1,387,403*

Central respiratory depression constitutes a major clinical problem of infancy. Factors in respiratory depression include treatment of newborns with prostaglandins or opiates and severe hypoxia, which depresses the medullary neuronal network that mediates breathing movements.

In addition, disturbed respiratory network function is likely involved in Sudden Infant Death Syndrome (SIDS). SIDS is the leading cause of death for babies between the ages of 28 days and one year of age.

The aim of the research is to develop a novel pharmacological strategy to treat respiratory diseases. Based upon their current results, Dr. Ballanyi will concentrate on clinically-applicable drugs which react on neurons responsible for modulating respiratory rhythm.

Dr. Ballanyi earned international recognition as a co-discoverer of a previously unknown group of cells in the brain stem that regulates breathing in newborns. He left Germany to continue his research in perinatal neurophysiology at the University of Alberta Perinatal Research Centre (PRC).

New information to prevent 'Sudden Infant Death Syndrome'

Currently, clinicians use high doses of caffeine and theophylin to stabilize the breathing rhythms of infants who are born prematurely. However, if the dose is too high, the infant will have seizures. Using *in vitro* models of the respiratory network of perinatal rodents, Dr. Ballanyi hopes to elaborate a pharmacological strategy that would allow for clinical applications of drugs for stabilizing respiratory rhythms and/or for reversing the respiratory depressing actions of drugs.

With the aid of a two-photon confocal microscope, partly financed by the SEGP grant, Ballanyi intends to find out how the newly discovered complex of cells works. With the equipment, researchers are investigating mechanisms that drive the individual cells and the cell group as a whole. The microscope is powerful enough that it will allow Ballanyi and his colleagues to “excite” living cells with chemicals and light and observe their behaviours.

The newly aquired equipment allows Dr. Ballanyi's research team to watch the cell group’s rhythmic operation as it sends instructions ordering the body to inhale and exhale. That view can then be fine-tuned to isolate cells that seem to initiate the action, and it can be further refined to look at specific parts of those cells at work.

With his many collaborators and with clinical groups at the U of A, Dr. Ballanyi hopes to develop clinical applications for drugs suited for the stabilization of respiratory rhythm and/or for reversing the respiratory depressing actions of other drugs in preterm infants.

02-114 ***'Electromagnetic Instrumentation for Studies of the Continents'***

The infrastructure provided in part by the SEGP grant facilitated research in magnetotellurics, a rapidly developing branch of exploration geophysics.

ASRMagnetotellurics (MT for short) is a remote sensing technique that can image the earth's electrical resistivity structure. This equipment uses natural electromagnetic signals to investigate the earth's crust from a depth of a few 100 metres to more than 100 km.

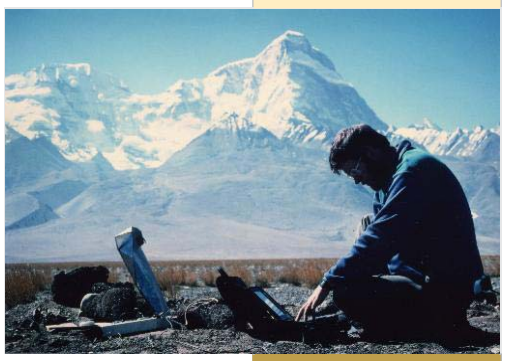
As a result, high-resolution, three-dimensional images generated by these techniques will help researchers understand earthquake dynamics and the faults that cause them. The resulting images of the subsurface structures can be used in a wide range of applications, spanning both academic and commercial studies.

A significant part of Dr. Unsworth's research is directed to understanding the structure of the Earth's crust, with the ultimate goal of evaluating seismic hazards in Canada and overseas. The instrumentation is currently being used in international collaboration to study tectonics and seismic hazards in Turkey, Taiwan and British Columbia.

In addition, the continued development of the magnetotelluric techniques at the University of Alberta will result in an improved tool for use in mineral exploration (both for hydrocarbons and minerals). The results of the research may have implications for diamond exploration in northern Alberta.

Magnetotellurics and related electromagnetic techniques can also be used in environmental geophysics, a developing field that is used to locate aquifers and map contaminants in the shallow subsurface in a non-invasive manner.

Dr. Unsworth's research has the added benefit of strengthening interdisciplinary links both within and outside the University. Interpreting the subsurface resistivity images requires a working knowledge of physics, chemistry and many aspects of geology. His research is fostering links between the Geophysics and Earth Science faculty and students. He has also established collaborations with other Canadian universities and overseas institutions (Turkey, Taiwan and China).



Dr. Martyn Unsworth, Department of Geophysics (Photo courtesy of Ian Billings)

Understanding earth-quake dynamics and the faults that cause them

The research programs that have been developed with the acquisition of the MT instrumentation will result in the training of a significant number of highly qualified personnel. As a result, many students and post-doctoral researchers are being trained to work in the geophysical and environmental industries.

By acquiring the MT infrastructure, Dr. Unsworth and his team are capitalizing on exciting developments in earth science that are giving an ever clearer view of the internal structure and history of the Earth.

Institution: *University of Alberta*

Lead Scientist: *Dr. Martyn Unsworth*

Funding Partners: *Canada Foundation for Innovation, University of Alberta*

SEGP Funding: *$118,423*

Total Project Cost: *$297,302*

03-019 ***'Single cylinder engine testbed facility for innovative internal combustion engine research'***

Dr. Bob Koch, Department of Mechanical Engineering

Infrastructure aquired through the SEGP grant has led to studies to control car engine valves electronically, so that fuel can be burned more efficiently and according to operating conditions.

Engine valves, which release a mixture of fuel and air into cylinders where it is burned, are normally operated mechanically according to fixed time rates set by a cam. As the engine changes speed or load, a corresponding change in the timing will greatly increase engine efficiency. A fully variable valve timing technology which is all electronically controlled will allow for better control of combustion in the car's engine.

The variable valve-timing system would run exceptionally well on high-octane fuel, but would also run successfully on lower-grade fuels. In such a mode, a vehicle would switch to a lower grade fuel once it's cruising down the highway and would thus realize greater fuel efficiency for the consumer.

New internal combustion engines that run without spark plugs

To achieve this goal, Dr. Koch and his research team are investigating a Homogeneous Charge Compression Ignition (HCCI) is a promising new combustion concept for internal combustion engines in which a homogeneous air-fuel mixture auto-ignites without a spark. HCCI has a premixed charge like a spark-ignition engine but the ignition is triggered by the chemical kinetics similar to a diesel engine.

The auto ignition in an HCCI engine must take place at the correct engine timing to maximize the useful mechanical work output and to avoid damaging mechanical stresses on the engine. To effectively control HCCI combustion, an improved understanding of the HCCI combustion and the methods of control are needed.

The problem becomes even more complex when variations in temperatures and pressures are present due to changing engine speeds and loads. It is thus essential to experimentally measure HCCI combustion under varied conditions.

Dr. Koch's research team are generating unique experimental data useful for modelling, and to develop computational tractable models that can be used to develop engine control strategies for HCCI combustion.

Dr. Koch's team has two masters students and two undergraduate students doing preliminary work on controlling the currents to the valves.

The research has also led to some interesting collaborations nation wide. Koch, his research associate, Dr. Checkel, and a team of researchers from Simon Fraser University and the University of Windsor have received grants totalling $986,000 from the AUTO21 Network of Centres of Excellence--a federal program that supports auto-related research at universities across the country - and the Canada Foundation for Innovation. They've also received $50,000 from Ford Canada and some parts supplied by Mercedes Benz.

Institution: *University of Alberta*

Lead Scientist: *Dr. Bob Koch, the University of Alberta*

Funding Partners: *Canada Foundation for Innovation,*

SEGP Funding: *$180,806*

Total Project Cost: *$602,686*

03-035 ***'Research Infrastructure for Asymmetric Catalysis and Supramolecular Chemistry'***

Funds provided by the SEGP along with additional support from the federal government and the private sector, have enabled Dr. Grace Greidanus-Strom to initiate an experimental research program in chemistry.

This infrastructure is located in the King's Centre for Molecular Structure (KCMS) and has enhanced both the Centre's and this researcher's ability to serve Canadians by providing scientific expertise and instrumentation to tackle important research questions in chemistry and biochemistry.

Dr. Greidanus-Strom's research program focuses on increasing fundamental knowledge of transition metal chemistry, with applications such as finding novel catalysts for asymmetric synthesis of pharmaceutical compounds and new materials with unique structure and molecular recognition properties.

The infrastructure is essential to provide the tools needed for the preparation of novel air- and moisture-sensitive compounds and the analysis and separation of chiral molecules.

The infrastructure supports other current research projects including:

1. investing basic metabolism processes in plants, so we can understand more about how plants respond to stresses like drought and climate change

2. eliminating impurities produced by industrial processes in the pulp and paper and fertilizer industries that have an environmental impact

3. characterizing biologically active components of medicinal plants in East Africa

Social and economic benefits have been realized through new collaborations supported by this infrastructure between KCMS researchers, the environmental sector and the fine chemicals industry. Recently, a collaboration with KCMS researchers was initiated in an ongoing investigation on particulate borne polycyclic aromatic hydrocarbons (PAH's) from forest fires. Results from this collaboration will be critical in the development of environmental policies related to the practice of controlled forest burns.

Research training of undergraduate students at The King's University College is of vital importance to Canada as this training contributes significantly to the country's need for highly qualified personnel.

Characterizing the metabolic pathways that allow plants to withstand drought

During the first two years of operation, eight undergraduate students benefited from the infrastructure and four technical personnel were trained to use the equipment. These unique skills are in increasing demand in the private sector, particularly in the pharmaceutical, chemical and agricultural industries.

Dr. Grace Greidanus-Strom, Department of Chemistry

Institution: *King's University College*

Lead Scientist: *Dr. Grace Greidanus-Strom*

Funding Partners: *Canada Foundation for Innovation,*

SEGP Funding: *$36,530*

Total Project Cost: *$123,479*

01-103 ***'Creation of a Multidisciplinary 3-Dimensional Morphometrics Facility'***

Dr. Hallgrimsson *(second from the right)* ***and his team at the 3-D Morphometrics Lab***

Dr. Hallgrimsson is a biological anthropologist and evolutionary biologist who combines developmental genetics with morphometrics. Morphometrics is the branch of mathematics studying the metrical and statistical properties of shapes and shape changes of geometric objects like molecules, fossils, brains, bird wings, and modern cars.

The microtomography system is supported by a computer infrastructure which reconstructs the raw microtomography output and stores the volumetric 3-D image data for analysis.

The 3-D imaging infrastructure provided by the SEGP grant comprises a laboratory setup designed to allow the collection and analysis of shape and size data in 3 dimensions from a variety of objects. The main themes of research supported by the infrastructure are biomedicine, biological anthropology, archaeology, paleontology and evolutionary biology research.

Using 3-D imaging to study and identify human bones

His current work focuses on the role of phenotypic variability in craniofacial dysmorphology in mice. One medical application of Hallgrimsson's work enables predictions to be made of the success of the reconstructive surgery of the human face.

The infrastructure has led to a close collaboration between engineer Steve Boyd, rheumatologist Frank Jirik and Dr. Hallgrimsson investigating bone diseases including analysis of cancer metastases in the bone. Other collaborations involve food sicence, bone biology, biomechanics, developmental biology, and bioinformatics. The infrastructure has contributed significantly to encouraging such interdisciplinary research.

Dr. Hallgrimsson's group is currently examining the possibility of commercializing software developed specifically for use with this imaging equipment. This software has much wider applicability in medical imaging and was developed through a multidisciplinary approach using evolutionary biology, morphometrics, engineering and bioinformatics.

The 3-D Morphometrics Lab has become known for innovation in morphometrics and imaging. This is evidenced by their quality and number of publications in this area and invitations to prestigious international conferences. Recently, Dr. Hallgrimsson has been invited to present his work, which merges morphometric assessment of skeletal shape in embryonic and postnatal mice with developmental biology at conferences in California, London and Vienna.

The new infrastructure supports basic and biomedical research and contributes to the growth of knowledge and to improvements in human health. Training of high quality personnel in the analysis of 3-D image data is an important benefit. Since the beginning of the project, 25 postdoctoral fellows and graduate students have used the infrastructure as a key resource in their research projects. Of these 25, 10 came to the University of Calgary from other institutions, in part, because of the new infrastructure at the 3-D Morphometrics Lab.

Institution: *University of Calgary*

Lead Scientist: *Dr. Benedikt Hallgrimsson*

Funding Partners: *Canada Foundation for Innovation, University of Calgary*

SEGP Funding: *$235,624*

Total Project Cost: *$802,952*

The Program

As this report illustrates, the SEGP serves as an important mechanism for leveraging funds from the federal Canada Foundation for Innovation (CFI), the private sector and other sources in order to maximize the research dollars flowing into Alberta.

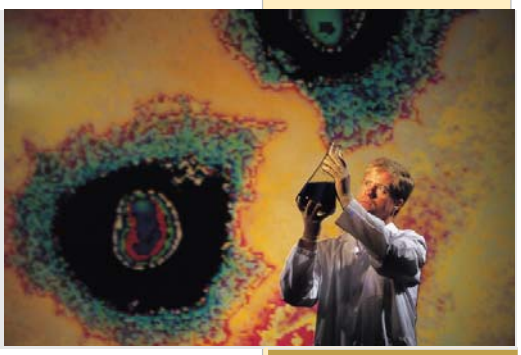
The province's universities are invited to submit their recruitment nominees for CFI Leaders Opportunities Fund awards to the Small Equipment Grants Program. There are three submission dates, March, July and November to coordinate with the CFI's three annual submission dates (with SEGP decisions preceding the CFI dates by three months per cycle). Such coordination strengthens Alberta's small equipment submissions in areas of strategic importance to the province. SEGP applications are assessed for research excellence and alignment with Alberta's strategic priorities, as identified by the Alberta Science and Research Authority (ASRA). The three strategic areas of priorities are:

- Energy;
- Life Sciences (the key components are health and wellness, agriculture/food/forestry and environment); and
- Information and Communication Technology (ICT).

SEGP's targeted research areas are: Energy, Life Sciences, and ICT

Proposals undergo an external peer review by leading scientists from around the world and are reviewed by individual members of the SEGP Scientific Review Panel. The Panel is comprised of members with multidisciplinary expertise and academic and industrial research, within and external to the province. Proposals are also reviewed for alignment with Alberta priority areas of research.

The Minister of Advanced Education and Technology makes the final funding decisions, based on the recommendations of the SEGP Scientific Review Panel.



Since its inception, SEGP has made targeted investments in Life Sciences ($8.3 million), Information and Communication Technology ($1.7 million), Energy ($1.4 million), while supporting multi-disciplinary projects ($4.1 million). Multi-disciplinary projects are often related to one or more of the priority areas and include platform technologies such as nanotechnology.

A total of 93 applications were funded since 2000. Funding details are displayed in Figures 1 & 2. A listing of all SEGP projects funded from 2000 to 2006 is detailed in Appendix 1.

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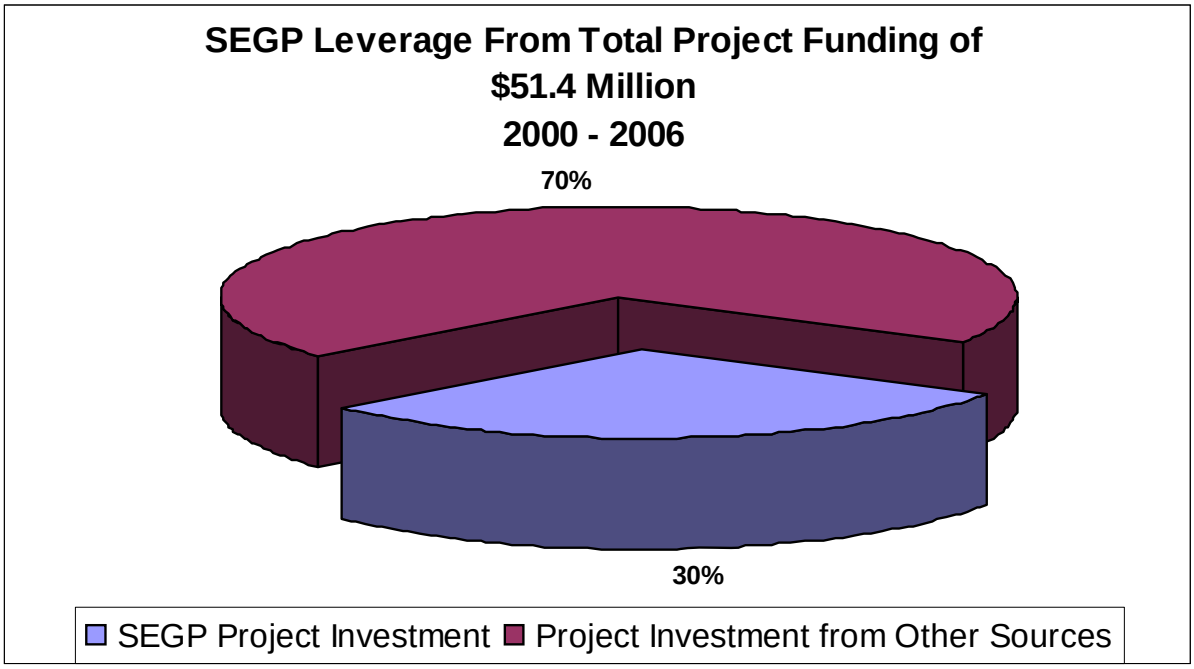
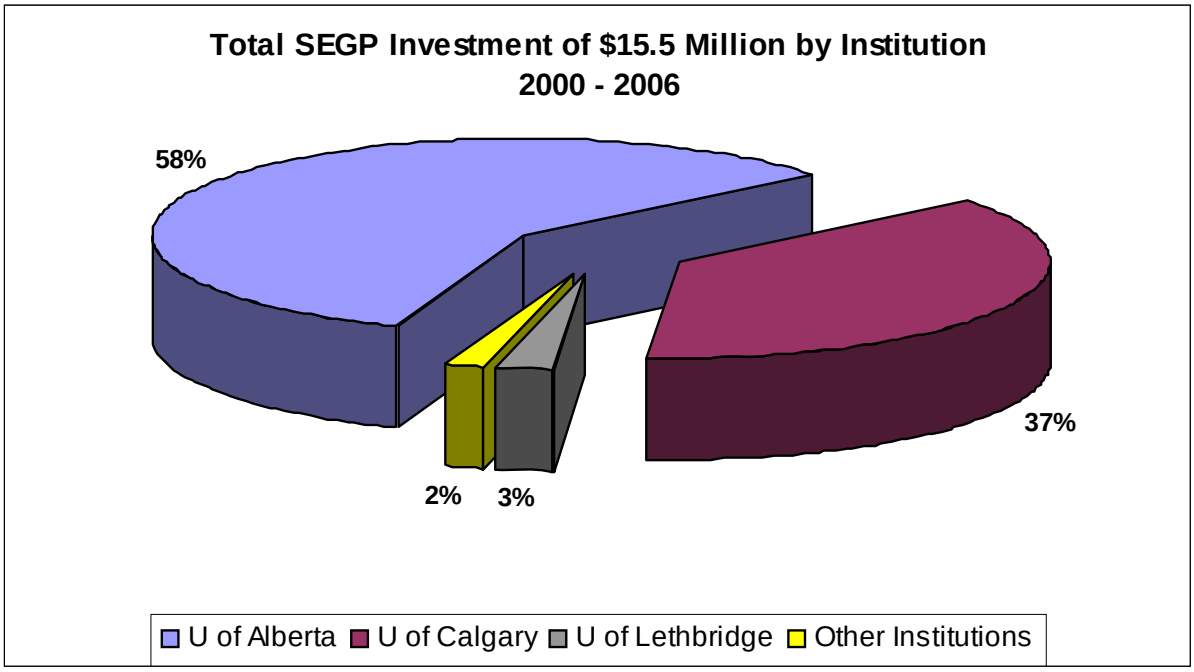
For more information visit our website at: www.innovation.gov.ab.ca

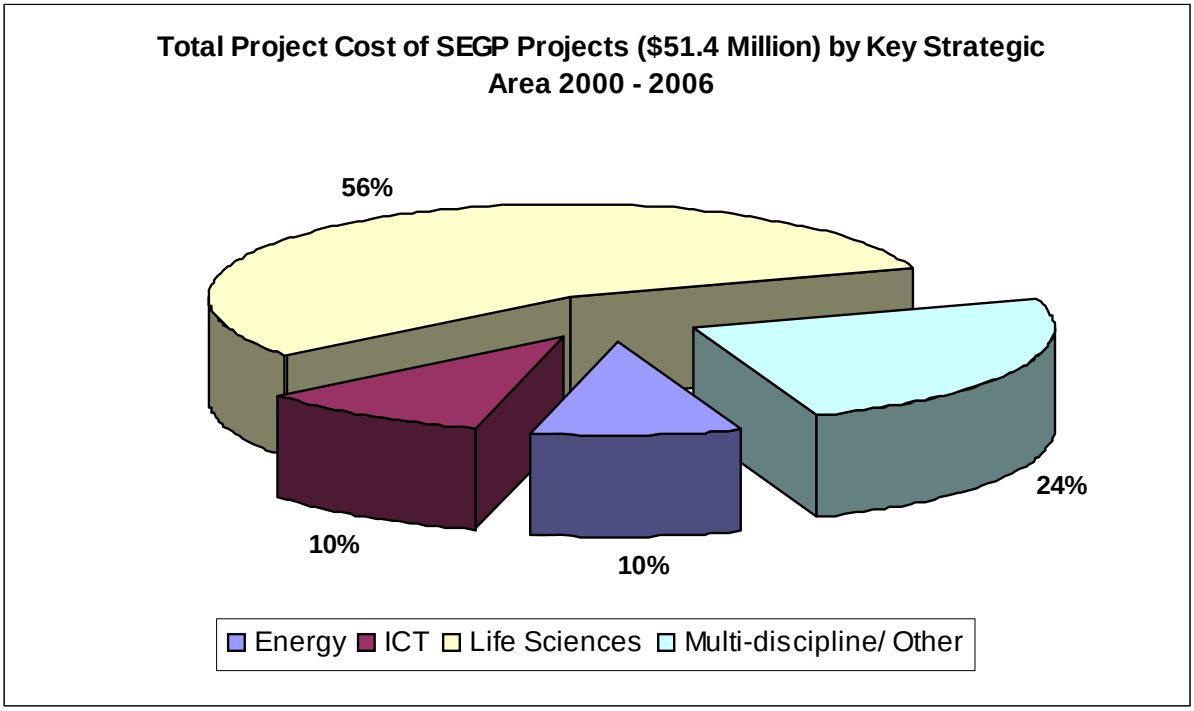
Figure 1
SEGP's Strategic Investment's – Leverage from Total Project Funding and Investment by Institution

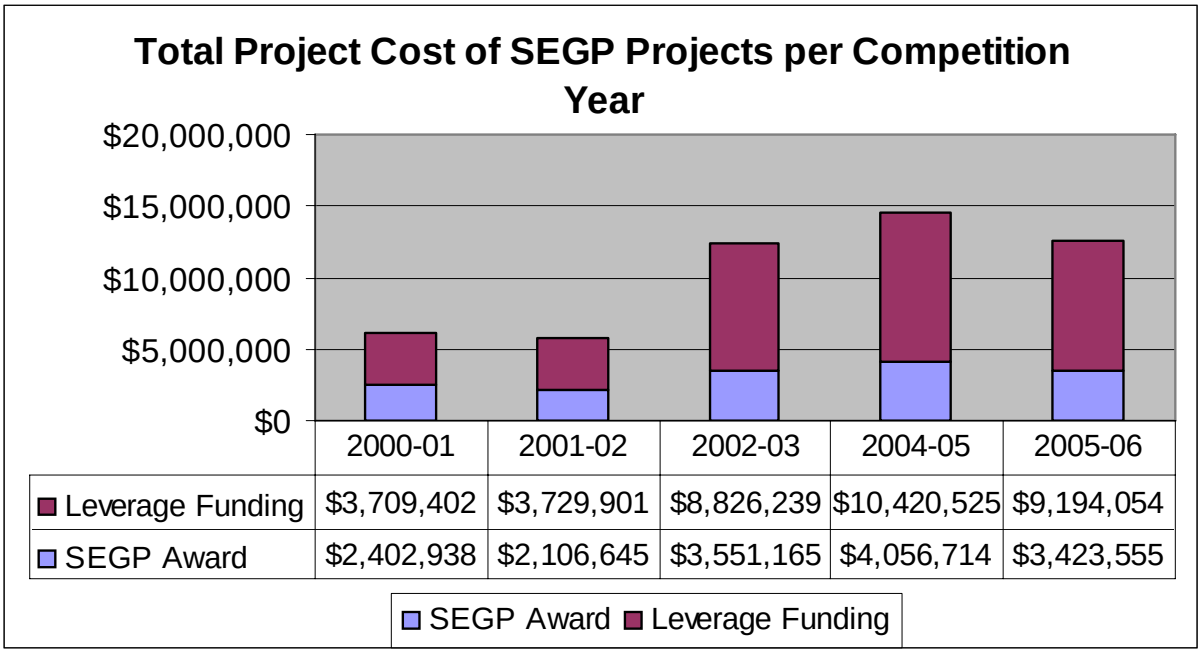




Since 2000, SEGP has leveraged nearly $36 million from other institutions in support of research. The three main institutions supported were the U of Alberta, the U of Calgary and the U of Lethbridge.

Figure 2
SEGP's Strategic Investment's – Research Capacity in Key Strategic Areas and Total Project Cost per Year





Since 2000, SEGP has supported projects in Life Sciences ($28.5 million-56%), Information and Communication Technology ($5.4 million-10%), Energy ($ 4.9 million-10%) and Other/Multi-disciplinary ($12.6 million-24%). Other research areas supported include: climate change/ environment, science awareness, engineering and technology commercialization. SEGP's total project cost has risen from $6.1 million in 2000/ 01 to a high of $14.5 million in 2004/05.

Appendix 1
Small Equipment Grants Program/ New Opportunities Program
Approved Projects 2000-2006

Project Number	Project Title	Descriptive Summary	Lead Organization	Project Leader	Total Project Cost	SEGP/New Opps Funding Approved	Key Strategic Area
01-038	Magnetic Resonance Imaging for the Assessment of Stroke and Other Neurological Disease	MRI techniques will play a critical role in understanding the evolution and treatment of strokes in humans. The goal of our proposal is to acquire the infrastructure needed to facilitate the development of a state-of-the-art MRI stroke research program a the U of A.	University of Alberta	Beaulieu, Christian	$728,438	$355,000	Life Sciences
01-039	Electrospray ionization - high field asymmetric waveform ion mobility spectrometry - tandem mass spectrometry (ESI-FAIMS-MS/MS)	ESI-FAIMS-MS/MS is a promising new technique for identification and characterization of polar compounds in complex matrices. The infrastructure will be used for human exposure research on disinfection by-products and metabolites, cyanobacterial toxins, gas/oil well flare emissions, and arsenosugars and metabolites in seafoods	University of Alberta	Froese, Kenneth	$497,083	$197,614	Life Sciences/ Energy
01-053	Cardiovascular Ion Channel Gene Therapy Unit	CIGNET is a core molecular physiology facility dedicated to the study of the role of cardiovascular potassium channels in health and disease. Research will range from molecular biology to whole animal and human physiology. CIGNET will support translational research on common diseases (eg. Sudden Infant Death Syndrome and hypertension).	University of Alberta	Michelakis, Evangelos	$806,498	$320,000	Life Sciences
01-056	Biotelemetry analysis system: infrastructure for cumulative effects assessment.	The infrastructure combines new space-based technology with sophisticated statistical computing and modeling to develop a powerful new tool for evaluating the cumulative effects of land-use development on wildlife populations. This new tool can be applied to a host of species and adapted to landscapes worldwide.	University of Alberta	Boyce, Mark	$860,815	$200,000	Life Sciences
01-060	Infrastructure for deposition and characterization of combinatorial arrays of thin-film inorganic compounds and opto-electronic devices	Construction of a deposition system to define and control the composition and architecture of combinatorial arrays of inorganic thin films and thin film heterojunctions for photovoltaic applications. Optical and electron beam induced current (OBIC & EBIC) instruments will be constructed to provide a rapid screening technique.	University of Alberta	Haber, Joel	$1,288,622	$540,000	Energy/ ICT
01-103	Creation of a Multidisciplinary 3 Dimensional Morphometrics Facility	Infrastructure to create a multidisciplinary laboratory for 3 dimensional morphometics. Components include a Micro CT,Reflex microscope and facilities for image analysis. Facilities will be used by researchers across faculties at UofC & UofA.	University of Calgary	Hallgrimsson, Benedikt	$802,952	$235,624	Life Sciences
01-112	Advanced Space Instrument Facility	The facility consists of a combination of expertise and specialized equipment for the design, evaluation and operation of micro-satellites and satellites. The infrastructure was used to upgrade an existing U of C lab into a world-class space science facility. ASIF's design capability includes electro-optical detectors, optical instrumentation, and space plasma instruments.	University of Calgary	Yau, Andrew	$605,505	$299,000	Other/ Multi-discipline

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01-159	Molecular Biology Infrastructure and Cell/Tissue Culture Facilities for Novel BioChemical Engineering Research	Will build on a proven track record in the biotechnology field and pursue innovative projects in upstream, process and downstream biochemistry engineering and will serve as a versatile and powerful analytical facility for other researchers.	University of Calgary	Kallos, Michael	$522,427	$255,700	Life Sciences
02-081	Plant Biotechnology Infrastructure: Applications of Molecular Biology and Gene Expression Assays	Develop a plant molecular biology laboratory. Key pieces of equipment include plant growth chambers, specialized camera systems, microscopes and specialized equipment to support molecular research approaches.	University of Lethbridge	Kovalchuk, Olga	$433,234	$171,825	Life Sciences
02-110	2-Photon/Confocal Microscopy in Voltage-Clamped Respiratory Neurons	Infrastructure to understand perinatal respiratory network functions, sudden infant death syndrome and other life-threatening diseases associated with disturbed neuronal respiratory functions.	University of Alberta	Ballanyi, Klaus	$1,387,403	$518,620	Life Sciences
02-111	Centre for Symbolic Computation	Development of software for symbolic computation for use in applied mathematics and in high energy and condensed matter physics, computational fluid dynamics, and electrical and chemical engineering.	University of Alberta	Czarnecki, Andrzej	$364,574	$133,835	ICT
02-112	Development of a Core Facility for Spatial Applications of Social Ecology	Development integrative models that involve both socio-economic and environmental variables for improved environmental and natural resource management planning.	University of Alberta	Davidson, Debra	$505,400	$173,240	Life Sciences
02-113	Laboratory for perceptual motor behaviour in Down syndrome and other special populations	A laboratory that is committed to the study of perception and human movement within special populations and across various levels of analysis.	University of Alberta	Maraj, Brian	$359,086	$100,000	Life Sciences
02-114	Electromagnetic Instrumentation for Studies of the Continents	Infrastructure for subsurface imaging techniques with natural electromagnetic signals for use in earthquake hazard research, tectonics studies, mineral exploration and environmental studies.	University of Alberta	Unsworth, Martyn	$297,302	$118,423	Life Sciences/ Energy
02-115	Establishment of a high-performance real-time digital signal, image and video processing laboratory	Creation a low cost automated intelligent sensors network with research and development in Real Time Digital Signal Processing, Multimedia Information Appliance Network, and Systems Identification and Advanced Control Systems.	University of Calgary	Badawy, Wael	$347,938	$131,870	ICT
02-116	Thermal Science Facilities	Experimental and computational facilities to perform research in the energy environment.	University of Calgary	Mohamad, Abdulmajeed	$366,379	$144,340	Energy
02-117	High-Field Magnetic Resonance Imaging for Vascular Diagnosis and Intervention	Clinical medical imaging research in the areas whole body imaging and vascular imaging.	University of Calgary	Frayne, Richard	$723,308	$220,000	Life Sciences
02-119	Foothills Climate Array; Spatial Array of Meteorological Instruments to Study Mesoscale Climatological Processes, Precipitation and Air Temperature Variability, and Regional Climate Change	Study of regional weather variability and the underlying climatic processes to improve process parameterizations in models and provide insight 'downscaling' of climate model predictions to the scales of impact for human development and the environment.	University of Calgary	Marshall, Shawn	$632,960	$234,002	Life Sciences/ Energy
02-120	The Experimental Economics Laboratory at the University of Calgary	A facility for innovative research on decision-making and market institutions with direct relevance to economic and social policy.	University of Calgary	Oxoby, Robert	$418,962	$160,490	Other/ Multi-discipline

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03-010	Equipment for Field Studies of Competition Ecology and Stand Dynamics in Western Boreal Forests	Development of the Mixedwood Growth and yield Models (MGM) and evaluation of the growth and yield implications of different silvicultural and management systems for Alberta's forests.	University of Alberta	Comeau, Philip	$334,476	$100,343	Life Sciences
03-011	Chemical and Biological Nanotechnology	Developing nanotechnological techniques which will use pathogens such as viruses to map the surface of human cells with nanometer resolution and, in turn, aid in the development of new drug therapies to combat infections.	University of Alberta	Green, John-Bruce	$1,159,096	$345,314	Life Sciences
03-012	Infrastructure for Flow-Surface Interaction Laboratory	Infrastructure to support research in fluid mechanics, turbulence, and combustion with research projects related to oil and gas production and refining, industrial and residential furnaces as well as IC engines and gas turbines.	University of Alberta	Fleck, Brian	$558,472	$166,861	Energy
03-014	Protein production and crystallisation facility for structural biology research	Protein crystallography poses challenges because proteins are unstable, soft molecules and require perfect conditions to crystallize. Hundreds of crystals are created with the help of a robot in the hope of finding perfect crystals that will reveal protein structures.	University of Alberta	Hazes, Bart	$684,988	$213,563	Life Sciences
03-015	Infrastructure for Establishing an Information Research Laboratory	Dr. Li's research interests are statistical genetics and genomics. In particular he is developing statistical methods to find genes responsible for complex human diseases, using either family or population based approaches. The laboratory is also used for statistical computing and modeling of reaction diffusion systems that arise in biological models.	University of Alberta	Li, Michael	$350,000	$105,000	Life Sciences
03-016	Manufacturing, Modeling and Control of Solid Oxide Fuel Cells	This research will concentrate on fundamental dynamic modeling with the objective of determining optimal designs and operating profiles. As electric vehicle power sources, the dynamic behavior of the batteries or fuel cells sets the limits on achievable performance.	University of Alberta	Meadows, Edward	$706,542	$211,963	Energy
03-017	Microinterfacial and Micromechanical Facilities	The infrastructure will support colloidal and interfacial science in general, and small scale interfacial phenomena or microinterfacial phenomena in particular. Here, "small scale" implies dimensions on the order of one to ten micrometers. Many important systems in industrial and biological applications appear in the form of liquid-liquid dispersions, i.e., the dispersion of micrometer-sized liquid drops in a distinct (often immiscible) liquid.	University of Alberta	Yeung, Anthony	$318,906	$95,407	Life Sciences/ Energy
03-018	Laboratory for visualization, monitoring and human interaction with intelligent machines and robots	Infrastructure to support work related to the areas of machine and biological vision, pattern recognition, robotics, and artificial intelligence. A human can easily pick up a visible object, and can even watch a whole task, learn, and transform the visual information into the necessary motor (muscle) movements to carry out the task.	University of Alberta	Jagersand, Martin	$750,000	$210,000	ICT
03-019	Single cylinder engine testbed facility for innovative internal combustion engine research	Infrastructure to study the behaviour of internal combustion engines and fluid systems and the application of control to these systems. Homogeneous Charge Compression Ignition (HCCI) is a promising new combustion concept for internal combustion engines in which a homogeneous air-fuel mixture auto-ignites without a spark.	University of Alberta	Koch, Charles	$602,686	$180,806	Energy

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03-020	Laboratory facility for biogeochemical studies of soil organic matter	Infrastructure to investigate the main components of the soil biota; the metabolic and molecular diversity of microbial populations and their role in soil processes; the microbiology and biochemistry of decomposition of organic matter in soil; kinetics of organic matter turnover; biogeochemical cycling of N, P, S, Si, base cations and metals; and the application of soil microbiology to selected environmental problems.	University of Alberta	Quideau, Sylvie	$488,045	$146,414	Life Sciences
03-021	Laboratory for the Design, Modeling, and Nonlinear Control of a Self-Bearing Motor	Infrastructure to investigate the modeling and control of a related system called the self-bearing motor (SBM) (sometimes also called a bearingless motor or integrated motor-bearing). The SBM is an emerging technology which has evolved from traditional active magnetic bearings (AMB) and electric motors.	University of Alberta	Lynch, Alan	$552,698	$165,809	Energy
03-022	Infrastructure for Fundamental Heterogeneous Catalyst Research	The surface chemistry of a catalyst is studied to predict the activity and selectivity for a variety of applications in the chemical process industry. This infrastructure will be used to investigate the surface chemistry of model heterogeneous catalysts for the petroleum and energy sectors, including bitumen upgrading and hydro treating, and direct oxidation solid-oxide fuel cell development.	University of Alberta	Nelson, Alan	$485,311	$145,560	Energy
03-023	Novel approaches to better understanding forest soil processes and their implications for forest productivity and global change	Infrastructure to investigate forest soil processes, soil microbial ecology, forest fertilization, tree nutrition, and silviculture-soil management interactions.	University of Alberta	Chang, Scott	$521,349	$155,658	Life Sciences
03-024	Molecular physiological analysis of voltage-clamped respiratory neurons	Infrastructure to understand basic mechanisms of neuronal information processing within respiratory networks. The lab is trying to understand how neurons and networks of neurons in the brainstem and spinal cord produce a breathing rhythm that is not only reliable and robust, but is also very dynamic.	University of Alberta	Funk, Gregory	$1,075,242	$280,792	Life Sciences
03-025	Development of a Wireless Network Testbed	Infrastructure to enhance user experience of wireless services and applications through research and development of innovative wireless networking protocols. Wireless provides flexibility and enables anytime, anywhere communications. Applications of wireless communications range from high power mobile cellular systems to low power personal area networks (e.g., Bluetooth-based networks).	University of Calgary	Fapojuwo, Abraham	$567,357	$150,000	ICT
03-026	Laboratory of Human Cerebrovascular Physiology	Infrastructure to better understand the physiological mechanisms that underlie the regulation of cerebral blood flow (CBF) by oxygen and carbon dioxide in young healthy humans, and to investigate the age-related alterations in this regulation.	University of Calgary	Poulin, Marc	$913,855	$219,002	Life Sciences
03-027	Development of Microarray Systems Using an Archaebacterial Model	Development a software package called Osprey for the calculation of optimal oligonucleotides for DNA sequencing and the creation of microarrays based on either PCR-products or directly spotted oligomers. It incorporates a novel use of position-specific scoring matrices, for the sensitive and specific identification of secondary binding sites anywhere in the target sequence.	University of Calgary	Sensen, Christoph	$270,158	$80,083	Life Sciences

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03-028	Instrumentation for Ultra Precision Dynamic Identification, Optimization and Prototyping of Microsystems Technology and Nanotechnology Based Devices	Work in the area of Noninvasive Precision Metrology, providing a foundation for the development of advanced sensing and estimation techniques applicable in ultraprecision machine tools, microelectromechanical systems (MEMS), microtechnology based energy and chemical systems (MECS), and nanoscale devices.	University of Calgary	Spiewak, Slawomir	$354,212	$105,480	ICT
03-029	A Microscopy System to Measure Vascular Communication	Infrastructure to study the nature of electrical and diffusional communication between smooth muscle and/or endothelial cells. Cell-to-cell communication is central to blood flow control and this process is enabled by intercellular ion channels called gap junctions. Work with cell-to-cell communication involves a combination of experimental techniques and mathematical modeling.	University of Calgary	Welsh, Donald	$446,962	$133,231	Life Sciences
03-030	In-vivo high resolution computed tomography centre for bone and joint injury research	Develop quantitative non-invasive methodologies to understand the etiology of musculoskeletal diseases and injuries, and to use that information for the development of improved treatment strategies. An important tool for much of their research, high resolution computed tomography (micro-CT) is a non-destructive method to image complex 3D structures.	University of Calgary	Boyd, Steven	$625,196	$164,055	Life Sciences
03-033	Creation of Biometric Technologies Laboratory	The laboratory emphasizes on modeling and generation of synthetic biometric information, and on testing the biometric devices and systems. The Lab focuses on synthesizing biometric data – for example, modeling fingerprint and signature forgeries as well as aging or surgically changed faces - which are then used for testing biometric systems.	University of Calgary	Yanushkevich, Svetlana	$488,374	$139,295	Life Sciences/ ICT
03-035	Research infrastructure for asymmetric catalysis and supramolecular chemistry	The infrastructure will support developing catalysts to assist in the design of pharmaceutical products; understanding basic metabolism processes in plants, so we can learn more about how plants respond to stresses like drought and climate change; eliminating impurities that have environmental impact from industrial processes in the pulp and paper and fertilizer industries; and characterizing medicinal plants in East Africa.	King's University College (The)	Greidanus-Strom, Grace	$123,479	$36,530	Life Sciences
05-010	ODEPR System for Novel Studies of Semiconducting Materials	The Optical Detection of Electron Paramagnetic Resonance (ODEPR) equipment is located in the Magneto-Optical Spectroscopy laboratory in the U of A Physics Department. One of the primary research interests of the group is the study of the fascinating physics of bulk and nano-scale semiconductor structures and devices.	University of Alberta	Chow, Kim	$542,187	$102,534	ICT
05-011	Nano-Designed Materials through Structural Chemistry	The research program is focused upon synthesis, characterization and application of small molecule precursors suitable for fabrication of monodispersed nanoparticles via solution borne chemistry. The resulting materials are suitable for a wide scope of applications including: DNA testing, organic light-emitting diodes (OLEDs), lasers, catalysis, nanoelectronics, and optoelectronics.	University of Alberta	Veinot, Jonathan	$362,046	$91,218	Life Sciences/ Energy/ ICT

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05-012	Development of a Real-Time Digital Simulation and Control Laboratory for Innovative Research in Power Engineering	New technologies based on sophisticated power electronic apparatus and their digital control systems are finding increasing applications in electric power systems at generation, transmission, distribution, and utilization levels. It is essential to carry out rigorous performance evaluation of the power electronic equipment and their digital controllers prior to their commissioning on the host power system.	University of Alberta	Dinavahi, Venkata	$500,857	$148,709	Energy/ ICT
05-013	Proteomic analysis of the cardiovascular system in hypertension	Infrastructure to develop a systems biological approach to the study of hypertension. The systems biological approach employs proteomics and computation as well as integrative physiology and pharmacology. The lab is testing the hypothesis that hypertension could result from the perturbation of just a few, yet fundamental, mechanisms of vasoregulation.	University of Alberta	Fernandez-Patron, Carlos	$441,431	$132,429	Life Sciences
05-014	Nanoscale Functionalization of Semiconductor Surfaces	Infrastructure for unique, unpredictable and highly intriguing physical, optical and electrical phenomena which result from the confinement of matter into nanoscale features. Much of the driving force for building tiny devices and features on the nanoscale is their importance for existing and emerging technologies such as microelectronics, nano-electromechanical systems (NEMS), sensors and diagnostics which communicate directly with cells, viruses and bacteria, quantum confinement effects, and a host of other applications.	University of Alberta	Buriak, Jillian	$707,130	$238,320	Life Sciences/ Energy/ ICT
05-015	Proteomics Tools for Plant Research	Microarrays are a new technology for measuring the levels of activity for thousands of genes at once. The group is also studying the process of tracheary element (wood) differentiation, and the structure and function of introns. This involves techniques of genetics, bioinformatics, and molecular biology, including high-throughput technologies such as DNA microarrays.	University of Alberta	Deyholos, Michael	$760,878	$228,263	Life Sciences
05-016	Infrastructure for Establishing a Communications Research Laboratory (CRL)	Infrastructure supports the fundamental theoretical research on space-time coded multicarrier modulation and ultra-wideband impulse radio, as well as the practical simulation, experiment and implementation of these cutting-edge technologies. The research will address critical physical layer issues in the development of future generation high data rate mobile communications and high speed wireless personal area networks.	University of Alberta	Tellambura, Chintha	$372,908	$135,143	ICT
05-017	Reconfigurable Testbed for High Performance Parallel Data Mining	Infrastructure to support research interests in computational intelligence (especially fuzzy logic and granular computing), data mining, and their application to software testing and epidemiology.	University of Alberta	Dick, Scott	$744,133	$250,000	ICT
05-018	In vivo imaging system for assessing intestinal microvasculature during inflammation	The infiltration of white blood cells into tissue is a key factor in the development of gastrointestinal inflammation. Dr. McCafferty's laboratory investigates the role of white blood cells in causing macroscopic/histological and epithelial permeability changes in various inflammatory models e.g. in response to bacterial products (LPS) and in experimental models of colitis.	University of Calgary	Mccafferty, Donna-Marie	$258,693	$69,134	Life Sciences

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05-019	Laboratory for Environmental Catalytic Applications	Dr. Josephine Hill (Faculty of Engineering) is researching catalyst applications for fuel cells and heavy oil processing. Currently most fuel cells operate with hydrogen as the fuel. Hill's research team is developing fuel cells that can use hydrocarbons, such as methane from natural gas, or alcohols, derived from biomass, directly as fuels in order to reduce emissions.	University of Calgary	Hill, Josephine	$521,905	$141,000	Energy
05-020	Tools for applied electromagnetics research	Infrastructure to support research in the area of computational electromagnetics, and their application to problems in the realms of electrical engineering, optical engineering, and bioelectromagnetics. The electrical and computer engineering professors are studying the interaction of electromagnetic fields and living biological systems. Specifically, Fear, Potter and their colleagues are exploring a new approach for breast cancer detection called tissue sensing adaptive radar (TSAR).	University of Calgary	Fear, Elise	$647,214	$265,127	Life Sciences/ ICT
05-021	Establishment of Environmental / Bio-XAS Centre	Infrastructure to support speciation and structural determination of metal complexes using synchrotron based X-ray Absorption Spectroscopy (XAS). This synchrotron-based method can be used identify the structures and properties of molecules, including those within potentially toxic and environmentally harmful heavy metals such as lead and mercury.	University of Calgary	Jalilehvand, Farideh	$628,085	$183,809	Life Sciences/ ICT
05-022	Applications of Main Group Inorganic Frameworks in Catalysis and the Material Sciences: State-of-the-Art Synthetic Laboratory	Infrastructure to support research in synthetic inorganic chemistry, with emphasis on the chemistry of the main group elements other than carbon, as well as combinations of these elements with transition metals. The goals are both the development of new molecular materials and the characterization of novel bonding patterns for the main group elements.	University of Calgary	Roesler, Roland	$314,462	$85,339	Other/ Multi-discipline
05-024	Functional and Neurochemical Correlates of the Pathology of Parkinson's Disease	Infrastructure to investigate physiological and environmental aspects in the pathology of Parkinson's disease, a disorder of the central nervous system mainly affecting motor function. The factors and mechanisms that lead to onset and progression of the motor symptoms of Parkinson's disease are still not clearly understood. Dr. Metz's research investigates some of these factors by using detailed behavioural analysis in rodent models, and evaluating the benefit of potential therapeutic interventions.	University of Lethbridge	Metz, Gerlinde	$314,328	$47,450	Life Sciences
05-025	Accessibility to Education Using Learning Objects: Implementing the semantic web with advanced development & testing of applications using metadata promoting interoperability among repository networks	Infrastructure to advance the development of innovative e-learning technologies, specifically to create a testbed of linked and interoperable learning object repositories. A repository addresses the problem of finding high-quality and appropriate learning materials using standard web searches by providing educators and learners with information that is structured and organized to facilitate searching, storing, and using learning materials regardless of their source location.	Athabasca University	McGreal, Rory	$592,794	$215,175	ICT

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05-026	Molecular insights into the regulation and recovery of cytosolic calcium during cardiac muscle relaxation.	Infrastructure to support research in membrane proteins involved in Ca2+ metabolism in the myocardium. Dr. Young uses electron cryomicroscopy to determine the structure of cardiac membrane calcium transport proteins, such as the sarcoplasmic reticulum Ca2+-ATPase and phospholamban.	University of Alberta	Young, Howard S.	$499,032	$130,007	Life Sciences
05-027	Neurophysiology laboratory to study and restore human limb movement	Laboratory will focus on research divided into two main categories: How sensory feedback contributes to movement control, including the role of reflexes in neural control of movements such as walking and grasping and the importance of feedback from sensory receptors in the skin; and how intrinsic properties of neurons within the spinal cord play a role in helping to shape motor output.	University of Alberta	Collins, David	$205,423	$60,969	Life Sciences
05-028	Functional analysis of the mitotic checkpoint using live cell time-lapse confocal microscopy	Infrastructure to support research to understand the molecular mechanisms of mitotic checkpoint control in mammalian cells. By investigating the molecular mechanism of the mitotic checkpoint, Dr. Chan's research group can better evaluate these genes as potential cancer drug targets as well as contributing to the basic understanding of cancer.	University of Alberta	Chan, Gordon	$670,498	$149,192	Life Sciences
05-029	Laboratory Equipment for Analog and Mixed-Signal Testing of High-Speed Communications Integrated Circuits	Infrastructure to support research in data transfer codes and protocols. Turbo and LDPC codes are now used in cell phones in order to allow us to send and receive information such as pictures. Future applications such as video-on-demand will require even more sophisticated coding schemes and computational technologies. One such innovation, called an analog decoder, which could potentially extend battery life in cell phones by a factor of 10.	University of Alberta	Gaudet, Vincent	$376,394	$128,037	ICT
05-032	Real-time, live-cell imaging of mRNA localization in epithelial cells.	Infrastructure to study RNA in fruit fly epithelial cells. RNA, or ribonucleic acid have often been thought of as simply passive messengers transmitting genetic information from the DNA in the nucleus to the cytoplasm and synthesizing proteins. But the new picture, which has come sharply into focus as the result of Dr. Simmond's work, shows the small RNAs at the helm of many of the cell's genetic workings.	University of Alberta	Simmonds, Andrew	$610,361	$164,132	Life Sciences
05-033	Molecular analysis of Helicobacter pylori: the cag- pathogenicity island and associated signaling pathways	Research to understand the complex interactions between the human pathogen Helicobacter pylori and the eukaryotic cells. Helicobacter pylori is associated with the development of several gastric diseases including peptic ulcer disease (PUD), MALT-lymphoma and adenocarcinoma. The research will broaden our understanding of the molecular basis of gastric diseases triggered by H. pylori, and may result in the identification of novel targets for drug development.	University of Alberta	Stein, Markus	$525,710	$129,700	Life Sciences

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05-034	Experimental Lung Development and Therapy Core	Infrastructure to support translational research on neonatal cardiopulmonary diseases, including bronchopulmonary dysplasia (BPD) and congenital diaphragmatic hernia (CDH). Dr. Thébaud studies the role of angiogenic growth factors, elastin protecting agents and stem cells to protect/regenerate oxygen-injured lungs in newborn rodents. Dr. Thébaud also explores the mechanisms underlying neonatal pulmonary hypertension in animal models of CDH.	University of Alberta	Thebaud, Bernard	$273,723	$77,412	Life Sciences
05-035	Scanning microscopy and vibrational spectroscopy for molecular device research	Infrastructure to support research in composite materials. To approach these goals the group uses tools to probe and manipulate matter at the nano-scale.	University of Alberta	Wolkow, Robert	$658,899	$181,500	Life Sciences/ Energy/ ICT
05-038	Facilities for the production of, and development of variable environmental testing standards for, dimensionally accurate composite materials	Infrastructure to support research in tissue mechanics research, and biomechanical engineering research. To approach these goals the group uses tools to probe and manipulate matter at the nano-scale.	University of Alberta	Carey, Jason	$131,093	$53,236	Life Sciences/ Energy
05-039	An interdisciplinary program in carbohydrate, medicinal, and computational chemistry	Infrastructure to support research focused in the areas of synthetic chemistry (with a particular emphasis in carbohydrate chemistry), the conformational analysis of oligosaccharides and the design of novel therapeutic agents that act by inhibiting carbohydrate-processing enzymes. The primary research focus is directed ultimately towards the identification of new drugs for the treatment of tuberculosis.	University of Alberta	Lowary, Todd	$338,356	$101,356	Life Sciences
05-041	Development of a biocatalytic suite for the processing of value-added agricultural commodities	Infrastructure to support research in the industrial application of chemical and biological systems for the catalytic conversion of conventional agricultural products to value-added commodities. Much of the biological work involves production, modification, purification, and design of biocatalytic systems.	University of Alberta	Bressler, David	$416,236	$100,222	Life Sciences/ Energy
05-042	Imaging Laboratory for Functional Recovery	Infrastructure to support the Seaman Family Research Centre's 3 Tesla magnetic resonance imaging (MRI) technology to prevent, diagnose and treat stroke. The goal is to find new and better ways to display the damaging effects of stroke and quantify the treatment being provided.	University of Calgary	Goodyear, Bradley	$602,016	$147,000	Life Sciences
05-043	Protein crystallization, macromolecular interaction and drug design infrastructure	Infrastructure to support research in understanding how biological macromolecules function at the molecular level. Dr. Ng's lab is particularly interested in understanding how the three-dimensional structures of proteins have evolved to act as highly specific and efficient chemical catalysts (enzymes) or binding proteins.	University of Calgary	Ng, Kenneth	$690,349	$115,301	Life Sciences
05-046	Facility for the Spectroscopic Studies of Radical Intermediates Formed in the Hot-wire Chemical Vapor Deposition of Semiconductor Thin Films	Infrastructure to investigate the structures, energetics and dynamics of radicals and intermediates formed in the processes of Hot Wire Chemical Vapor Deposition (HW-CVD) of semiconductor thin films. HW-CVD is a new technology to produce device quality silicon-based thin films, which are found to have large potential in low-cost optoelectronic devices (e.g. solar cells) and thin film transistors.	University of Calgary	Shi, Yujun	$770,098	$185,000	Energy/ ICT

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06-001-SEGP	Remote Monitoring System for Monitoring Numerical and Functional Responses of Wildlife in Dynamic Landscapes	To understand how alterations of natural landscapes by energy sector development interacts with climate change to influence ecosystems, information linking behaviour of animals to population processes is needed. Developments in remote wildlife monitoring will allow us to make innovative advances that will help Alberta grow sustainably.	University of Alberta	Dr. Erin Bayne	$253,824	$58,331	Life Sciences/ Energy
06-002-SEGP	Ecological Genomics Laboratory	This funding is for a DNA-typing facility to study genetic structure, pedigree analysis, molecular systematics and gene mapping in wildlife using automated DNA analysis and high-throughput sample handling. The Ecological Genomics Laboratory (EGL) will consist of a wet lab and a separate high-throughput automated DNA fragment analysis suite.	University of Alberta	Dr. David Coltman	$436,502	$100,000	Life Sciences
06-004-SEGP	Development of a Porcine Gamete and Embryo Evaluation/Manipulation Facility	The infrastructure proposed would establish a state-of-the-art reproductive technology facility at the University of Alberta (U of A) Swine Research and Technology Centre (SRTC). Reproductive technologies in livestock represent an efficient means for disseminating genetic resources.	University of Alberta	Dr. Michael Dyck	$390,719	$110,000	Life Sciences
06-005-SEGP	Self-Assembled Nanostructured Organic Materials	This proposal makes the case for the acquisition of state-of-the-are 500 Mhz nuclear magnetic resonance (NMR) spectrometer for the investigation of the 3D structure, dynamics, and quality control of organic molecules, materials, polymers, and macromolecular systems used in nanoscale science and engineering, and nanomedicine.	University of Alberta	Dr. Hicham Fenniri	$1,276,040	$299,056	Life Sciences/ Energy/ ICT
06-008-SEGP	Combined Pulsed Laser Deposition - Sputter System for Synthesis of Multiphase Nanostructured Materials and Micro-Devices	Infrastructure for advanced thin-film deposition techniques to synthesize metal-based three-dimensional nanostructured composites for MEMS applications, and the first true on-chip solid oxide fuel cell (SOFC) with tunable dimensions.	University of Alberta	Dr. David Mitlin	$900,000	$270,000	Energy/ ICT
06-013-SEGP	Infrastructure for Plant Pathology and Breeding Research	Infrastructure to understand plant pathogen virulence and host resistance. This knowledge will be applied to the development of canola germplasm with improved disease resistance. Research will also aim to produce numerous value-added nutraceutic compounds in canola and to broaden genetic diversity of the crop.	University of Alberta	Strelkov, Stephen	$739,937	$175,000	Life Sciences
06-014-SEGP	Development of Cardiovascular Magnetic Resonance Imaging	Magnetic resonance imaging (MRI) is a non-invasive diagnostic imaging modality that yields anatomic and functional images of the beating heart, providing a one-stop shop for diagnosis of heart disease. New designer radiofrequency receiver coils (MRI hardware component) will be used to increase the sensitivity of cardiac MRI and provide significantly faster imaging than is currently available.	University of Alberta	Dr. Richard Thompson	$120,044	$36,013	Life Sciences
06-015-SEGP	Building a pediatric N-of-1 research service	This project is focused on enabling the development of a first class research facility that will allow for product based clinical research in the area of pediatric medicine and natural health products. In particular, the equipment requested will enable the development of a pediatric N-of-1 service that specializes in NHP evaluation.	University of Alberta	Vohra, Sunita	$300,786	$90,236	Life Sciences

Project Number	Project Title	Descriptive Summary	Lead Organization	Project Leader	Total Project Cost	SEGP/New Opps Funding Approved	Key Strategic Area
06-016-SEGP	Infrastructure for the Study of Gut Microbial Communities	In vitro continuous culture simulations of the gastrointestinal microflora, in combination with molecular and cell biology techniques, will be used to analyze the role of gut microbial structure and function on the aetiology of Inflammatory Bowel Disease (IBD).	University of Calgary	Dr. Emma Ambrose	$493,838	$148,149	Life Sciences
06-020-SEGP	A Molecular Biology Laboratory to Study HIV and WNV Pathogenesis	To establish infrastructure to study the molecular mechanisms underlying the pathogenesis of both Human Immunodeficiency virus and West Nile virus. In addition, therapeutic strategies for West Nile virus-induced neurological disease will be explored, and antiviral drug resistance of the Human Immunodeficiency virus will be studied.	University of Calgary	Dr. Guido van Marle	$214,711	$64,413	Life Sciences
06-022-SEGP	Centre for Integrative Chronobiology	This grant will help establish novel and fundamental infrastructure necessary to study the inner-workings of the mammalian circadian system at the behavioural, anatomical and molecular levels, with the ultimate goal of developing pharmacological or behavioural interventions for sleep and circadian disorders.	University of Calgary	Dr. Michael Antle	$197,358	$59,207	Life Sciences
06-023-SEGP	Canadian Satellite Altimetry Database & Processing System (CADS)	It is proposed to develop a satellite altimetry database system with user-specific product generation and on-line dissemination to support research and engineering in climate change, sea level change, surface water and hydrology, and surface deformation. The infrastructure consists of computer hardware and in-house developed software.	University of Calgary	Dr. Alexander Braun	$547,463	$146,250	Life Sciences/ Energy/ ICT
06-025-SEGP	Generation of a C. elegans Facility to Study the Control of Stem Cell Proliferation	Dividing stem cells have the ability to either remain a stem cell or to differentiate into a specific cell type. The proposed infrastructure will be used to identify and characterize new factors that are involved in regulating this decision using the C. elegans germ line as a model.	University of Calgary	Dr. David Hansen	$383,516	$53,601	Life Sciences
06-027-SEGP	Establishment of a Tissue and Cellular Engineering Research Facility within the Centre for Bioengineering Research and Education at the University of Calgary	This project will establish infrastructure at the University of Calgary to support tissue and cellular engineering research efforts. This research will be conducted by two new faculty members (C. Hunter and K. Rinker), and will also be used to recruit up to three new faculty to the Centre for Bioengineering Research and Education.	University of Calgary	Hunter, Christopher	$342,104	$102,631	Life Sciences
06-028-SEGP	A Cell Biology Laboratory (CBL) for the Institute of Biocomplexity and Informatics (IBI)	This application will result in the establishment of a Cell Biology Laboratory (CBL) for systems biology-biocomplexity research, headed by Dr. Stuart Kauffman (IBI's Director) at the University of Calgary. Aligned with major Alberta Strategies and priorities, the CBL will support extensive research, collaborations, training and technology transfer activities.	University of Calgary	Dr. Stuart A. Kauffman	$1,775,768	$532,730	Life Sciences
06-030-SEGP	Research Tools for Cardiac Electrophysiology	The purpose of this application is to develop a research lab specializing in Cardiac Electrophysiology for Dr. Nygren and his students. Two experimental setups are requested: one for measurements at the tissue level, and one for measurements at the cellular level.	University of Calgary	Dr. Anders Nygren	$444,390	$100,000	Life Sciences

Project Number	Project Title	Descriptive Summary	Lead Organization	Project Leader	Total Project Cost	SEGP/New Opps Funding Approved	Key Strategic Area
06-032-SEGP	Confocal Imaging System for the Analysis and Optimization of Engineered Tissues Generated from Mammalian Steam Cells for Therapeutic Applications	A confocal imaging system is requested to characterize and model cultured stem cells, and the tissues generated from them. The proposed infrastructure will greatly facilitate the development of protocols aimed at scaling-up stem cell/tissue production for clinical applications such as the treatment of Parkinson's disease and diabetes.	University of Calgary	Dr. Arindom Sen	$789,519	$236,856	Life Sciences
06-034-SEGP	Research Facility for Laboratory Spectroscopy of Terrestrial and Outer Planetary Molecules	A ultra-high resolution laboratory molecular spectroscopy studies of atmospheric constituents. The research will develop spectroscopic tools needed to study molecules of environmental interest and interpret remote sensing data.	University of Lethbridge	Predoi-Cross, Adriana	$295,072	$88,521	Life Sciences/ Energy
06-036-SEGP	Ultra-Trace Clean-Laboratory for Environmental and Human Health Sciences Research on Emerging Organic Contaminants	The new infrastructure will enable a broad range of new studies relating to fate of chemicals in the environment, their exposure pathways, and their possible effects on health.	University of Alberta	Martin, Jonathan W	$819,602	$183,586	Life Sciences
06-039-SEGP	3-D VR Planning System for Surgical Treatment of Lung Cancer	The project focuses on the research and development of planSys - a three-dimensional (3-D) surgical planning system for treating lung cancer - by using the advanced technologies of virtual reality (VR).	University of Calgary	Hu, Yaoping	$441,220	$132,366	Life Sciences
06-040-SEGP	Supramolecular Interfaces Research Facility (SIRF)	Research laboratory to study novel approaches to solar cells. The research investigates synthetic organic approaches to create self-assembling surface components, based on photosynthetic reaction centres, to create functional photovoltaic devices.	University of Calgary	Sutherland, Todd C	$431,827	$129,548	Energy
06-041-SEGP	Laboratory for Advanced Materials Science - Fuel Cells, Sensors and Batteries (LAMS-FSB)	The state-of-art equipments for the investigation of materials for solid oxide fuel cells, proton exchange membrane fuel cells, sensors and batteries are requested.	University of Calgary	Thangadurai, Venkataraman	$662,612	$198,784	Energy
06-043-SEGP	Cell Culture and Molecular Virology Infrastructure for Development and Enhancement of Baculovirus-based Technologies	Development of baculvirus-based platform technology for protein and vaccine production using insect bioreactors and targeted gene delivery in mammals by engineering baculovirus surface proteins.	University of Lethbridge	Lung, Oliver	$360,757	$108,277	Life Sciences
				Total:	**$51,421,138**	**$15,541,017**	