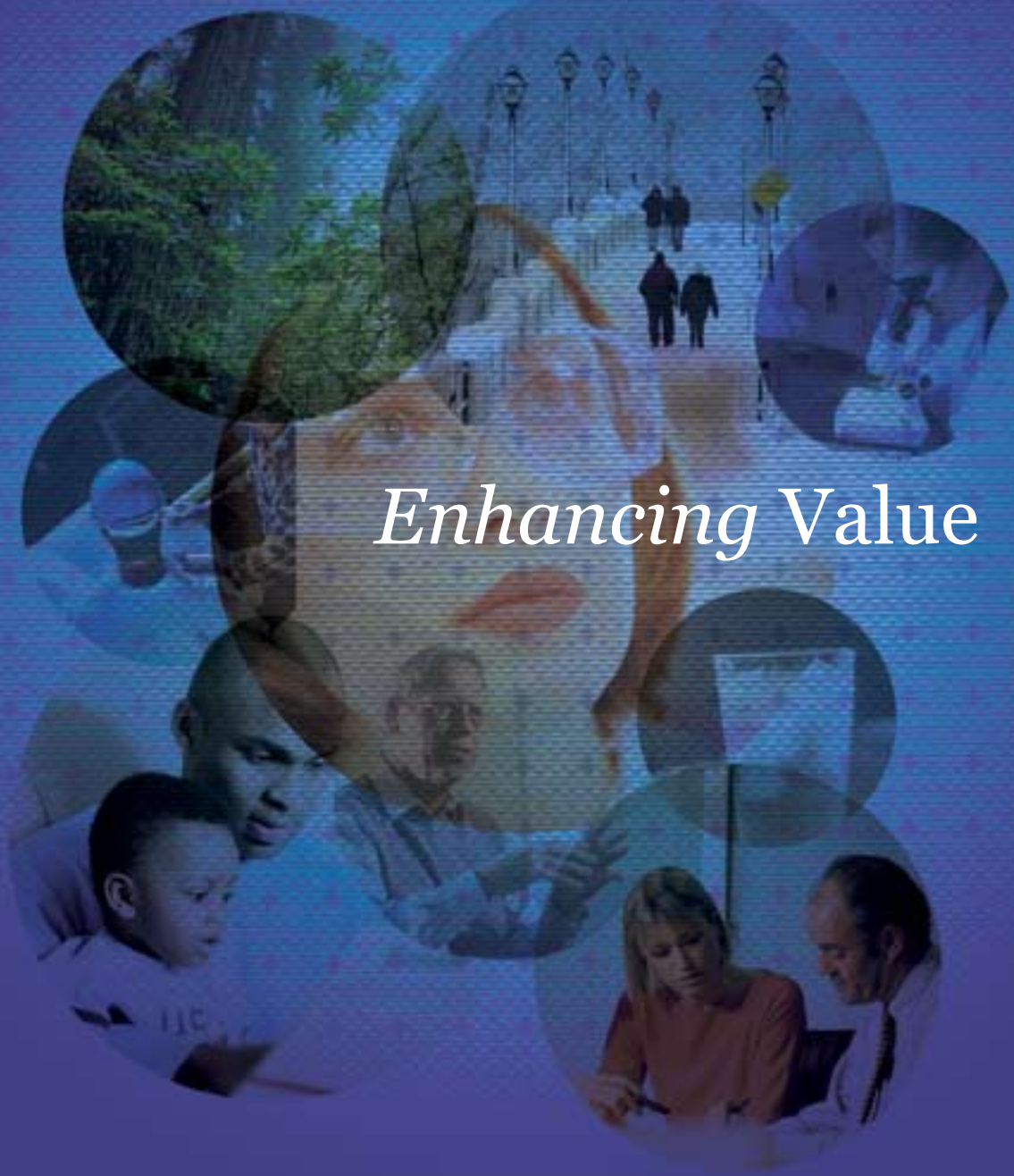
Networks of Centres of Excellence

Annual Report 05/06



Enhancing Value

Networks of Centres of Excellence (NCE)

Annual Report 2005-2006

Enhancing Value

The Networks of Centres of Excellence (NCE) program is a uniquely Canadian way of mobilizing the immense research talent spread across this vast country.

Each network builds partnerships between academia, industry and government to put new knowledge, research and technology to work to create a better Canada. Highly qualified personnel – from graduate students and postdoctoral fellows to world leaders in their particular fields – work co-operatively through NCE-sponsored initiatives in the natural, social and health sciences. Their work involves everything from leading-edge investigations into the causes of and potential cures for cancer to the use of robots and intelligent systems to perform tasks in difficult environments.

NCE-sponsored researchers are at work improving the quality of the food we eat and the water we drink. They are helping to keep our forests flourishing, to ease the impacts of climate change and to reduce the social and economic burden of illiteracy. And by involving thousands of talented young Canadians in this work, we are training tomorrow's scientific leaders and ensuring Canada's continued role as a world science and technology leader.

This 2005-2006 Annual Report illustrates how this outstanding work, undertaken for the benefit of all Canadians, is accomplished.

The Mission of the Networks of Centres of Excellence

To mobilize Canada's research talent in the academic, private and public sectors and apply it to the task of developing the economy and improving the quality of life of Canadians.

The Networks

Enhancing value across the country, across all disciplines

In 2005-2006, the NCE program comprised 25 networks, five of which were New Initiative networks unveiled in the spring. The areas of expert investigation ranged from advanced mathematics, to climate change, from studying stem cells for keys to cures, to managing forests to ensure their survival. The positive impacts of this work in the natural and social sciences are being felt – and will be felt for years to come – as it enhances Canada's performance in agriculture, industry, health care and technology.

Advanced Foods and Materials Network (AFMNet)

Allergy, Genes and Environment Network (AllerGen)

AquaNet (Network in Aquaculture)

ArcticNet

AUTO21 Network of Centre of Excellence

Canadian Arthritis Network (CAN)

Canadian Design Research Network (CDRN)

Canadian Genetic Diseases Network (CGDN)

Canadian Institute for Photonic Innovations (CIPI)

Canadian Language and Literacy Research Network

Canadian Network for Vaccines and Immunotherapeutics (CANVAC)

Canadian Obesity Network

Canadian Stroke Network (CSN)

Canadian Water Network (CWN)

Emerging Dynamic Global Economies Network (EDGE)

Geomatics for Informed Decisions (GEOIDE)

Institute for Robotics and Intelligent Systems (IRIS)

Intelligent Sensing for Innovative Structures (ISIS Canada)

Mathematics of Information Technology and Complex Systems (MITACS)

National Initiative for the Care of the Elderly (NICE)

Protein Engineering Network (PENCE Inc.)

Promoting Relationships and Eliminating Violence Network (PREVNet)

PrioNet Canada

Stem Cell Network (SCN)

Sustainable Forest Management Network (SFM)

Networks of Centres of Excellence

Annual Report 05/06

Message From The Chair

Welcome to the 2005-2006 Networks of Centres of Excellence (NCE) Annual Report. This year's theme is enhancing value, reflecting the major role of the program – that of adding value to the high quality research of the networks' investigators. That value-added takes many forms, from focusing research in critical areas for Canada to transferring knowledge results to Canadians.

The NCE program brings together investigators from a wide range of natural, social, technological and health sciences to integrate expertise, overcome obstacles and inspire innovation. We help researchers – in fields as diverse as structural engineering, mathematics, geomatics, forestry and photonics or in the areas of stroke and arthritis prevention and treament, for example – interact with industry, governments and the not-for-profit sector to ensure that innovation is transformed into products and processes to improve Canada's economic prosperity and quality of life. We initiate the interface between Canada's leading scientists and those who guide our governments so that Canadians benefit from informed and enlightened public policy.

Over the past year we were particularly successful in enhancing value. The numbers are impressive:

- The NCE program leveraged partnership investments of almost $70 million in 2005-2006, including $27.4 million from private sector companies. When the NCE program's own funding is included, almost $150 million was available for research, training, knowledge translation and commercialization.
- Overall, 926 companies, 350 provincial and federal government departments and agencies, 64 hospitals, 202 universities and 628 organizations from Canada and around the world were linked through NCE-enabled activities.

- More than 6,000 researchers and HQP (highly qualified personnel such as research associates and technicians, postdoctoral fellows, and graduate students) were involved in NCE projects.
- NCE scientists filed 60 patents and published 3,958 papers in refereed scientific journals. In total, 37 licences were granted or were under negotiation, while three spin-off companies were born.

The year also saw considerable expansion with the introduction of the NCE New Initiatives (NCE-NI) program which resulted in five new networks in the areas of design, global economics, obesity, prevention of violence, and the care of the elderly. The idea behind the New Initiatives is not to fund research, but to encourage and enable networking and partnerships between already established researchers or groups of researchers so that they can apply their proficiencies to the pressing issues of the early 21st century.

A new network also began its work in 2005-2006. PrioNet was established to deal with the threat of bovine spongiform encephalopathy (BSE) and other transmissible spongiform encephalopathies. BSE has already inflicted billions of dollars in damage to the Canadian agriculture. PrioNet is recruiting researchers to build Canadian capacity to diagnose, treat and hopefully prevent BSE and other prion-related diseases.

It was also a year of change at the NCE offices in Ottawa. Dr. Thomas A. Brzustowski, who successfully chaired the NCE steering committee for 10 years as a part of his role as President of the Natural Sciences and Engineering Research Council (NSERC), stepped aside to return to academia. It was my honour and privilege to be named his successor. I very much look forward to building upon his outstanding accomplishments.

In conclusion, let me restate that the NCE program enhances value by mobilizing excellence. It was designed as an initiative of Industry Canada and the three granting agencies: NSERC, the Canadian Institutes of Health Research (CIHR), and the Social Sciences and Humanities Research Council (SSHRC). The NCE program stresses the importance of using scientific research to improve Canada's economy and our quality of life. The NCE program could not exist without the generous support of Canada's universities and its partners who provide the networks with the infrastructure and research personnel they require. As ever, we are truly grateful for their co-operation.

At the very centre of the NCE program, however, are the researchers themselves. The work they do daily in their laboratories and research facilities is the source of the value that the NCE program builds upon and enhances. Their enthusiasm in embracing the multi-disciplinary teamwork approach to finding scientific solutions has made the NCE program successful in delivering economic and social benefits to Canadians. On behalf of myself and Dr. Alan Bernstein, President of the CIHR, and Dr. Chad Gaffield, President of SSHRC, I thank them for their vitally important contributions.

I would also like to thank the Honourable Maxime Bernier, the Minister of Industry, for his continued support and encouragement.

Dr. Suzanne Fortier
Chair, NCE Steering Committee

The NCE Program

Enhancing the value of Canadian Research

To *enhance* is to make better, to provide with improved or advanced capabilities. To *enhance value* means to take something of worth and turn it into something greater, more useful or functional – with a capacity to have a stronger impact.

The Networks of Centres of Excellence (NCE) program enhances value. It takes important research that thousands of research professionals are engaged in and enhances its value by bringing it to the attention of industry partners who can turn it into products to improve our quality of life and enrich our economy.

The NCE program enhances value by ensuring excellent research results are put into the hands of leaders and policy-makers so that they can make informed and enlightened decisions on how to deal with the many challenges of the 21st century. For example, it enhances value by encouraging new insights into how to protect our natural resources and deal with climate change. And it enhances value by making sure the latest developments in defeating disease are delivered to doctors' offices and hospital wards.

As the pages of this report show, the NCE program made great advances throughout 2005-2006 in enhancing value by pooling the talents of the academic, private and public sectors to make life better for all Canadians.

The NCE Program

The Young Innovators

Building a better future depends on giving our next generation of leaders the training, support and encouragement needed to do great things.

In 2004, to mark its 15th anniversary, the NCE program established the Young Innovator Awards to honour outstanding individuals who have shown exceptional leadership in not only undertaking brilliant research, but applying it to solve problems and pay social and economic dividends. The three 2005 winners embody exactly that spirit and achieved exactly those goals.

Dr. Sasha Bernatsky

Dr. Sasha Bernatsky not only led the co-ordination of the largest-ever investigation of the link between cancer and systemic lupus erythematosus (SLE), an autoimmune disease that primarily affects women of childbearing age, she fostered the sharing of that knowledge to those at risk.

Dr. Bernatsky, a medical doctor and Assistant Professor at McGill University, co-ordinated a collaborative effort involving almost 10,000 patients in 23 countries. The study showed that people with SLE are 15% more likely to develop cancer.

In addition to publishing the findings in peer-reviewed journals, Dr. Bernatsky made presentations at several scientific conferences and spoke to patient groups across the continent. She worked closely with Lupus Canada to disseminate the knowledge in patient-friendly formats, such as newsletters, bulletins and media interviews.

"As a direct result of Dr. Bernatsky's work, both physicians and patients have been alerted to the importance of the routine use of standard cancer screening programs for patients with SLE," said Dr. Jane Aubin, CEO of the Canadian Arthritis Network, the responsible for some of Dr. Bernatsky's training. "This is one of the best means of decreasing cancer-related morbidity and mortality in this population."

Dr. Charles Dugas

Mix an entrepreneur's passionate sense of purpose with the investigative instincts of a scientist and you get Dr. Charles Dugas, the Young Innovator Award winner from Mathematics of Information Technology and Complex Systems (MITACS) who is helping Canada's insurance companies do business better.

In 2001 and still in his 30s, Dr. Dugas teamed up with his Ph.D. supervisor and two fellow doctoral students to create ApSTAT Technologies Inc. to commercialize research developed in their MITACS project. They were trying to improve neural networks – systems of programs and data structures that mimic brain function – to sharpen the predictive tools used by the insurance sector.

The start-up company succeeded by building a client base of insurance firms. "The technology's ability to perform better risk estimation could result in considerable cost savings," said Alain Lessard, Senior Vice-President of AXA Canada Inc., a $1.3-billion insurance and financial services company.

"The NCE program opens doors for young investigators. Not only does it provide a trans-disciplinary research environment that promotes collaboration and networking, but you also learn very practical skills needed in today's research environment, such as writing research proposals, commercialization of intellectual property, knowledge translation and building partnerships."

*- **Dr. Sasha Bernatsky***

Dr. Dugas, who remains active with ApSTAT as Vice-President of Insurance Solutions, is also an Assistant Professor in the Department of Mathematics & Statistics at the Université de Montréal.

Dr. Philippe Simard

Dr. Philippe Simard has a deep appreciation for the training he received at the GEOIDE Network – guidance that helped him to create his Montreal-based SimActive Inc. company and turn it into an up-and-coming player in the production of real-time, three-dimensional computer models.

"The support we received from GEOIDE allowed us to perform market studies, prepare our business plan and secure our intellectual property," said Dr. Simard, Young Innovator Award winner.

SimActive's solutions are geared primarily for use by the defence sector – so it is not surprising that the company has worked with Department of National Defence and CAE Inc., a global heavyweight in aircraft flight simulators. But its work with Ottawa-based Neptec Design Group in designing 3D modeling software for the camera system on the space shuttle Discovery is indicative of the potentially widespread applications. Because it makes updating map materials easier and faster, the technology also could be used for precise flood risk analysis, urban planning and disaster assessment.

"The career of Philippe Simard demonstrates a spectacular success in the Canadian contribution to the worldwide marketplace in the treatment of imagery and spatial information," said Dr. Nicholas Chrisman, GEOIDE's Scientific Director. "He is an innovator and a great demonstration of the potential for the NCE approach that links researchers, industry and user communities."

The Criteria:

The Young Innovator Award recipients are selected by a panel of judges on the basis of the excellence and leadership of the nominee; the excellence of the nomination, including research carried out and quality of results being transferred; the socio-economic impact of the transfer of knowledge; and challenges encountered in transferring that knowledge. The panel of judges included:

- Réjean Landry (Chair) – Université Laval
- Beverly Sheridan – Technology Now
- Michael Owen – Brock University
- René Douville – Life Science Ventures
- Aubrey Tingle – Michael Smith Foundation

The NCE Program

Enhancing value with highly qualified people

"As a terrestrial ecologist, I never imagined myself conducting research on an icebreaker.

The ArcticNet Training Fund gave me the opportunity to experience ship-based science first-hand. This exposure to completely new fields of research was fantastic, and further strengthened my appreciation for ArcticNet's interdisciplinary approach."

*- **Paul Smith**, Ph.D. Candidate, Carleton University*

Potential is too precious a commodity to waste.

In an interview after winning a 2005 Young Innovator Award, Dr. Charles Dugas, a former trainee with the Mathematics of Information Technology and Complex Systems (MITACS) Network, talked about the frustrating fate that used to await young mathematicians who "headed out to find a job, with very little chance that their graduate work would be truly relevant to the task."

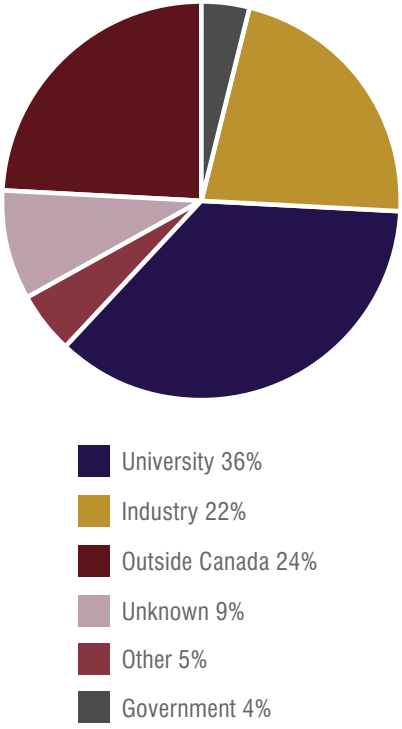
That, he explained, is no longer the case because MITACS and the NCE program have paved the way for the next generation to pursue its passions. Each year, each network concentrates considerable effort on making sure its highly qualified personnel get every opportunity to enhance Canada's capacity to meet the challenges of the future. To cite just three examples:

- The Canadian Arthritis Network (CAN) receives $500,000 a year from The Arthritis Society for graduate students, research fellows and research scholars to acquire experience in basic science, clinical research, product services and development, and industrial partnering.
- The Canadian Institute for Photonic Innovations (CIPI) supported the participation of 10 students in the 2005 NATO Advanced Study Institute in photon-based nanoscience and technology.
- As part of the 2005-2006 Training Fund competition, seven ArcticNet graduate students participated in the Nansen and Amundsen Basin Observing System summer school onboard the Russian icebreaker Kapitan Dranitsyn.

Highly qualified personnel bring new ideas, fresh approaches and unbridled energy to solving problems. In 2005-2006, the NCE program directly supported 2,286 research staff (research associates and technicians) and research trainees (postdoctoral fellows, graduate and undergraduate students). Another 2,181 were involved in NCE project work while supported by other funding sources.

Fiscal Year 2005-06

POST-NETWORK EMPLOYMENT BY SECTOR



The NCE Program

Embracing the commitment to enhanced value

The NCE program's ability to respond to challenges as they arise has been pivotal to its success in helping Canada grow in health and prosperity. The program constantly evolves, as evidenced by the creation of PrioNet, a new network charged with addressing a specific threat to the cattle industry and human health.

PrioNet

Specific threats to Canada's health and prosperity require specific, targeted responses.

In May of 2003, a cow from an Alberta farm was identified as infected with bovine spongiform encephalopathy (BSE). It was a discovery that, so far, has cost billions of dollars, forced farms into receivership and caused once-solid industries to shrivel.

That is why the NCE, at the request of the federal government, launched a targeted competition to create a new network to investigate BSE and other transmissible spongiform encephalopathies (TSEs) caused by prions – proteins that occur normally in a harmless form but, by folding into aberrant shapes, result in puzzling diseases that are neither bacterial, fungal nor viral and contain no genetic material.

With the creation of PrioNet in November of 2005, top researchers from across the country began pooling their laboratory resources, students and expertise to strengthen Canada's efforts to diagnose, treat and hopefully prevent BSE and other prion-related diseases such as chronic wasting disease (CWD) in elk and deer and Creutzfeldt-Jacob disease (CJD), which is fatal to humans.

PrioNet, which is receiving funding of $5 million a year, is headquartered in Vancouver at the University of British Columbia. It is co-ordinating collaboration between experts from several research areas, universities and government departments within Canada and across the globe. It works in close partnership with the Alberta Prion Research Institute.

Dr. Neil Cashman, PrioNet's Scientific Director and one of the world's leading prion researchers, said the first priority is to build "an intellectual infrastructure" and then begin translating the research knowledge into effective measures to deal with prion diseases. The network's success, he said, "will be defined as the application of basic research and social research to the socio-economic problems posed by prion diseases."

Although these are early days, PrioNet has already developed a research network and has projects underway at several Canadian universities. It is working in collaboration with more than 20 different organizations and industry partners.

The NCE Program

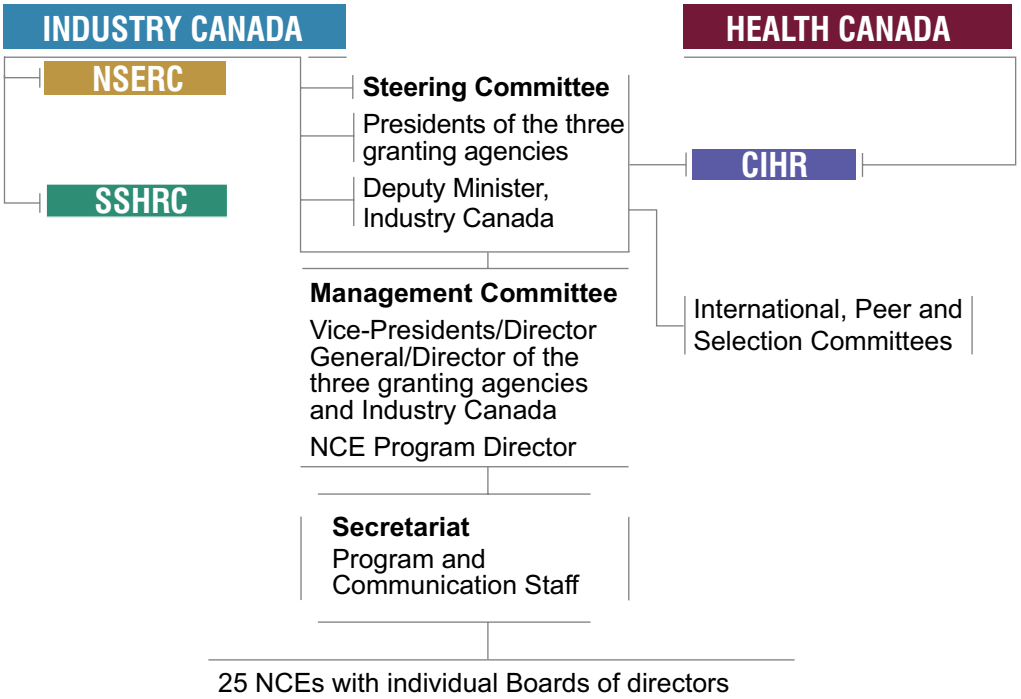
How the NCE is Governed

The NCE program is jointly administered by Canada's three granting agencies: The Canadian Institutes for Health Research (CIHR), the Natural Sciences and Engineering Research Council (NSERC) and the Social Sciences and Humanities Research Council (SSHRC). This is done in partnership with Industry Canada.

A Steering Committee comprising the presidents of the three granting agencies and the Deputy Minister of Industry Canada manages the program. It is assisted by the NCE Management Committee, made up of the granting agencies' program vice-presidents, the Director General of Industry Canada's Innovation Policy Branch, the NSERC Director of Policy and International Relations, and the NCE Program Director.

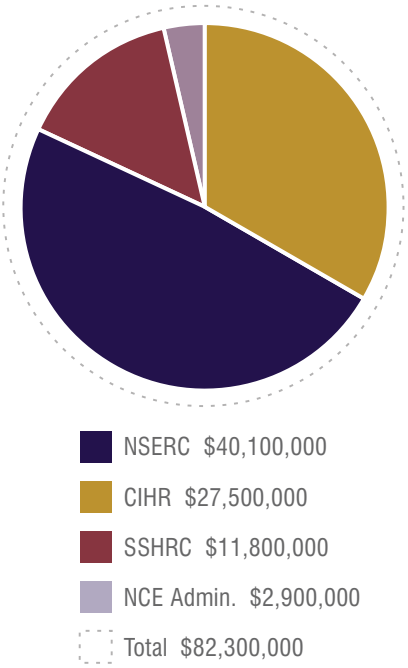
The NCE was made a permanent program of the Government of Canada in 1997. Its funding is channelled through the three granting agencies.

GOVERNANCE STRUCTURE



Fiscal Year 2005-06

PATHS THROUGH WHICH NCE PROGRAM FUNDS FLOW TO THE NETWORKS



The 2004 federal Budget identified additional funding of $5 million a year, starting in 2005-2006 to support the creation of a new NCE for research on bovine spongiform encephalopathy (BSE) and other transmissible spongiform encephalopathies (TSE). The new NCE is PrioNet Canada.

Networks of Centres of Excellence

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This Year's Highlights

How we enhanced value

From helping children in lower-income neighbourhoods overcome their literacy setbacks to showing civil engineers how to build better bridges in cold climates, NCE investigators in 2005-2006 were intensely involved in a broad spectrum of research activities to enhance and enrich Canadian lives.

Areas of endeavour included health, human development and the biosciences; engineering and manufacturing; natural resources and the environment; and advanced technologies.

Research took place in the High Arctic and the Lower Mainland of British Columbia. Our investigators tracked the flow of fish through rural rivers and the flow of shoppers through urban malls. We helped Canadian businesses mine data and apply mathematics to particularly tricky problem-solving. We brought Canadian experts together to better safeguard the water supply, boost Canadian competitiveness in the auto industry and apply stem cell breakthroughs to fight Alzheimer's and Parkinson's disease.

It was – in a variety of ways in a variety of fields, a successful year of enhancing the value of Canadian research.

This Year's Highlights

Enhancing value throughout the year

It has been said that the days are long but the years are short – meaning that while we work long days, the years seem to disappear on us. The year 2005-2006 should not be allowed to disappear without noting at least a few of many NCE program accomplishments – especially given the realization that each one represents many months, if not years, of diligent dedication to enhancing the quality of life in Canada. Here are a few of the highlights:

March, 2006

Intelligent Sensing for Innovative Structures - ISIS Canada succeeds in its efforts to have the Canadian Highway Bridge Design Code updated to permit the use of fibre-reinforced polymers to strengthen new and rehabilitated bridges and structures. The final approval by the **Canadian Standards Association's Technical Committee** is a clear example of transferring innovation into practice.

February, 2006

International experts in watershed management attend the first **Linking Watersheds Workshop**, held at the **University of New Brunswick** in Fredericton and jointly co-ordinated by the **Canadian Water Network (CWN)**, the UNB-based **Canadian Rivers Institute (CRI)** and the **United Nations University's International Network on Water, Environment and Health**.

January, 2006

Dr. Marc Fortin, an Associate Professor at **McGill University**'s Faculty of Agricultural and Environmental Sciences and an **Advanced Foods and Materials (AFMNet)** researcher, joins **Agriculture and Agri-Food Canada** as Deputy Minister, Research.

The **Canadian Institute for Photonic Innovations (CIPI)** launches the **Innovative Photonic Applications Program** to bring together university researchers, technology implementers and end-users in projects to improve productivity, increase competitiveness and transfer exploitable technologies to Canadian-based partner companies.

December, 2005

A study by **Stem Cell Network** researcher **Dr. Mick Bhatia** of **McMaster University** is published in ***Nature Medicine***, showing that an experimental drug already being tested for diabetes and Alzheimer's disease can boost the number of stem cells from umbilical cord blood, allowing them to regenerate the blood system more quickly.

November, 2005

The NCE program awards $5 million per year over seven years to **PrioNet**, a national network to accelerate Canada's understanding of and response to BSE ("mad cow" disease) in cattle, chronic wasting disease (CWD) in elk and deer and Creutzfeldt-Jacob disease (CJD), which is fatal to humans.

GEOIDE hosts an international conference in Québec City, the first such gathering of its kind in Canada, to discuss how geomatics – the science of measuring, representing, analyzing, managing, retrieving and presenting spatial information – can best be applied to determine the impact of human activities on fish habitats.

Research generated by two **AUTO21** projects – Anti-Social Behaviour and the Automobile and Automobile-Linked Crime in Canada – contributes to legislation introduced in the **Canadian Senate**. The legislation would create a new summary conviction for those driving vehicles with a blood alcohol concentration limit of 0.5%.

The Canadian Language and Literacy Research Network partners with the **Canadian Child Care Federation** to develop and distribute language and literacy resource kits to 15,000 Canadian early learning and child care practitioners by August 2007.

October, 2005

Intelligent Sensing for Innovative Structures – ISIS Canada's Scientific Director **Dr. Aftab Mufti**, the **University of Manitoba**, and **Vector Construction** win the 2005 **NSERC Synergy Award** for Innovation for a 10-year collaboration that has set new standards for innovation in the construction industry.

September, 2005

BioSyntech Canada Inc. announces it has raised $6 million in funding and is moving forward with clinical trials of a new gel that can repair damaged cartilage and bone. Developed by a multi-disciplinary research team supported by the **Canadian Arthritis Network (CAN)**, **BST-CarGel**® could be on the market within two years.

StrokEngine, a Web-based tool to provide state-of-the-art information about rehabilitation therapies and treatments for people recovering from stroke, goes live. Primarily funded by the **Canadian Stroke Network (CSN)**, StrokEngine will provide easily accessible information to people with stroke and their families, rehab clinicians, health care students and administrators.

August, 2005

The ***CCGS Amundsen*** icebreaker leaves Quebec City to begin **ArcticNet**'s 84-day coastal Canadian Arctic expedition. More than 100 investigators, students and technicians from 10 universities, three federal departments and four foreign institutions take part in the first-hand studies of the current and future effects of climate warming on the North.

Dr. Jane E. Aubin, Scientific Director and CEO of the **Canadian Arthritis Network (CAN)** is elected Vice-President of the 60-country **International Bone and Mineral Society (IBMS)**. With membership in 60 countries, IBMS promotes the generation and dissemination of knowledge of basic biology and clinical science of the skeleton and mineral metabolism.

July, 2005

As part of the **Mathematics of Information Technology and Complex Systems (MITACS)** Internship Program, supporters from industry, government and research in British Columbia and Alberta commit $2.3 million to place more than 100 of Canada's top mathematical science students into western Canadian businesses over two years.

Nature Biotechnology publishes research results from projects led by **Dr. Robert Hancock** of the **University of British Columbia**. Funding from the **Advanced Foods and Materials Network (AFMNet)** enabled Dr. Hancock to collaborate with **Dr. Santosh Misra**, a plant molecular biologist at the **University of Victoria** on the use of plants as peptide factories. Patents are pending for two antimicrobiological technologies that could fight infections in humans and reduce crop losses.

June, 2005

AUTO21 announces it has secured $24.5 million in funding for 41 innovative auto-related research projects. The total includes $9.8-million from the **Government of Canada** and $14.7 million from industry players, including vehicle manufacturers and automotive suppliers, and public sector partners.

A team of scientists, led by **Stem Cell Network** researcher **Dr. Andras Nagy**, produces Canada's first two human embryonic stem cell lines, a development that gives researchers ready access to material needed to explore the vast therapeutic potential of stem cells.

May, 2005

A Canada-wide clinical research study, supported in part by the **Canadian Stroke Network (CSN)**, recommends the widespread use of thrombolytic drugs for acute stroke. Published in the **Canadian Medical Association Journal**, the confirmation that tissue plasminogen activator (t-PA) saves lives will help hospitals across Canada develop stroke protocols for better treatments.

Five years after the devastating outbreak caused by unsafe drinking water, the **Canadian Water Network (CWN)** hosts a week-long **Walkerton Workshop** for students and young professionals from a variety of disciplines including biology, chemistry, hydrogeology, public health and engineering.

April, 2005

Sheila Watt-Cloutier, a member of the **ArcticNet** Board of Directors, is elected one of seven "Champions of the Earth" by the **United Nations Environment Programme** for her contributions in addressing global climate change.

AllerGen begins receiving seed funding of over $5 million annually from the **NCE** to support research, networking, commercialization and capacity building activities to reduce the morbidity, mortality and socio-economic impact of allergic disease. With 100 investigators at 20 university and research centres, it forges links with 70 Canadian and international partners.

This Year's Highlights

Enhancing value through partnerships: An overview

The NCE program enhances value by mobilizing partnerships between academia, federal and provincial departments and agencies, and the private sector.

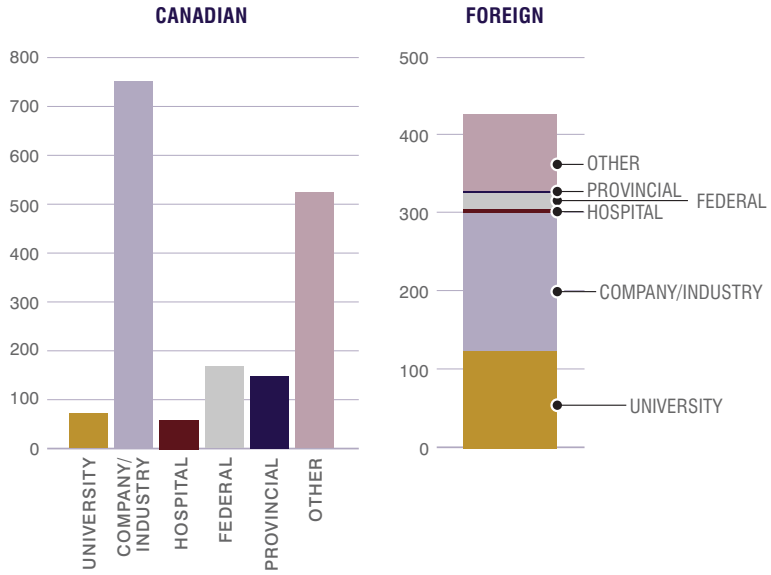
The 2005-2006 fiscal year saw the NCE program's 1,663 researchers and 4,467 highly qualified personnel involved in research relationships with 926 companies, 350 provincial and federal government departments and agencies, 64 hospitals, 202 universities, and 628 other organizations from Canada and world-wide.

The synergies created by these partnerships serve Canadians well. In 2005-2006, the networks stimulated outside cash and in-kind investments of almost $70 million, with more than $27 million of that coming from private sector companies. This leveraging allows taxpayers' research dollars to go further and researchers to accomplish more with their work.

Fiscal Year 2005-06

NCE PARTICIPATING ORGANIZATIONS

PROVINCE/TERRITORY	UNIVERSITY	COMPANY/ INDUSTRY	HOSPITAL	FEDERAL	PROVINCIAL	OTHER	TOTAL PERSONNEL
NWT, Nunavut & Yukon	0	4	0	5	5	15	**29**
British Columbia	10	126	6	18	25	72	**257**
Alberta	4	77	3	6	17	44	**151**
Saskatchewan	2	9	1	2	5	6	**25**
Manitoba	2	12	0	8	13	19	**54**
Ontario	22	342	25	96	36	246	**767**
Quebec	18	137	22	22	30	79	**308**
New Brunswick	4	19	0	8	10	19	**60**
Nova Scotia	7	23	2	5	6	12	**55**
Prince Edward Island	1	1	0	1	4	3	**10**
Newfoundland & Labrador	1	6	0	3	4	10	**24**
Total Canadian	**71**	**756**	**59**	**174**	**155**	**525**	**1,740**
Total Foreign	131	170	5	20	1	103	**430**
Grand Total	**202**	**926**	**64**	**194**	**156**	**628**	**2,170**



This Year's Highlights

Enhancing value through partnerships: Industry

Why do industries invest in the NCE program? Beyond the fact that the linkage with Canada's top university researchers keeps them on the leading edge of investigation, it can drive down costs and pump up profitability.

Consider the auto industry. Partners who contributed to AUTO21's Processing Technologies of Light Materials Cast Components project are saving millions of dollars in production costs by using the recently patented technology.

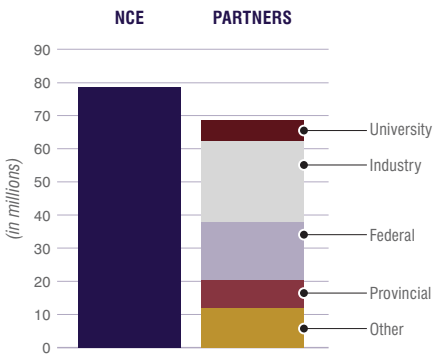
Participation in the NCE program also enhances a company's ability to develop new product lines and services. As Jan Jakubczyk, General Manager of Optiwave Systems Inc., said about his company's partnership with the Canadian Institute for Photonic Innovations (CIPI): "The immediate commercial impact of this research will be of significant benefit for our company. We are already committed to develop and market optoelectronic simulation tools resulting from this research."

Such partnerships also help companies – large and small – be better corporate citizens. Dr. Michael Mackinnon, Senior Research Scientist at Syncrude Canada, said the partnership his company's partnership with the Canadian Water Network (CWN) is ensuring "that Canada's immense oil sands resource is developed in an environmentally acceptable manner and that reclamation will lead to a viable and sustainable legacy."

Fiscal Year 2005-06

CONTRIBUTIONS TO THE NETWORKS OF CENTRES OF EXCELLENCE

SOURCE	CASH	IN-KIND	TOTAL
NCE (1)	$ 79,400,000	$ –	$ 79,400,000
PARTNERS			
University	$ 3,284,377	$ 3,774,556	$ 7,058,933
Industry	$ 12,903,771	$ 14,529,180	$ 27,432,951
Federal	$ 7,034,739	$ 5,340,761	$ 12,375,500
Provincial	$ 7,135,899	$ 2,516,678	$ 9,652,577
Other	$ 7,400,194	$ 5,973,700	$ 13,373,893
Partner's Total	$ 37,758,980	$ 32,134,875	$ 69,893,855
Grand Total	**$ 117,158,980**	**$ 32,134,875**	**$ 149,293,855**



(1) Does not include administration.

* Other partners include hospitals, research institutes, and not-for-profit organizations

This Year's Highlights

Enhancing value by putting great ideas to good use

"We are going to get a challenge to Canadian sovereignty in the Northwest Passage. As researchers, we feel a responsibility to take what information we've learned so far and to alert Canadian policy makers and the Canadian public that we have very little time to plan for that eventuality."

*- **Dr. Michael Byers**, ArcticNet researcher*

Knowledge translation is the art of taking academic research and creating real life results. Those results can take the form of a new product or an improved industrial process, a far-sighted public policy shaped by strong science, or the organization of complex data into accessible, useable information. It can be a patent applied for or issued. A licence granted, a paper published.

A good example is the creation of Attodyne Inc., a company that was incorporated in February of 2006 to capitalize on Canada's leadership in medical applications of ultra fast laser pulses. Attodyne emerged from the Technical Exploitation Program instituted by the Canadian Institute for Photonic Innovations (CIPI).

Perhaps Dan Sinai, Managing Director of the Canadian Language and Literacy Research Network (CLLRNet) described knowledge translation best, talking about his network's goals: "We have to put our science to work, in partnership with practitioners and clinics, in schools with teachers, at home with parents, and ultimately to the benefit of children across Canada. That's the only result that matters."

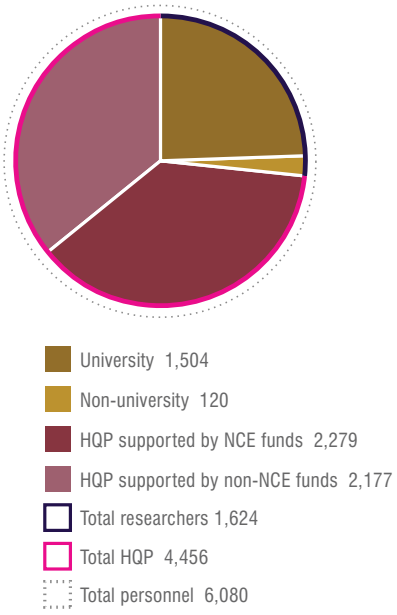
Fiscal Year 2005-06

REGIONAL DISTRIBUTION OF NCE RESEARCHERS AND PERSONNEL

	NCE Researchers (1)			HQP (2)			
PROVINCE/TERRITORY	UNIVERSITY	NON-UNIVERSITY	TOTAL RESEARCHERS	HQP SUPPORTED BY NCE FUNDS	HQP SUPPORTED BY NON-NCE FUNDS	TOTAL HQP	TOTAL PERSONNEL
NWT, Nunavut & Yukon	0	0	0	1	1	2	**2**
British Columbia	230	7	237	225	232	457	**694**
Alberta	202	0	202	316	350	666	**868**
Saskatchewan	28	0	28	32	19	51	**79**
Manitoba	41	0	41	91	27	118	**159**
Ontario	554	94	648	893	867	1,760	**2,408**
Québec	294	18	312	525	500	1,025	**1,337**
New Brunswick	53	0	53	54	85	139	**192**
Nova Scotia	68	1	69	116	46	162	**231**
Prince Edward Island	12	0	12	9	35	44	**56**
Newfoundland & Labrador	22	0	22	17	15	32	**54**
Total Canadian	**1,504**	**120**	**1,624**	**2,279**	**2,177**	**4,456**	**6,080**
Total Foreign	13	26	39	7	4	11	**50**
Grand Total	**1,517**	**146**	**1,663**	**2,286**	**2,181**	**4,467**	**6,130**

(1) An NCE researcher is a researcher from the academic, public or private sector responsible for a certain aspect of a network funded research project.

(2) Highly Qualified Personnel means research staff such as research associates and technicians, and research trainees such as postdoctoral fellows, graduate students and summer students.



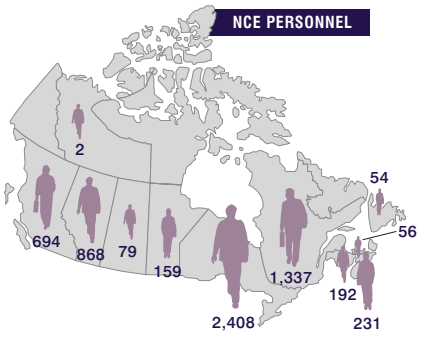
Fiscal Year 2005-06

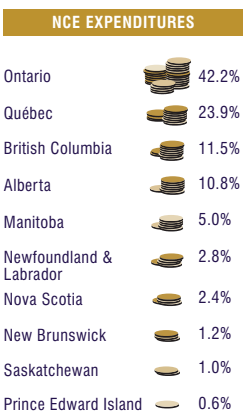
REGIONAL DISTRIBUTION OF NCE PERSONNEL AND FUNDS

	NCE Researchers (1)		Highly Qualified Personnel (2)		NCE Expenditures	
PROVINCE/TERRITORY	**# TOTAL**	**PERCENTAGE**	**# TOTAL**	**PERCENTAGE**	**# TOTAL**	**PERCENTAGE**
NWT, Nunavut & Yukon	0	0%	2	0%	$ 0	0.0%
British Columbia	237	14%	457	10%	$ 8,253,390	11.5%
Alberta	202	12%	666	15%	$ 7,777,114	10.8%
Saskatchewan	28	2%	51	1%	$ 727,847	1.0%
Manitoba	41	2%	118	3%	$ 3,567,521	5.0%
Ontario	648	39%	1,760	39%	$ 31,066,824	42.2%
Québec	312	19%	1,025	23%	$ 17,216,832	23.9%
New Brunswick	53	3%	139	3%	$ 878,963	1.2%
Nova Scotia	69	4%	162	4%	$ 1,751,256	2.4%
Prince Edward Island	12	1%	44	1%	$ 426,838	0.6%
Newfoundland & Labrador	22	1%	32	1%	$ 1,991,356	2.8%
Total	**1,624**	**98%**	**4,456**	**100%**	**$ 73,657,941**	**100%**
Total Foreign	39	2%	11	0%	$ 0	0.0%
Grand Total	**1,663**	**100%**	**4,467**	**100%**	**$ 73,657,941**	**100%**

(1) An NCE researcher is a researcher from the academic, public or private sector responsible for a certain aspect of a network funded research project.

(2) Highly Qualified Personnel means research staff such as research associates and technicians, and research trainees such as postdoctoral fellows, graduate students and summer students





This Year's Highlights

Enhancing value through new initiatives

A major achievement in 2005-2006 was the establishment of the NCE-New Initiative (NCE-NI) program which, on March 27, 2006, brought five New Initiatives into existence.

The NCE-NI program was created to support networking among already established researchers or research teams and to encourage them to build new partnerships with industries, government departments and agencies, as well as not-for-profit organizations. With their research costs already covered by other sources, the New Initiatives receive NCE funding for two to four years to stimulate research relationships to improve Canadians' social, health-related or economic well-being. In essence, the New Initiatives provide platforms for research coordination and intellectual exchange.

The Canadian Design Research Network (CDRN)

Design determines function. How things are designed plays a vital role in all areas of building and manufacturing. Design that is driven by first-rate research has positive impacts on long-term economic growth and contributes to social benefits.

Based at Simon Fraser University in Surrey, British Columbia, the Canadian Design Research Network (CDRN) is built on the premise that good design is crucial to productivity, innovation and sustainability.

The CDRN brings together researchers from across the country – along with partners in the private and public sectors – to improve Canadian design through research, outreach and collaboration. Its goal is to foster and undertake world-class research in themes such as sustainability, advanced design technologies, digital fabrication, design visualization and simulation, and interactive technologies. The multi-disciplinary network includes the key disciplines of architecture, landscape architecture, engineering, urban design, planning, industrial design, interaction design, computer science and human-computer interaction.

The Canadian Obesity Network

With more than 5 million obese adults and a half a million obese children, Canada is facing an epidemic that threatens the nation's health and well-being. In 2001, obesity costs represented $4.3 billion – or 2.2% of Canada's total health care budget. There are also substantial economic costs in terms of absenteeism or short or long-term disability.

Like other chronic diseases, obesity results from complex interactions between environmental and biological factors. The determinants of this epidemic are entrenched social trends, including urban sprawl, sedentary lifestyles, unhealthy diets, stress and nutritional illiteracy.

The Canadian Obesity Network, which is hosted by McMaster University in Hamilton, was created to encourage collaborations that will advance knowledge in obesity prevention and treatment. Its mission is to become the primary Canadian network of health professionals, researchers, policy makers and other commercial and non-commercial stakeholders interested in preventing and reducing the mental, physical and socio-economic consequences of excess body weight.

The Emerging Dynamic Global Economies (EDGE) Network

To prosper in the 21st century Canada needs to properly position itself in a rapidly transforming global economic landscape. The large emerging economies – particularly China, India and Brazil – are changing the world and creating major challenges to and opportunities for Canadian businesses and governments at a variety of levels: economic, social, and legal.

The Emerging Dynamic Global Economies (EDGE) Network, which is headquartered at the University of Ottawa, is working to ensure Canada remains economically competitive and productive while preserving the social fabric of its communities, protecting its environment and securing its energy and resource supplies for future generations.

EDGE will produce multi-disciplinary, relevant analysis that leads to practical and effective public policy proposals. It will encourage extensive, informed public discussion and debate, and deliver targeted training and exchange programs to help cultivate the next generation of economic leaders.

The National Initiative for the Care of the Elderly (NICE)

Canada is growing older. Adults over 65 make up Canada's fastest growing population group. The senior population will hit 6.7 million by 2021 and grow to 9.2 million by 2041 – when almost one in four Canadians will be a senior. And already there is a shortage of trained medical professionals to care for seniors.

The National Initiative for the Care of the Elderly (NICE), a network of researchers and practitioners involved in the care of older adults through medicine, is addressing the challenges presented by this impending demographic shift.

NICE, based at the University of Toronto, will influence the care of Canada's seniors by transferring knowledge about best practices for the care of the elderly; encouraging students to specialize in the care of older persons; refining existing practitioners' skills in the care of the elderly; shifting other practitioners' attention to the importance of caring for older adults; and influencing policy initiatives affecting Canada's seniors.

Promoting Relationships and Eliminating Violence Network – PREVNet

Recent high-profile reports of bullying and victimization in which Canadian children have died or been seriously hurt have raised public fears that the problem is a prevalent one. Those concerns were confirmed by a recent World Health Organization Health Behaviours in School-Aged Children survey, in which Canada ranked 26th and 27th out of 35 countries on the measure of bullying and victimization.

Canada needs a national strategy on bullying and the Promoting Relationships and Eliminating Violence Network – PREVNet has been created to help shape it.

PREVNet, based at Queen's University in Kingston, brings together university researchers, non-governmental organizations (NGOs) and other partners to promote safe and healthy relationships for Canadian children and youth. With a goal of creating socio-cultural change by reducing the negative use of power and aggression in relationships, PREVNet will provide NGOs and governments with the capacity to tailor and disseminate scientifically based resources to build awareness, change attitudes, assess bullying, implement evidence-based strategies and develop effective policies.

Membership of the NCE New Initiatives Selection Committee

Chair:
Dr. Camille Limoges
Consultant
Outremont, QC, Canada

Members:
Dr. Jacques Albert
Carleton University
ON, Canada

Dr. Lajos Balogh
Roswell Park Cancer Institute
NY, USA

Dr. Janine Brodie
University of Alberta
AB, Canada

Dr. Katy Campbell
University of Alberta
AB, Canada

Ms. Margaret Coopey
Agency for Health Care Research and Quality
Maryland, USA

Dr. David Castle
University of Guelph
ON, Canada

Dr. Eric Fong
University of Toronto
ON, Canada

Dr. Michael Geist
University of Ottawa
ON, Canada

Dr. G. Sarwar Gilani
Health Canada
ON, Canada

Dr. Claude Hillaire-Marcel
Université du Québec à Montréal
QC, Canada

Dr. Gordon Huang
University of Regina
SK, Canada

Dr. Diane Ingraham
Cape Breton University
NS, Canada

Dr. Penny Jennett
University of Calgary
AB, Canada

Ms. Natacha Joubert
Health Canada
ON, Canada

Dr. Ahmed Koubaa
Université du Québec en Abitibi-Témiscamingue
QC, Canada

Dr. Janet E. McElhaney
University of British Columbia
BC, Canada

Dr. John McHugh
Dalhousie University
NS, Canada

Dr. Ellen Moss
Université du Québec à Montréal
QB, Canada

M. Edward J. Mullen
Columbia University
NY, USA

Dr. Kenneth W. Neale
Université de Sherbrooke
QC, Canada

Dr. Brigitte Schroeder
Université de Montréal
QC, Canada

This Year's Highlights

Renewing the commitment to excellence

"You need a national networking organization like the Canadian Stroke Network to do this (the Canadian Stroke Strategy) across the country and to translate research into improvements in health care and the health care systems. It's creating the momentum and the capacity to drive forward change."

*- **Sally Brown**, CEO of the Heart and Stroke Foundation*

After completing a seven-year cycle, each network undergoes a renewal process, with its past work and future plans reviewed. In 2005-2006, The Canadian Stroke Network successfully secured NCE renewal for a second seven-year term.

The Canadian Stroke Network (CSN)

In the late summer of 2005, when the NCE program announced that the Canadian Stroke Network (CSN) had been awarded $25.6 million in funding for four years, it was both an acknowledgement of impressive accomplishments and an act of anticipation of more great things to come.

In its first six years of operation, under the direction of CEO and Scientific Director Dr. Antoine Hakim, the CSN established itself as an international leader in the stroke effort by assembling world-class research initiatives, setting standards for rehabilitation and supporting the creation of spin-off companies to develop new anti-stroke therapies.

The CSN built the Registry of the Canadian Stroke Network – the world's premier tool to monitor and evaluate stroke care – and forged a mutually beneficial partnership with the Heart and Stroke Foundation (HSF) to translate state-of-the-art research into stroke care procedures and practice. And it created an award-winning training program for its highly qualified personnel.

Looking forward, the CSN is poised to make an even greater contribution to reducing the growing burden of stroke – a devastating disease that strikes 50,000 Canadians each year and is the leading cause of long-term adult disability.

In partnership with the HSF, the CSN is driving the Canadian Stroke Strategy to significantly improve stroke prevention, treatment and rehabilitation in every province and territory by 2010. The massive project involves everyone concerned with stroke care – from paramedics to policy-makers – and will ensure that the best practices for stroke are in place right across the country. "This co-ordinated stroke strategy will help us reduce death and disability from one of society's most sudden and devastating illnesses," said Dr. Hakim.

Along with driving the national strategy, the CSN's renewed funding is supporting a number of high-impact projects to decrease the physical, mental, social, and economic burden of stroke. As Dr. Alan Bernstein, President of the Canadian Institutes of Health Research, pointed out at the renewal announcement, the work the CSN is doing to forge partnerships with industry, health care practitioners, public organizations, and policy-makers is ensuring that scientific innovations are "making it out of the laboratory and into the world where they can do the most good."

The year 2005-2006 also saw two networks – AquaNet and CANVAC – wrap up their participation in NCE program. Canada benefited significantly from the research these networks encouraged, the knowledge translation they fostered and the industry partnerships they forged.

AquaNet

AquaNet's activities helped Canadian aquaculture – the farming of fish, shellfish and aquatic plants in fresh or salt water – become a globally competitive and sustainable sector. Activities included:

- Mobilizing Canadian academic researchers into multi-disciplinary research teams.
- Connecting Canada to a world of R&D through international research collaborations.
- Providing industry, governments and other sector stakeholders with a trusted, independent source of research and scientific advice.

CANVAC – Canadian Network for Vaccines and Immunotherapeutics

CANVAC, the Canadian Network for Vaccines and Immunotherapeutics, built a consortium of leading medical researchers across the country to develop vaccines to help in the fight against cancer and viral diseases. Among its accomplishments:

- CANVAC researchers identified 10 T-cell epitopes (antigenic sites against which antibodies react) of the SARS-Cov N protein.
- Work supported by CANVAC led to the development of the adjuvant 4-IBBL, an immune system booster with strong potential application in therapeutic anti-HIV and cancer vaccines.
- Research initiated by CANVAC is helping move forward preclinical and clinical trials in the effort to develop vaccines for melanoma, HIV, HCV, breast and prostate cancer, SARS and Yellow Fever.

The 2006 NCE Renewal Competition Selection Committee

Chair:
Dr. Camille Limoges
Consultant
Outremont, QC, Canada

Members:
Dr. John Clement
iCo Therapeutics Inc.
BC, Canada

Dr. Terry Dick
University of Manitoba
MB, Canada

Dr. Cathy Garner
Boweham House
Lancaster, England

Dr. Peter Hackett
Alberta Ingenuity Fund
AB, Canada

Dr. Shoo Lee
University of British Columbia
BC, Canada

Dr. Tim Mosmann
University of Rochester Medical Center
NY, USA

Dr. Jane E. Pagel
Jacques Whitford Ltd
ON, Canada

Dr. Mark Rosenberg
Queen's University
ON, Canada

"We are identifying new solutions for the development of more sustainable forest management practices across the country. Our research findings are making a difference on the ground."

*- **Dr. Jim Fyles**, Scientific Director of the SFM Network*

In late March of 2006 the NCE program announced the investment of up to $21.9 million over three years to extend the research activities of two networks. One is involved in building better bridges, while the other is securing the sustainability of Canada's forests.

The funding renewal for Intelligent Sensing for Innovative Structures – ISIS Canada and the Sustainable Forest Management Network (SFM Network) came only after an in-depth review of their scientific accomplishments, future research priorities, and training and knowledge transfer activities.

That review process indicated the two networks not only have admirable track records for moving research out of their laboratories and into the world, they have put plans in place to do even more to provide benefits to Canadians.

Intelligent Sensing for Innovative Structures - ISIS Canada

Heading into the second half of its second seven-year funding term, Intelligent Sensing for Innovative Structures – ISIS Canada has good reason to be proud.

The network, which marked its 10th anniversary in 2005, has essentially rewritten the book on how bridges are built. Research and knowledge translation that ISIS championed on glass fibre reinforced polymers (GFRPs) has led to the updating of the Canadian Highway Bridge Design Code.

The network is also having a global impact. International adoption of the ISIS Winnipeg Principles is shifting thinking and setting new standards and application specifications for the design and construction of concrete bridges. It is leading to the adoption of technologies for longer lasting structures that are easier and less-expensive to monitor and maintain.

"With our funding secured, we can continue our mission for the benefit of the engineering profession and Canadians at large," said Dr. Aftab Mufti, President and Scientific Director of ISIS.

Sustainable Forest Management Network (SFM)

The reason behind the success of the Sustainable Forest Management Network (SFM) can be summed up in two words: it listens.

Instead of funding research and then trying to find a use for it, the SFM Network first listens to what its partners in industry, government, First Nations, and non-governmental organizations (NGOs) indicate are their priorities. Funded university-based research teams then work in collaboration with those partners and the network's staff to make sure research knowledge is shared and implemented.

It's a system that works. "The structure and mandate of the SFM Network has provided Weyerhaeuser with an opportunity to contribute to setting research direction and to focus on research priorities that are of importance to the company," said Norm Denney, Alberta Forestlands Manager, Weyerhaeuser Company Ltd. "As a result, our company has access to reliable scientific data on such issues as natural disturbance, variable retention, and a variety of wildlife projects."

The Canadian Genetic Diseases Network (CGDN)

The Canadian Genetic Diseases Network (CGDN) successfully completed its NCE funding in 2004-2005 and has received a total of $500,000 in research management funding (RMF) since that time to complete its activities and make the transition to sustainability.

As part of that process, CGDN held a series of bioinformatics workshops to meet the increasing demand for computational biology skills in Canada. The short, practical workshops provided a comprehensive introduction to the methodology and algorithms that underlie successful development and application of bioinformatics tools and software.

The Institute for Robotics and Intelligent Systems – IRIS

One of the original networks established by the NCE program in 1990, the Institute for Robotics and Intelligent Systems (IRIS) was managed by Precarn Incorporated, an independent, not-for-profit company that supports the pre-commercial development of leading-edge technologies.

IRIS developed innovative programs to advance the understanding and application of robotics and intelligent systems. The Technology Gap Assistance Program bridged the gap between academic results and a marketable reality. The Precarn Scholars Program funded top students and promoted their work. The Emerging Opportunities Fund allowed tenured researchers to explore early-stage concepts with commercial potential. In partnership with the Canadian Space Agency and Precarn, IRIS funded a one-year agreement to promote Canadian leadership in space telerobotics and telemedicine technologies.

IRIS, which received transition funding in 2005-2006 after the successful completion of 14 years of NCE support, did outstanding work in developing HQP, patents, licences and start-up companies to commercialize inventions that will benefit Canada and Canadians.

IRIS research resulted in 151 technology disclosures, 50 licences, and 55 patent applications – of which 47 have been issued. Significant new knowledge was applied in areas such as robotic manipulation, data mining and motion planning.

The work IRIS undertook helped integrate innovations in robotics and intelligent systems with health care and industry. These successes are being carried forward by Precarn to transform university and government research into products and processes.

Protein Engineering Network (PENCE Inc.)

PENCE was one of the original 15 NCEs that were launched in 1989 and successfully completed their two cycles of NCE funding. NCE funding of PENCE came to an end in fiscal year 2004-05; however, NCE terms and conditions allow networks' researchers one year after NCE funding to complete their research and student training activities.

With an early mandate to engineer and study novel proteins for economic benefit, PENCE evolved as it responded to changes in the research and scientific climates.

As it evolved, PENCE created a vast wealth of knowledge. Its advances in carbohydrate technologies, protein analysis and protease studies have stood the test of time. It built a bridge between academic research and industry application by partnering with existing companies and helping to create new ones. It trained the next generation of protein scientists: more than 900 postdoctoral fellows, graduate students, undergraduate students, summer interns and technicians were trained directly through the network.

PENCE's work has had direct application in the health sciences by helping to create vaccines and treatments, including advances made by a PENCE research group in the treatment for Tay-Sachs Disease. As well, PENCE was quick off the mark when SARS struck in 2003: within days of the announcement of the determination of the SARS genome sequence, network researchers were working on proteins that play key roles in how the virus replicates.

PENCE proved the power of collaboration. The "network approach" of recruiting multidisciplinary researchers – including bioinformaticians, protein biochemists, physicists, chemists, cell biologists and engineers – to overcome challenges was the cornerstone of its achievements. Without PENCE, many of the outstanding Canadian accomplishments in protein engineering and proteomics over the past 15 years simply would not have occurred.

This Year's Highlights

The life cycle of funding

Funding allocations are reviewed and revised throughout the life cycle of each network within the NCE program. Budgets and funding levels for new networks are set by the Steering Committee and are based on recommendations by the Selection Committee. Existing networks undergo reviews at the midpoints of their seven-year terms to make sure they are meeting the NCE program objectives. Networks that are leaving the program can apply for Research Management Funding (RMF) to help them transition into sustainability.

Fiscal Year 2005-06

CURRENT NETWORK ROADMAP

NETWORKS	FUNDING PERIOD	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
IRIS	1989-2006																
CGDN	1989-2007																
ISIS	1995-2009	MT			RMF												
SFM	1995-2009	MT			RMF												
CAN	1998-2009				MT			RMF									
GEOIDE	1998-2009				MT			RMF									
MITACS	1998-2009				MT			RMF									
AQUANET	1999-2006	RC															
CANVAC	1999-2006	RC	***														
CSN	1999-2010	RC				MT			RMF								
CIPI	1999-2009				MT			RMF									
AUTO21	2000-2008			RC				MT			RMF						
CLLRNet	2000-2008			RC				MT			RMF						
CWN	2000-2008			RC				MT			RMF						
SCN	2000-2008			RC				MT			RMF						
AFMNet	2003-2008			MT			RC				MT			RMF			
ArticNet	2003-2008			MT			RC				MT			RMF			
AllerGen	2004-2009				MT			RC				MT			RMF		
CDRN	2005-2007			MT													
CON	2005-2007			MT													
EDGE	2005-2007			MT													
NICE	2005-2007			MT													
PREVNet	2005-2007			MT													
Prionet	2004-2009				MT			RC				MT			RMF		

RC Competition for renewal of last funding cycle

MT Mid-term Review

1st seven-year funding cycle

2nd seven-year funding cycle

RMF Funding

*** Winding down funding

Remaining years of eligible funding based on successful mid-term review and/or competition for renewal of last funding cycle and/or RMF.

This Year's Highlights

Enhancing value by doing more, doing it better

With a theme of "Doing More and Doing it Better," the NCE program's annual meeting for 2005 was an exercise in examining how to enhance value in almost every activity in which the networks are engaged.

Network managers and scientific directors from across the country exchanged ideas on everything from improving communication and co-operation between networks to weaving social science research into NCE program activities.

With "best practices" sessions for scientific directors, network managers, students and young innovators and communications officers, the participants came away with practical knowledge they could put to use immediately.

Knowledge translation was a key concern for those gathered at the conference and featured speaker Dr. Réjean Landry, an economist and political scientist who leads a program in knowledge transfer and innovation at the Université Laval, provided new insights into what it takes to translate academic research into real-world application.

Conference attendees also considered how they can best measure the impacts networks are having, how to best train highly qualified personnel so that they are prepared for the "real world," and how to foster interaction between the individual networks to further increase positive impacts and deliver more benefits to Canadians.

"Prior to AUTO21, automotive research occurred throughout Canada in small pockets but with little alignment, strategic planning or connection to industry's needs. With an active research community of about 230 academic researchers, AUTO21 has led to more research being conducted in Canada, and has helped smaller Canadian companies leverage a national team of experts for in-house R&D. AUTO21 has helped to position Canada as an advanced nation capable of world-class R&D which makes it more attractive to potential investors."

*- **J. Norman Lockington**, Chair of the AUTO21 Board of Directors*

Benefits

How NCE investment enhances value

Some have described it as putting science to work. Or transforming research into results. Jean-Claude Gavrel, Director of the NCE Program, calls it "turning NCE discoveries into technologies, products and policies for the benefit of Canadians." The NCE program delivers benefits by applying scientific research to advancing Canada's economy and improving quality of life. As a permanent federal government program, it provides the long-term resources required to build partnerships between academia, industry and government.

Managing outcomes

The NCEs must report on their activities and achievements in all areas, including excellence of research, the extent of their collaborations, the knowledge they have created and transferred to users, and the personnel they have trained and retained. These data are collected and reported globally for the overall program in each annual report.

Investing in networks

The NCE program invests in national research networks that:

- Stimulate leading-edge research in areas critical to economic and social development
- Develop and retain world-class researchers in areas essential to Canada's productivity
- Create nation-wide multi-disciplinary and multisectoral research partnerships
- Accelerate the exchange of research results within the networks and the use of these results by organizations that can harness them for economic and social development

Benefits

Benefits for Canadians

Canadians accrue benefits from the NCE program's investments in health, human development and biotechnology. The NCE program is also active in protecting and enriching our natural resources by encouraging best practices for sustainable development. It also enables industry to deal effectively with environmental issues and is addressing Canadians concerns about the impacts of climate change.

Benefits

Benefits for industries

With 917 private sector partnerships, the NCE program helps Canadian industries stay on the cutting edge, cut costs and prepare for the future. A case in point: the automobile industry is benefiting from NCE-sponsored research into biodegradable vehicle parts which are cheaper to produce and easier on the environment. The NCE program's investments in engineering and manufacturing are helping streamline production processes, while NCE-sponsored research in advanced technologies is helping Canadian companies stay competitive.

Benefits

Benefits for government

The NCE program helps its federal and provincial government partners stay informed so that new knowledge can help them prepare prudent public policy. The knowledge could help governments mitigate the effects of a worldwide decline in wild Atlantic salmon, or make informed decisions about the use of stem cells in dealing with degenerative diseases. It could save lives by helping governments prepare for influenza outbreaks, or alleviate social problems by reducing the incidence of illiteracy.

Benefits

Benefits for Research

The networking model pioneered by the NCE program encourages researchers to work co-operatively, not competitively. Instead of competing with each other for grant money, researchers are encouraged to pool their talents and propose multi-disciplinary approaches to solving complex problems. These research synergies often can be more significant benefits than individual investigations.

The Networks

Fiscal Year 2005-06

Summary of the 25 networks—2005-06

NETWORKS	FUNDING PERIOD	NCE AWARD	NETWORK RESEARCHERS (1)	HQP (2)	UNIVERSITIES (3)	INDUSTRIES (3)	GOVERNMENT DEPARTMENTS/AGENCIES AND OTHERS (3)	TOTAL ORGANIZATIONS (3)
AFMNet	2003-2008	$ 5,559,000	68	121	30	29	21	**80**
AllerGen	2004-2009	$ 5,023,000	42	41	31	46	99	**176**
AquaNet	1999-2006	$ 3,600,000	98	176	33	43	60	**136**
ArcticNet	2003-2008	$ 6,441,000	76	230	48	17	89	**154**
AUTO21	2000-2008	$ 5,800,000	255	415	47	120	72	**239**
CAN	1998-2009	$ 4,073,000	47	684	34	81	84	**199**
CANVAC	1999-2006	$ 4,700,000	36	148	16	42	98	**156**
CDRN	2005-2007	$ 200,000	n/a	n/a	16	12	17	**45**
CGDN	1989-2007	$ 250,000	53	37	12	36	85	**133**
CIPI	1999-2009	$ 4,243,000	115	198	32	54	20	**106**
CLLRNet	2000-2008	$ 3,550,000	73	187	41	13	58	**112**
CON	2005-2007	$ 200,000	n/a	n/a	28	11	49	**88**
CSN	1999-2010	$ 4,700,000	79	208	19	16	40	**75**
CWN	2000-2008	$ 3,700,000	117	173	36	43	99	**178**
EDGE	2005-2007	$ 200,000	n/a	n/a	21	11	37	**69**
GEOIDE	1998-2009	$ 3,510,000	110	290	54	42	66	**162**
IRIS	1989-2006	$ 250,000	59	56	32	116	26	**174**
ISIS	1995-2009	$ 3,200,000	44	203	14	43	16	**73**
MITACS	1998-2009	$ 5,401,000	177	715	65	148	86	**299**
NICE	2005-2007	$ 200,000	n/a	n/a	15	n/a	5	**20**
PENCE	1989-2005	$ 0	59	n/a	12	6	5	**23**
PREVNet	2005-2007	$ 200,000	n/a	n/a	19	5	35	**59**
PrioNet	2005-2009	$ 5,000,000	16	10	7	1	9	**17**
SCN	2000-2008	$ 5,300,000	69	303	29	37	65	**131**
SFM	1995-2009	$ 4,100,000	70	273	40	41	85	**166**
TOTALS		**$79,400,000**	**1,663**	**4,467**	**731**	**1,013**	**1,326**	**3,070**

Health, Human Development and Biotechnology | Natural Resources and Environment | Engineering and Manufacturing | NCE - New Initiatives (4) | Advanced Technologies

(1) Network researchers include Canadians and foreigners.

(2) HQP: means Highly Qualified Personnel including research staff (research associates and technicians) and research trainees (postdoctoral fellows, graduate and undergraduate students).

(3) Organizations (Canadian and foreign) are counted for each appearance, ie. if an organization participates in multiple networks, they will be counted more than once.

(4) NCE-New Initiative funding is intended for networking activities and is not intended to support researchers as it is expected that the researchers will already have research funding.

The Networks

Advanced Foods and Materials Network (AFMNet)

From nature's defence strategy to commercialization strategy

AFMNet research and tech transfer know-how lead to birth of a company

Compounds that plants use as a shield against fungi, bacteria and other pathogens are travelling the path to the commercial marketplace, thanks to the efforts of researchers and technology transfer experts in the Advanced Foods and Materials Network (AFMNet). Nature's wisdom about protecting organisms from harm holds promise for a host of agricultural and medical applications, including the development of antimicrobials to protect human health.

This "discovery to start-up" journey began in 1999, with research at the University of Victoria into defensive compounds produced by Douglas fir trees. In February 2006, a milestone was reached with the creation of a new commercial venture, FloraPure BioSciences Inc.

"This is a tale of how some basic research into plant reproductive tissues led to the formation of a company – a transition that would not have been possible without the help and guidance of AFMNet," says Dr. Brett Poulis.

Dr. Poulis embarked on research for his doctoral dissertation seven years ago, in collaboration with Dr. Patrick von Aderkas, a professor at the university and an expert in botany. Dr. Poulis had just completed an undergraduate double-major degree in chemistry and biochemistry.

Their research goal was to unravel one of nature's mysteries. How did conifers – in this case, Douglas firs – protect themselves from bacteria, fungi and viruses during pollination? When windblown pollen arrives at the female cones of the trees, it also brings along a number of pathogens. Yet, the trees were effectively erecting a barrier to these outside invaders. "Our assumption was that a particular secretion that is produced during these reproductive events was providing an effective defensive

R2B Program

FloraPure BioSciences is the first company incorporated in AFMNet. "It is great to see our first commercialization result so quickly in the life of this young network," says Dr. Murray McLaughlin. "The market potential of this research was significant enough that we all realized creating a company was the way to harness this opportunity."

Through workshops at universities and support for specific projects, the Research to Business Program (R2B) provides scientists with the fundamentals of commercialization and modern business methods. "Our objective is to help scientists understand the processes and pitfalls of going from an idea to creation of a company," says Dr. McLaughlin. R2B supports a key AFMNet mandate – to transform food and bio-materials research into economic and social benefits for Canadians.

barrier against these potentially devastating pathogens because the cones didn't seem to have a big problem with infection," says Dr. Poulis. "But no one had ever definitively shown there was antimicrobial material within this liquid."

Even in the early days, Dr. Poulis says he had a sense that commercial applications might well emerge. "These trees are ancient, and they have a defensive system that has worked for them for hundreds of millions of years. I believed there definitely could be something in there that would not only help defend plants and crops, but human health as well."

So the researchers began their quest to profile the defensive compounds contained in the secretions. This kind of investigation had not been possible previously because the liquid droplets were so minute – in the realm of 100 nanolitres – that their components could not be analyzed. By 1999, however, advances in proteomic technologies allowed the research to proceed. State-of-the-art equipment was supplied by the UVic-Genome BC Proteomics Centre, a world-class protein research facility.

AFMNet funding supported the research as it progressed. There were a number of collaborators including renowned protein chemist Dr. Bob Olafson, also from the University of Victoria, and floral nectar expert Dr. Robert Thornburg from Iowa State University, who has been researching defence compounds in flowering plants. More recently, interdisciplinary collaborations have been formed with AFMNet researchers throughout Canada, including those at Dalhousie University, the University of Guelph, St. Francis Xavier University, and the Université de Montréal.

Drs. Poulis and von Aderkas have discovered that plants use an array of defensive compounds with antibacterial and antifungal properties. As they worked to purify, identify and characterize the various proteinaceous and low-weight molecular compounds, the commercial potential became increasingly clear.

With two scientists at the helm and neither of them knowing how to proceed into the unfamiliar territory of commercialization, they reached out to AFMNet which put them in contact with AFMNet Board members Drs. Jeff Turner and Murray McLaughlin, founders of the Research to Business (R2B) Program, the business development and commercialization arm of AFMNet. For the first year, Drs. Turner and McLaughlin served in a mentorship capacity for the program.

"The R2B program was instrumental, because the people in it had a wealth of experience and they encouraged us at precisely the right moments," says Dr. von Aderkas. "The next stage is to build substantial investor support." With the support of the program, the researchers developed a start-up strategy and are currently transferring the technologies developed and characterized in the lab into their company.

FloraPure BioSciences Inc. plans to use a unique plant protein expression system to produce and purify the relevant compounds on a large commercially useful scale. There are a number of potential applications in the agricultural and forestry industries, such as encapsulations to protect the seeds of trees or crops against fungal contamination. In medicine, applications include new topical antibacterial and antifungal creams, and unique and cost-effective antibiotics.

www.afmnet.ca

The Networks

Allergy, Genes, and Environment Network (AllerGen)

Helping drug companies pick winners

Clinicians form national network to identify promising new therapies for allergy and asthma

The AllerGen Network of Centres of Excellence has launched a new initiative that will fast-track the development of new asthma and allergy therapies, making Canada an attractive location for early-stage research and development (R&D).

Industry demand is growing for a unique Canadian service that could save drug companies hundreds of millions of dollars in R&D costs by identifying which medicines show promise for treating asthma and allergies – and which ones are duds.

Launched in 2005 with funding from AllerGen, the Clinical Investigator Collaborative (CIC) provides a "one-stop shop" for pharmaceutical and biotechnology companies to test early-stage molecules and compounds. The CIC has already completed three early-stage clinical trials with another three in line for 2007. Clients include Topigen Pharmaceuticals (Montreal), Boehringer Ingelheim Ltd. (Mississauga), IVAX Research (Miami), MedImmune (Frederick, MD) and Alexion Pharmaceuticals (Cheshire, CT).

"We're getting overwhelmed with the response from industry. There are even two studies we couldn't take on because we're too busy," says Dr. Paul O'Byrne, principal investigator for the CIC and Chair of Medicine at McMaster University.

Canada has broken new ground internationally with the AllerGen CIC – a unique consortium that pools the nation's collective expertise in allergy research to conduct early-stage clinical trials at McMaster, the University of Saskatchewan, University of Alberta, University of British Columbia and Université Laval. The CIC provides a cost-effective way to evaluate how

CIC trial moves asthma therapy to next stage

A potential new therapy for asthma has moved one step closer to market as a result of studies conducted by AllerGen's Clinical Investigator Collaborative (CIC).

Topigen Pharmaceuticals, Inc., an emerging biopharmaceutical company based in Montreal, has reported positive results for a new inhalant for people with mild-to-moderate asthma. It could eventually provide an alternative to inhaled corticosteroids, which can cause weight gain, high blood pressure, cataracts and other side effects.

"This is a significant milestone towards building Topigen into a leading biopharmaceutical company focused on developing innovative treatments for respiratory diseases," said Dr. Paul Wotton, President and CEO of Topigen.

The Phase II trial of 17 patients was led by Dr. Paul O'Byrne, Chair of Medicine at McMaster University and a principal investigator with the CIC.

well new molecular compounds treat inflammation in people's breathing passages.

But the CIC is about much more than clinical trials, stresses Dr. Judah Denburg, AllerGen's Scientific Director and CEO. With a broader focus on clinical investigation, Dr. Denburg says researchers will study the mechanisms of allergic disease, including what causes it, how it develops and how it persists. The CIC also assists with the development of research protocols, regulatory submissions, budget management, and the training of research assistants, graduate students and postdoctoral fellows.

"Our goal is not to turn Canada into a clinical trials machine. We're looking for something more comprehensive," says Dr. Denburg, whose Network brings together some 158 investigators and 83 trainees from across Canada. "The main purpose of CIC is to take the earliest frontier-breaking medicines for allergy and asthma, test them quickly, understand how they work and predict whether they will be right for big-scale market development."

For a fee, pharmaceutical companies work with the CIC to test therapies and molecules at multiple research centres, using "gold standard" scientific methods pioneered by Canadian researchers.

"If you have methods that aren't really well done or standardized, you might need 50 or 100 patients in the study," explains Dr. O'Bryne. "Using our model and multiple sites, we can produce reliable and reproducible results often with as few as 20 or 30 patients. It means we can do these studies with greater speed and efficiency, and that's what industry is really attracted by."

Another major benefit to companies is finding out early in the research cycle if a molecule or drug has potential. It can take 10 to 12 years to move a molecule from its early stage to regulatory approval. The CIC can let companies know within the first three to four years if the molecule works, saving them millions of dollars in development costs.

"The worst thing that can happen for companies is to push ahead with a big, very expensive development program that doesn't produce very much at the end of the day, and that often happens, unfortunately," says Dr. O'Byrne.

Researchers are in the process of analyzing data from the first three studies, and the results so far look promising (see sidebar article on TOPIGEN). The studies examined new molecules that have never been tested and new combinations of anti-inflammatories. One study has produced information on new DNA sequences that could help to reverse a patient's allergic response.

Dr. Denburg says the studies likely would not have happened without the CIC: "What will this mean for people with allergies and asthma? It will mean a better understanding of the medications they're getting, better medications, better treatments and possibly even cures."

www.allergen-nce.ca

Allergy Facts

- Canada ranks near the top of the list of countries facing a growing epidemic of allergies
- Nearly half of Canadians suffer from some sort of allergic reaction and 15 to 20 per cent of children have asthma
- $15 billion cost to the Canadian economy

The Networks

ArcticNet

Is Canada's Arctic poised to become the Panama Canal of the north?

The ArcticNet Network of Centres of Excellence (NCE) has brought together international law experts, marine geologists, biologists, sea ice physicists and other scientists to map the geological and political factors that could help Canada maintain its sovereignty over the Northwest Passage.

Exactly when will it be possible for ships to use the Northwest Passage to travel between Asia and Europe? Is the seabed suitable for resource development? What about the environmental risks?

Those are among the many questions government officials are asking as melting sea ice in the Northwest Passage begins to open a viable sea route that is 7,000 kilometres shorter between Europe and Asia than the Panama Canal.

Scientists predict many parts of the Arctic could be ice-free in summers by 2050. The timeline is much shorter for both the Northwest Passage and the Northeast Passage (between Norway and Alaska), which could see summertime open waters within five-to-10 years, if not sooner.

"What we're realizing is that any summer now – it could be the summer of 2006 or 2007 – we are going to get a challenge to Canadian sovereignty in the Northwest Passage," says Dr. Michael Byers, a Canada Research Chair in Global Politics & International Law at the University of British Columbia, and member of the ArcticNet research team. "As researchers, we feel a responsibility to take what information we've learned so far and to alert Canadian policy makers and the Canadian public that we have very little time to plan for that eventuality."

ArcticNet has rallied Canada's research community to provide answers that will help the federal government manage a coastal region that will become increasingly accessible, not only to international shipping, but also commercial fishing, resource development, tourism and potentially drug smuggling or illegal immigration. Dr. Byers is leading a project examining the international law and diplomacy of Canada's Arctic waters.

But he's not working in isolation. An article published earlier this year in *Policy Options* is co-authored by three ArcticNet researchers from very diverse disciplines: Dr. Byers (international law), Dr. Louis Fortier (biology, Université Laval) and Dr. David Barber (sea ice physicist, University of Manitoba). Their article details the ecological,

ArcticNet represents Canada's single largest scientific response to understanding changes in the Arctic. Over 100 ArcticNet researchers and 200 graduate students, post-doctoral fellows, research associates and technicians from 27 Canadian universities and five federal departments collaborate with more than 100 partner organizations from Canada and abroad to study the impacts of climate change in the coastal Canadian Arctic. Their main research platform is the *CCGS Amundsen* research icebreaker, a retrofitted Canadian Coast Guard vessel which began crisscrossing the Canadian Arctic in 2003 to investigate the environmental, social and economic impacts of a warming Arctic.

economic and political impacts of polar climate change. Titled "The Incredible Shrinking Sea Ice", Dr. Byers describes it as "one of the most important policy articles that have been published so far" on the melting Canadian Arctic.

"It is essential that we take a multidisciplinary approach to Arctic research, and that's what the NCE program enables us to do," says Dr. Byers.

For example, it's not enough for governments to know that the Arctic may be ice free in summer by 2050. Policy makers specifically want to know when it will be possible for ships to navigate through the Northwest Passage, or resource companies to begin exploring there.

"That's where I can help," says Dr. Byers. "By collaborating with the scientists, I can tell them what research is most helpful to policy makers and lawyers.

The crucial issue concerns the western end of McClure Strait, which is the main water channel that connects the Passage to the western Arctic Ocean. For thousands of years, McClure Strait has been the main gateway for concrete-hard, thick, multi-year ice to enter the channels of the Passage. Research led by Dr. Barber has shown that in recent years the Arctic Ocean multi-year ice edge has retreated north and now lies at the northern limit of McClure Strait, potentially limiting the influx of threatening multi-year ice through the Passage in the near future.

"The melting single-year ice is irrelevant in summer," says Dr. Byers. "An ice-strengthened tanker can go through it like a hot knife through butter. It's the multi-year ice that matters."

Mapping below the Northwest Passage

Some answers also lie beneath the ice, on the seafloor of the Northwest Passage. Another group of ArcticNet researchers, led by Dr. John Hughes Clarke at the University of New Brunswick and Dr. Steve Blasco at the Geological Survey of Canada in Dartmouth NS, are using the Canadian research icebreaker *CCGS Amundsen* to map the seabed topography and the geological structure of the Northwest Passage.

High resolution, three-dimensional maps are needed to manage intercontinental ship traffic and resource exploration. Scientists want to determine if geological processes that have happened over hundreds or thousands of years are still active. This is particularly critical for the oil and gas industries which don't want to spend billions of dollars erecting a rig or installing a pipeline that will be damaged by moving ice in the winter.

"We already know from past mapping that the Northwest Passage is deep enough for shipping. Where there's still significant interest is in iceberg and ice ridge scouring, shallow gas and slumping of the sea floor," explains Dr. Hughes Clarke.

Partners

- Geological Survey of Canada (Atlantic)
- Kongsberg Maritime
- C&C Technologies
- Canadian Hydrographic Service (Central & Arctic Region)

While the Northwest Passage may eventually be ice free in the summer, the winter ice forms pressure ridges that pierce deep into the water and carve the seabed. The ArcticNet team has already found evidence of heavy scouring by ice ridges and icebergs down to depths of at least 400 metres in the western Arctic and 850 metres in the eastern Arctic. Most of these deep water scours are likely relict features formed during glacial times, but the present day sea ice regime can still generate ice scours down to depths of 55 metres. The ongoing collection and analysis of ice scour information will help ArcticNet to contribute to regulatory needs and engineering considerations for seabed infrastructure development.

Another concern is the presence of shallow gas in seabed sediment. "Very often there is gas in the upper 10 to 20 metres of sediments. You try putting a jack up (offshore drilling) rig on it, it's likely to collapse," says Dr. Hughes Clarke.

Another threat to jack up rigs is unconsolidated sediment (sediments not made into rock) which is prone to underwater landslides. ArcticNet researches are using acoustic imaging systems, attached to the hull of the *Amundsen* to locate where landslides have occurred. The next challenge is determining if the slides are 100,000 years old, 10,000 years old, or more recent.

To get more detailed pictures, the team will need to use an autonomous underwater vehicle (AUV) that can travel up to 100 kilometres under the ice.

"There's huge areas of the Passage which we can't see because the *Amundsen* can't get through the older ice," adds Dr. Clarke. "An AUV would allow us to map under the ice where the *Amundsen* can't go. It would provide enough resolution to answer a lot of these questions."

Dr. Byers fears that Canada is quickly running out of time if it wants to enforce its sovereignty over the Northwest Passage. He's encouraging the government to look at interim solutions that can be implemented quickly, including stationing a helicopter and soldiers at Resolute Bay to monitor, and if necessary board, vessels that refuse to comply with Canada's environmental laws or do not ask permission to use the Passage.

www.arcticnet.ulaval.ca

The Networks

AUTO21 Network of Centre of Excellence

From cars to compost

A product has the potential to replace vehicle parts and biodegrade 100% at the end of its lifespan

In Mohini Sain's vision of the future, the world is free of breakers' yards, rusty vehicles suffering from Canada's salty winter roads and broken car parts clogging landfill sites.

"Most vehicle parts will be 100 per cent manufactured from biomaterials," says Sain, a professor in the University of Toronto's Faculty of Forestry and the Department of Applied Chemistry and Chemical Engineering. "At the end of their cycle, people will be able to cover their cars with soil – right in their back yards – let them biodegrade and eventually plant something over the top."

That's not as far-fetched as it sounds. Working with funding from AUTO21 and industry partners, Sain and his team have successfully manufactured a lightweight, biodegradable material that is currently being tested for use as interior door panels for cars. For the average North American market, such a panel would have a lifespan of 10 to 15 years. Aesthetically and metaphorically speaking, the product still needs some polish to be considered for exterior vehicle parts. It has a certain texture that can't beat the dazzling sheen and smoothness of metal. That aspect is currently being improved.

One of Sain's objectives in developing this product was to be cost-competitive over existing materials. To do that, the team looked at the price of producing plastics for vehicles and used that as a base.

"Right now," says Sain, "we *are* cost-competitive globally but you have to take other factors into account, such as supply from China. So we're always working on bringing the cost down."

One of the ways to do that is to use a cheap, renewable resource with good performance. Sain's team tried fibres from all over the world before settling on wheat, hemp and wood fibre. Then they worked on developing a cost-effective manufacturing process. The savings here were twofold: in the process itself and in the reduced need for petroleum-based products.

"Biofibres only need half the energy needed to make fibreglass, so that's a saving," explains Sain. "Using natural fibres instead of petrochemical-based fibreglass and synthetic plastics is another saving. Plus, this biofibre is biodegradable so no petro-based energy is spent to recycle it."

The environment is also a winner. Less petro-energy spent in production and a physically lighter, less petro-hungry vehicle mean fewer greenhouse gases released into the air. And because the product breaks down faster than a synthetic, there are fewer problems with waste disposal.

Sain and his team have several U.S. and Canadian patent applications pending and more than seven disclosures in the technologies involved. The work resulted in a spin-off company, Greencore Composites Inc., that is commercializing products for structural applications.

From plant to product

Sain and his team isolated individual fibres from agricultural and woody plants, combined them with chemicals and separated the fibres under pressure. The result is a product that looks and feels somewhat like fibreglass, has the strength of carbon fibre and is just as light. If the fibres are combined with natural polymers, the result is totally biodegradable.

Sain describes the two technologies involved. "The first one involves isolating the fibre in its elemental form and separating it. The second is incorporating it into a plastic and exploding its performance."

Although initial studies used hemp and wood fibres, any plant with strong fibres and good structural integrity is a potential source. The team has experimented successfully with wheat, flax, corn and soya, and is now working with wild carrot roots.

From vehicles to... ???

Says Sain, "The product passed the stringent strength and safety requirements of the auto industry. Now other industries that are in the market for high-performance structural materials can adapt it for their own use."

Other uses in the transport sector include railway crossties and airplane wings. The entire construction industry beckons – from beams to siding to roof shingles to fences. Sain foresees that the electronics sector will make computer, TV and cell-phone casings, and circuit boards from it. It could be used for biomedical devices such as cardiac valves and intravenous blood bags. The sporting industry will surely benefit – canoes, skis, skateboards, helmets. And then there are household appliances, furniture, docks ... the list goes on.

www.auto21.ca

The Networks

Canadian Arthritis Network

Familiarity breeds content: NCE trainees make a smooth transition from research to development

Making the leap from innovation to market in a cost-effective way has always posed challenges. When transferring knowledge from university to industry, things sometimes get lost in translation. A good solution? Instead of transferring knowledge, transfer the people who have the knowledge.

That's what the Canadian Arthritis Network (CAN) has done – with great success.

Thanks in part to NCE funding, researchers Martin Garon and Éric Quenneville have parlayed their academic careers at École Polytechnique de Montréal directly into productive careers at BioSyntech Canada Inc., a leading biotechnology firm in Laval.

Both, by the way, were finalists for the NCE Young Innovators Award, Garon in 2004 and Quenneville in 2005. The Award recognizes the success of the NCE program in training young researchers who accelerate knowledge transfer to the user for socio-economic benefit.

Quenneville and Garon, now full-time employees at BioSyntech, are helping commercialize Arthro-BST™, a product they had major roles in developing over the past four years, while simultaneously working part-time at BioSyntech and completing their studies at École Polytechnique.

Arthro-BST™ is a hand-held clinical instrument that lets surgeons make precise and accurate assessments of the health and functional properties of articular cartilage. It will also help improve our understanding of joint diseases such as arthritis, contribute to the development of new therapeutic products, and perhaps lessen the need for knee and hip replacements.

Arthro-BST™ works by measuring the electric fields produced by cartilage when it is compressed. The central component of the device is a microelectrode array that Quenneville developed for his PhD project while working part-time at BioSynech. After completing the array, Quenneville came up with an innovative and cost-effective process for manufacturing it and patented it as the Arthro-BST™ Disposable Tip. Garon is focused on electronics components of the device.

Quenneville and Garon are now familiar with how innovations are brought to market, but early on they learned an important difference between academic and industry settings.

"As an academic researcher, you have the freedom to go in different directions," says Quenneville, "but in a company like BioSyntech, you have to define the straight way in front of you and stay on course. We learned to think about timelines, industry standards, production costs and marketing as well as the science. As a result, when we finish our degrees, we will already have the experience of bringing a product to market."

BioSyntech is currently taking the Arthro-BST™ through clinical trials and has already sold three systems for preclinical use. To be able to sell it in Canada, the United States and Europe, however, they must ensure that it is electrically safe and biocompatible, and that it will remain sterile in operating rooms.

"In the lab, you can prove in principle that something works," says Garon, "but even if it's the best system in the world, if you can't make it work in the real world, you won't be able to sell it. For one thing, there are a lot of regulations involved in manufacturing and marketing medical devices that we never considered in university," says Garon. "We soon learned about them at BioSyntech."

They also learned the value of making connections with other experts.

"CAN is really incredible," says Garon. "It gives us the opportunity to develop relationships with people in other fields. In fact, it is the networking that has helped a lot in developing some aspects of this project faster."

"It is very interesting and rewarding to start from the beginning of a project at university, as we have done, and see it through working for a private company," says Quenneville.

It's rewarding for the company as well, which gets researchers who are already intimate with the details of a project and have a sense of pride and ownership in it.

"BioSyntech appreciates not having to look too far for well-trained, highly motivated and loyal employees who understand our particular needs and customers," says Dr. Matthew Shive, Vice President, Product Development, BioSyntech.

And BioSyntech will not have to look far in the future – several other students at École Polytechnique are honing basic research skills at school while collaborating with teams at BioSyntech on specific projects.

From here to there

You might say that Dr. Mike Buschmann has a thing for movement.

As Professor of Chemical and Biomedical Engineering at École Polytechnique in Montréal and the Canada Research Chair in Cartilage Tissue Engineering, Buschmann's research into cartilage and other connective tissue promises to help people with arthritis or joint injuries gain greater movement with less pain.

Buschmann is also interested in moving knowledge and expertise to where it will have the greatest impact. At École Polytechnique, he supervised both Martin Garon and Éric Quenneville during their PhDs and enabled them to train with the Canadian Arthritis Network while working at BioSyntech Canada Inc. He continues to work with other young researchers, facilitating their growth and careers.

In addition, he has helped bring together high-quality researchers from complementary disciplines, including engineers, cell and molecular biologists, biochemists, analytical chemists, physicists, orthopedic veterinary surgeons, cartilage experts, bone biologists and social scientists. His research laboratory dedicated to cartilage regeneration is one of the largest and most advanced of its kind in the world.

Buschmann is also interested in moving innovations to market. He co-founded BioSyntech in 1995, passing on his discoveries and patents via an exclusive technology transfer agreement between BioSyntech and his research group at École Polytechnique.

The end result of this movement of knowledge and people is that two new technologies are now being commercialized by BioSyntech: the Arthro-BST™ (see main story) and BST-CarGel®, an injectable polymer gel that adheres to cartilage defects and promotes regeneration of articular cartilage.

The Networks

Canadian Design Research Network (CDRN)

Increased productivity and environmental sustainability aims of new research network

Want to increase worker productivity in Canada and cut energy use at the same time? Try using more natural lighting

That's just one example the new Canadian Design Research Network (CDRN) cites when explaining how novel approaches to design can improve Canadian productivity, reduce greenhouse gas emissions and make people healthier.

"Between 30 and 40 per cent of the greenhouse gases in Canada are emitted through the heating and cooling of buildings. We already know through research how to make buildings that can reduce that by 60 per cent. Through CDRN, we want to popularize those methods, make them more affordable and even look at new ones," says Dr. Robert Woodbury, CDRN's Scientific Director and a Professor at Simon Fraser University, the administrative headquarters for the Network.

The CDRN is one of five New Initiative networks funded by the Networks of Centres of Excellence. NCE support will enable over 100 researchers at more than a dozen institutions from across Canada to collaborate with each other, and with public and private sector partners, to identify the best new approaches to design. For the CDRN, design is inclusive; buildings are important, but not its sole focus. From handheld devices to cities, good design is key to good outcomes for our society.

The CDRN is taking an innovative and inclusive approach to design – one that brings together several key disciplines, including engineering, architecture, landscape architecture, urban design, industrial design, computer sciences and human-computer interaction to collaborate on common problems and solutions.

Using the NCE to create a critical mass of expertise is the first critical step. CDRN is also working with the private sector to build a pan-Canadian infrastructure that would be shared by research institutions via high-speed networks. This physical network would provide equipment and facilities to allow CDRN researchers to collaborate online and in real-time on rapid prototyping, digital fabrication, sensing technologies, visualization and simulation.

"Some of this work is already happening, some needs to happen, and, most importantly, it all needs to be connected," says Dr. Woodbury. "The NCE funding is enabling us to make that collaboration happen. It is also enabling us to leverage funding from other sources to build the most comprehensive design research network in the world."

Improving Productivity

The CDRN's main goals are to improve Canada's productivity and sustainability through design research.

In California, for example, Lockheed Martin was able to increase worker productivity by as much as 15 per cent by introducing more daylight into their buildings. In schools, children exposed to simulated sunlight

In the U.K., companies that practiced good design outperformed the Financial Times Stock Exchange Index by 200%.

Source: U.K. Design Council

(full spectrum lighting) have been found to experience less stress, less sickness, improved attendance and, surprisingly, less cavities.

"We live in buildings. If we make them more sustainable and more productive then we can have a direct and immediate impact on the lives of Canadians. We use designed objects everyday and many can be greatly improved," adds Dr. Woodbury. "With the NCE's support, we now have the team to do that."

Research Priorities

Starting this year, the CDRN will organize workshops for researchers and people in industry to share the latest research findings, and to identify new research projects for each of its six themes.

1. **Advanced Design Techniques**: Advanced design will have a transformative effect by providing more intelligent ways of putting a building together. For example, if one window was changed in a building design, the software could automatically update them all.

2. **Collaborative and interactive design visualization**: By combining 3D visualizations with high-speed networks in a collaborative online environment, researchers in different cities could work together on a building design. If one moved a mechanical duct, for example, it would appear in 3D on the computer screens of the other researchers.

3. **Rapid prototyping and fabrication**: Once you've designed it, how do you make it? Exciting research in this area is already underway in universities across Canada, from innovative fabric form work for concrete pillars at the University of Manitoba to the energy-efficiency of ceramic materials at the Nova Scotia College of Art and Design.

4. **Sustainability**: What are the effects of design? How can our designed world make wiser use of resources and better support a rapidly changing world? Achieving sustainability spans politics, policy, design and engineering. CDRN researchers work along this spectrum, from new techniques for efficient wood design, to multi-criteria optimization, to engagement with key policy processes.

5. **Visual Analytics** is the science and design of analytic reasoning facilitated by interactive visual interfaces. It focuses on visual representations and interaction techniques that take advantage of the human eye's broad bandwidth pathway that allows users to see, explore and understand patterns in large amounts of information.

6. **Interactive Technologies**: The interplay between person and device and among people using devices remains poorly understood both empirically and in terms of design methods and results. The aim of the Interactive Technologies theme is to leverage and extend design research in new technologies, new design and creative methods, and new modes of evaluation for human experience.

www.cdrn.ca

The Networks

Canadian Institute for Photonic Innovations (CIPI)

CIPI researchers put picosecond lasers on ultrafast commercialization track

Most patients – and many doctors – may not know much about the field of ultrafast science that measures time in atto-, femto- and picoseconds. But "picosecond" may quickly join "nanosecond" as a household word once patients start benefiting from the painless, bloodless dental and surgical procedures that picosecond laser instruments can bring to surgeons' operating rooms and dentists' offices.

That time will be sooner rather than later, now that two members of the Canadian Institute for Photonic Innovations (CIPI), Drs. Dwayne Miller and Michael Cowan, senior researchers at the University of Toronto, have formed their own company, AttoDyne. Also involved in formation of AttoDyne are the two doctors' colleagues Darren Kraemer, Kresimir Franjic and Renzhong Hua. Their goal: to accelerate the commercial availability of the picosecond surgical laser technology they have developed.

Dentists and their patients are likely to be the first beneficiaries, says Dr. Cowan: "In the dentist's office, laser instruments hold the promise of pain-free cutting of teeth, allowing patients to escape from the dreaded needle and drill."

The medical applications are even more promising: "In the hands of skilled surgeons," he says, "lasers could enable incredibly precise non-invasive surgery, allowing surgeons to perform unique procedures that previously could only be dreamed of."

For example, says Dr. Cowan, the picosecond laser is ideal for precise surgery. "Current medical lasers make cuts that do not heal because of burning or other damage to the surrounding tissue," he explains. "Consequently, they are used only in applications where you don't really want healing, such as in lasik eye surgery, where you want the cornea to stay changed." AttoDyne's lasers solve this problem and will allow for widespread use in many surgical procedures, he says, "as was dreamt of ever since the laser was invented."

"Take prostate cancer," he elaborates. "Most men will get it if they live long enough. But prostate surgery is currently very dangerous and is avoided, because the prostate is entangled with important nerves. Any mistake will ruin the patient's quality of life." Picosecond lasers, however, are so precise that they could make this type of surgery possible.

Another advantage of AttoDyne's lasers: not only will they be practical in hospital operating rooms, they will be inexpensive and robust enough to be within reach of a dentist's or doctor's office.

Dr. Cowan and Dr. Miller knew that their picosecond laser could address such challenges, and that there would certainly be a receptive market for it.

But like most university researchers, they also knew that industry is often slow to take up innovations developed in university labs. That's why they formed AttoDyne in February 2006. "Given the length of time it took to develop our laser to its current marketable potential," explains Dr. Cowan, "we wanted to expedite the technology's marketability as quickly as possible."

Considerable funding support enabled the team to reach the pre-commercialization stage. For their initial development work, the two CIPI members successfully competed for one of CIPI's own research assistance programs, Technology Exploitation Grants.

Recognizing, however, that it would take several funding sources to complete the development process, Dr. Miller also contacted several other organizations for additional funding, including NSERC's Ideas to Innovation (I2I), and the Ontario Centres of Excellence.

CIPI's and NSERC's support, combined with a Market Readiness grant from the Ontario Centres of Excellence, enabled the University of Toronto team to modify the original attosecond-based concept, which proved to be still too experimental. While the slower femtosecond lasers also held promise, it turned out that the still-slower picosecond laser systems were uniquely suited to dental and medical applications.

Since its 2006 incorporation, AttoDyne has filed four new patents. The company also has taken advantage of the services of the Institute for Optical Sciences (IOS) at the University of Toronto, whose experienced business advisors have worked to accelerate growth by contacting potential investors. AttoDyne will be leasing space from the University of Toronto to further speed production of the first systems to be delivered for clinical tests.

Optimistic about AttoDyne's future, Drs. Miller and Cowan appreciate the assistance they have received from their various financial supporters – and especially for CIPI's support of the initial activities that, as Dr. Miller puts it, "resulted in a very high-value proposition for potential investors, and the creation of a company with so much potential for strong growth."

www.cipi.ulaval.ca

How fast is "ultrafast"?

The answer depends on whether you are working with attoseconds, femtoseconds, picoseconds or nanoseconds.

"Ultrafast" has very precise connotations for the laser researchers who work in ultrafast science.

The current ultrafast frontier is focused on the attosecond, which scientists represent mathematically as 1/1,000,000,000,000,000,000 of a second. This is the speed at which a camera would have to "move" to photograph the behaviour of electrons orbiting an atom.

Femtoseconds are represented mathematically as 1/1,000,000,000,000,000 of a second. One analogy that gives non-scientists a feeling for their magnitude describes a femtosecond as being to a second what a second is to the age of the universe.

The picosecond is represented as 1/1,000,000,000,000 of a second; a nanosecond drops to 1/1,000,000,000 of a second.

Nanotechnologies are already becoming part of commercial and even rather hyperbolic household language (many a teenager falsely promises to "be there in a nanosecond").

The CIPI researchers fully expect picosecond technology to make inroads into medical and dental applications quickly.

Femto– and attosecond technologies, however, are considerably further off in terms of specific commercial applications – although the AttoDyne founders were optimistic enough to choose "atto" for their new company's name. They must be telling us something!

The Networks

Canadian Language and Literacy Research Network

Overcoming a poor start:

Researcher's work links child poverty to lower literacy – and helps kids catch up

Six years ago, while asking schoolchildren to share their thoughts on friendship, Prof. Lily Dyson saw something that changed the course of her research career – something that could enrich life for thousands of Canadian children.

"We started at the more privileged schools," says the Professor of Special Education and Educational Psychology at the Education Faculty of the University of Victoria. "Children in these schools, they all had their hands raised every time we asked a question. Almost every child wanted to have a turn. When they spoke up, the sentences were long and articulate."

But when Prof. Dyson took her federally funded project - designed to promote friendship and acceptance of children with disabilities – to inner city schools, she saw a marked difference.

"In these schools that were less socially and economically privileged, we had trouble getting kids to participate in class discussion. They did not raise their hands. Those who did respond spoke in short sentences. Most of the time, they gave one-word or one-phrase answers. The vocabulary was not rich."

Prof. Dyson, who teaches courses in child development, says that seeing the drop-off in literacy levels at underprivileged schools "happening right in front of me" prompted her "to examine literacy development in poor kids to see if there was a need for remediation." After completing the friendship project, she went back into the schools to measure the impact of lower socio-economic status on literacy levels. With the help of her research assistants, graduate and undergraduate students, she set up tutoring sessions in Victoria's less-affluent elementary schools to gauge the impact of "literacy intervention" on children from less-well-off homes.

With subsequent funding, she has expanded her study and provided intervention to an increasing number of children in low-income homes. Based on a cross-sectional examination of 360 children, she observed the increasing gap in literacy skills from Kindergarten to Grade 4 between those from low-income homes and those who are more privileged.

While some research has been done in the United States linking socio-economic conditions to literacy levels, Canadian research data is limited. "We have used more refined measurement," says Prof. Dyson, whose ongoing work is funded by the Canadian Language and Literacy Research Network (CLLRNet) with seed money provided by the British Columbia's Human Early Learning Partnership (HELP). "Most other studies only look at children's vocabulary using a brief, simple test – the Peabody Picture Vocabulary Test. We look at different major aspects of literacy such as reading recognition, reading comprehension, spelling, and the ability to recode and comprehend a passage of reading material. It's a more extensive assessment of literacy skills."

Maryanne Trofimuk, a Grade 4-5 teacher at Victoria West Elementary School, sees the value of Prof. Dyson's project all around her. She can see the improvement in literacy skills of those children who take part in the reading project at her inner city school in the British Columbia capital.

"I had one pupil last year, a Grade 4 student, who was well below his grade level in reading," says

Ms. Trofimuk, who is also Vice-Principal at the school. "He was a very apathetic student and had a lot of issues from home – a student who rarely met expectations. He would go three times a week with the tutor who was assigned to him. Sometimes he would go apprehensively and reluctantly, but he did go. And over the course of the year, his reading level went up two grade levels. I'm not saying that was completely because of the tutoring, but I know it had a huge impact."

For Prof. Dyson, the next step is to make an impact on provincial governments' policy in dealing with the challenge of lower literacy levels in poorer economic areas. Through the HELP program, her work is already linked with British Columbia's Ministry of Children and Families. And she has had requests from Ontario's Ministry of Education for more information about her published work.

"The next step is to share the results with government agencies to show that more resources and extra time spent tutoring or teaching poor children is going to make a difference," says Prof. Dyson. "It has the potential to affect policy."

www.cllrnet.ca

A good beginning helps a child have a better life

A poor start in literacy can affect a person's entire life. The inability to fully understand text or to express oneself clearly can limit enjoyment of life, reduce chances of professional success and lead to social problems. Poverty can then perpetuate and form the so-called "vicious circle" – perpetuating limited language development in children for generations of the same family.

Prof. Lily Dyson's work has shown that low-income environments have a negative correlation to children's literacy levels, with poorer children falling behind in Kindergarten and losing ground with each passing year.

What affects a child's ability to read?

"Whether the parents read and the parents' education levels are related to literacy," says Prof. Dyson. "For example, what my student assistants and I found was that parents in low-income homes were not necessarily not interested in literacy. They are enthusiastic about it and they attend our parent workshop for home reading, but their education limits play a factor to some degree."

While reading at home plays a big role, teachers also have a strong impact on literacy levels, especially for low-income children, says Prof. Dyson.

"Higher teacher expectations can translate into higher literacy levels, which can make up for what human capital and learning resources are lacking at home for low-income children" she says. "Children respond to the challenge."

The Networks

Canadian Obesity Network

Treating obesity – and its stigma – among goals of new network

Most obesity researchers in Canada don't know each other. An even larger number don't realize their field of research is relevant to obesity.

That's about to change. The Networks of Centres of Excellence's decision to fund the Canadian Obesity Network reflects a growing concern over the country's rising obesity epidemic – and an urgency to do something about it.

Dr. Arya Sharma is the founding Scientific Director of the new Network, and a world-renowned expert in obesity research and management. He is also the Canada Research Chair for Cardiovascular Obesity at McMaster University, the host institution for the Network.

Over the next two years, he intends to find out which researchers and health professionals in Canada do work that is relevant to obesity. Only then, he says, can Canada develop a comprehensive research program aimed at treating a "disease" that has been largely left untreated.

When you look at obesity as a broad, societal, complex, biological phenomena of our times then you suddenly realize there's a lot of research going on," he says. "The problem is that researchers who focus on breast cancer, hip replacement research or psychiatry, for example, don't realize that their work can be very relevant to obesity."

Obesity and excess weight affects some 18 million Canadians and costs the Canadian health care system more than $4.3 billion annually. Approximately 12 million people are overweight. Another 5.5 million are obese, with 500,000 of those being morbidly obese.

And most alarming, more than 500,000 Canadian children are also obese. The Canadian Obesity Network will provide an urgently needed response to this growing epidemic.

Network participants include scientists from 21 Canadian universities, more than 10 international institutes in North America and Europe, 15 non-profit organizations, governmental agencies, and 20 industry partners.

It has already identified 500 obesity-related health professionals, researchers and students from a wide range of disciplines, including behavioural psychology, advertising, agriculture, molecular genetics, population health, nutrition and bariatric surgery. Dr. Sharma estimates as many as 2,000 people from academia, government, industry and NGOs are working in obesity-related research across Canada.

The Network will provide an unprecedented opportunity for researchers, health planners, industry and policy makers to work together on innovative strategies to prevent and treat obesity. This will include interacting with everyone from school boards to parks and recreation departments. "It's everybody because obesity is ultimately a consequence of how our society functions," says Dr. Sharma.

The goal of the Canadian Obesity Network is to reduce the mental, physical and economic burden of obesity on Canadians through collaborations that create valuable new knowledge in obesity prevention and treatment.

Research priorities

The Network will work with its partners over the next two years to identify research priorities. For example, scientists are learning more about the biological and environmental factors that contribute to obesity. What's lacking, says Dr. Sharma, are a broad range of medical treatments for what he describes as a "serious and debilitating chronic disease. While for most chronic diseases we have a variety of treatment options, for obesity we are just at the beginning".

Dealing with the stigma and misconceptions surrounding obesity will be another priority. The fact that little research has been done on medical treatments reflects a bias within the general population – and within the research community – that obesity is simply the result of lifestyle choices, and not a disease. "We're learning that obesity is far more complicated than just not eating right and not exercising enough."

While there has been an appreciable surge in funding for research on the causes and prevention of obesity, there remains a critical shortage of researchers and health professionals specifically trained in obesity prevention and management.

The Network hopes to entice more students to specialize in obesity by providing training opportunities, including an eight-day Obesity Boot Camp and apprenticeships with leading obesity researchers and clinicians. Of the 500 professionals participating in the network so far, about 100 are students and young professionals.

Even among doctors and health care professionals, Dr. Sharma says there is a dearth of basic understanding of obesity issues. To address the problem, the Network plans to develop educational resources that can be distributed to health professionals, and organize e-learning conferences and workshops.

"We will not be able to address this problem, even at a policy level, until health professionals have a basic understanding of what the issues are," explains Dr. Sharma. "The NCE is providing the opportunity Canada needs to increase training and education through networking. That's the first step in reducing the human and economic impact of obesity."

www.obesitynetwork.ca

Network Supporters:

Over 25 Canadian Universities

Over 10 International Institutes

Over 15 Non-Profit Organizations

Over 10 Governmental Agencies

Over 20 Industry Partners

Industry links:

Agri-Food

Sports & Leisure

Media & Entertainment

Health Care

Pharmaceutical

Medical Devices

Hospitality

Advertising

Appliances

Insurance

Biopharma

Clinical Trials

The Networks

Canadian Stroke Network (CSN)

"It would be nice if we could find a patent or a drug for preventing strokes from occurring and nobody is going to give up on that. But in the interim, we have the research today that shows what's needed in rehab and in prevention. We need to apply it and that's what this is all about it."

***Sally Brown**, CEO*

Heart and Stroke Foundation of Canada

"If we're going to make a difference in stroke, we need to bring together all those organizations who have a role to play, including ministries of health, the Heart and Stroke Foundation, the Canadian Institutes of Health Research, drug companies, research enterprises and universities. The Networks of Centres of Excellence program is uniquely positioned to help establish those partnerships."

***Dr. Antoine Hakim**, CEO, Scientific Director*

Canadian Stroke Network

Canada's battle against stroke

The Canadian Stroke Network and the Heart and Stroke Foundation are leading a national campaign to improve stroke prevention, treatment and rehabilitation in every province by 2010.

Science alone cannot prevent the devastating consequences of a stroke. Not unless we start practising what we know.

The Canadian Stroke Network (CSN) and the Heart and Stroke Foundation of Canada (HSF) have taken proactive steps to do just that – among paramedics, doctors, nurses, rehabilitation professionals and other health care staff in every province and territory across the country.

The CSN and HSF are leading a national effort to develop a Canadian Stroke Strategy, in partnership with provincial ministries of health, public health agencies and other organizations. The Strategy will aim to bridge the gap between the latest stroke research and the current practices in most parts of the country.

Science hasn't yet unearthed all the answers – but it has discovered many over the past 10 years. For example, researchers now know that many of the damaging effects of stroke can be prevented if patients recognize the first warning signs. If treatment is administered within the first three hours, the patient can often go home the same day. Stroke is more preventable and treatable than ever before, yet approximately 50,000 Canadians have a stroke and more than 16,000 people die each year.

"Not only do we know what should be done when a stroke happens, we also know how to prevent strokes, as opposed to other brain conditions like Alzheimer's or Parkinson's," says Dr. Antoine Hakim, CEO and Scientific Director of the CSN. "But if you ask if stroke is being prevented the best way we know how today, the answer is 'no'."

Canada is on track to bridge that gap before the end of the decade. On September 12, the Networks of Centres of Excellence announced that the CSN would receive $25.6 million in renewed funding and the HSF is contributing a further $3 million. The Canadian Stroke Strategy is a key priority for CSN over the coming years.

Towards a National Strategy

The goal isn't to develop a one-size fits all strategy. Rather, the CSN and HSF aim to establish a national framework and structure that would enable provinces to improve systems, policies, professional education and best practices at the local level where health care is delivered.

"Every province has paid attention to stroke, but in a different way – sometimes putting the emphasis on rehab, sometimes on prevention, sometimes on the acute care of the patient with the stroke," adds Dr. Hakim. "It shouldn't matter where you live in Canada. You should have access to the best possible care, rehabilitation and prevention methods."

Working with the provincial arm of the HSF, Ontario has already rolled out a provincial stroke strategy. Sally Brown, CEO of the HSF, says the success of the Ontario strategy prompted the CSN and her organization to join forces to raise standards across the country – something that would have been difficult for either organization to do alone.

"Our goal is to take the important accomplishments of the past few years and drive a technological transformation in the Canadian economy, to push the scientific advances occurring on campuses and in research institutions across this country into the marketplace, to the benefit of the economy... ultimately to the benefit of citizens."

The Honourable
David Emerson
Ministry of Industry
February 25, 2005

"You need a national networking organization like the Stroke Network to do this across the country and to translate research into improvements in health care and the health care systems. It's creating the momentum and the capacity to drive forward change."

And momentum is growing. Alberta is finalizing its provincial stroke strategy and Manitoba is considering a pilot project. The Canadian Stroke Strategy has also provided provinces with seed money to get the ball rolling.

The CSN and HSF have struck working groups across the country to develop national platforms to support public awareness building, guidelines and standards of care, training of health professionals, coordinated research and ongoing monitoring. All levels of government will be engaged as the strategy develops.

In August, a steering committee was formed to oversee the development of the Canadian Stroke Strategy. Chaired by Kenneth Fyke, who headed Saskatchewan's 2001 Commission on Medicare, the committee will engage more partners, stakeholders and ministries in developing the vision and plan further.

The Canadian Stroke Strategy also plans to develop an economic model that shows the cost of stroke to each province, and the potential savings from having a strategy in place.

More than 300,000 Canadians live with the effects of stroke, representing a direct cost of $2.7 billion a year to the national economy. "The Canadian Stroke Strategy can change these numbers, as well as prevent strokes, reduce suffering and save lives," says Dr. Hakim. "But first we need to get the research results into our communities."

www.canadianstrokenetwork.ca

The Networks

Canadian Water Network (CWN)

"The (Nova Scotia) Department of the Environment was so keen to have us involved with the CWN on this project because it provides them with validity of their work. The same goes for a small company like Brooke Oceans Technologies, which benefits from being associated with a national organization with such credibility in the water field."

Dr. Graham Gagnon

Dalhouse University

The dream of arsenic-safe water for all

Two new Canadian technologies could help small communities and developing countries

Removing arsenic from drinking water is a standard water treatment practice in larger towns and cities across Canada. Now, a Network of Centre of Excellence team is working to bring effective, low-cost solutions to small communities and rural homes.

Health Canada is considering strict new regulations for arsenic levels in groundwater that could prove particularly problematic in Nova Scotia. High concentrations of arsenic occur naturally in underlying bedrock in areas throughout the province, including Halifax and Guysborough Counties. The province estimates that some 12,000 households with private wells would be effected by the new rules. Installing treatment systems would cost residents more than $12 million.

"Because of the natural geology of Nova Scotia, we could have quite a few homes and small communities that will have problems meeting the new Health Canada guidelines so we decided to partner with the Canadian Water Network (CWN) in search of cost-effective solutions," says Judy MacDonald, Supervisor, Drinking Water Management at the Nova Scotia Department of Environment.

The problem is compounded by insurance companies which want greater assurances that arsenic is being treated before insuring homeowners. "This has been a particularly big driver for this research project," says Dr. Graham Gagnon, a Canada Research Chair in Water Quality and Treatment at Dalhousie University.

Dr. Gagnon is the principal investigator on a two-year CWN project that is working with the province and private industry to assess the performance of existing commercial systems and to develop and commercialize two arsenic treatment technologies that would meet the new regulations.

One of those technologies is already showing results at a mine site in Trail BC. Developed by Nature Works Remediation Corp., the system uses inexpensive biodegradable nutrient sources (i.e. manure, spent mushroom compost) to filter arsenic. The process produces less contaminated sludge than chemical systems.

Unfortunately, biological treatment systems are not well understood and therefore difficult to replicate. That's where the NCE program proves valuable. It encourages diverse scientific disciplines to collaborate to find solutions.

To understand what makes this particular biofiltration system so effective, the CWN has brought together an arsenic specialist (Dr. William Cullen) and a microbiologist (Dr. William Mohn) from the University of British Columbia, an analytical chemist (Dr. X. Chris Le) from the University of Alberta and a chemist with experience with remediation technologies (Dr. Ken Reimer) from the Royal Military College.

"Ken Reimer's group at the RMC is working with Tech Comenco (the mine site in Trail) and other mines trying to get this technology to work. It's like backwards engineering to understand the design parameters that made it work," says Dr. Gagnon.

"There's a definite demand out there for a system like this," adds Dr. Reimer. "In addition to arsenic, the Trail system also removes zinc and cadmium from landfill leachate. If we can understand the microbiology and the chemistry behind the system, there are opportunities to

remove other metals in the wastewater stream." A commercial biofilter could also be made available to small communities and individual households.

Building on previous NCE research

A second technology under development would use a chemical absorption process to remove the arsenic. The research builds on a previous CWN project in which Dalhousie University Ph.D. student Maruf Mortula developed a low-cost system for removing phosphorus using alum sludge from water treatment plants.

"The results from my project with the CWN encouraged other graduate students to try alum residuals as an adsorbent for arsenic, and the results proved successful," he explains. "Disposal of these residuals is of huge concern economically and environmentally. Therefore effective adsorption of arsenic can lead to efficient and cost-effective commercial application of this technology."

Dr. Gagnon says an added benefit is that the process uses industrial waste materials. "Nova Scotia is doing everything in its power to get 50% diversion from landfills, including any industrial waste, by 2007. This process offers an opportunity to use industrial waste."

The potential markets for this technology extend well beyond Canada. Arsenic is a problem in the southwestern United States, as well as in poor countries such as Sri Lanka and Bangladesh, where much higher concentrations of arsenic poison millions of people each year.

Dr. Reimer and Dr. Cullen are working with the Canadian International Development Agency on its arsenic mitigation program in Bangledesh and see opportunities to link that work to the CWN.

The CWN researchers move from the lab to field testing at two sites in Nova Scotia in 2006, with preliminary results expected by the Summer. The next step will be market studies and further talks with companies interested in bringing the technologies to market.

Partners

- Brook Oceans Technology, Inc.
- CANMET, Natural Resources Canada
- City of Brampton
- Enviro Soil
- Halifax Regional Municipality
- Halifax Regional Water Commission
- McGuire Environmental
- Nature Works Remediation Corp.
- Nova Scotia Department of Transportation and Public Works
- Nova Scotia Department of Environment and Labour
- Regional Municipality of Waterloo
- Veolia Water International

Project Researchers

Researcher	Organization	Department/Affiliation
William Cullen	University of British Columbia	Chemistry
Graham Gagnon*	Dalhousie University	Civil Engineering
X. Chris Le	University of Alberta	Environmental Health Sciences
William Mohn	University of British Columbia	Microbiology and Immunology
Ken Reimer	Royal Military College	Chemistry and Chemical Engineering

* CWN Principal Investigator

Advantages to working with the CWN

Working on a Network of Centres of Excellence team has given graduate students a whole new perspective on the value of networking.

Principal investigator Dr. Graham Gagnon, who has worked on three Canadian Water Network projects, says NCE funding makes it possible for students to travel to other labs, collaborate with other researchers, and attend Network events and workshops.

"This is the biggest bang for me and it's an intangible benefit that resonates very strongly with the students," he says.

For Maruf Mortula, who's currently working on a Ph.D. in civil engineering at Dalhousie University, the NCE experience opened his eyes to the advantages of networking and collaborating with other scientific disciplines.

"The project I worked on (removing phosphorous from wastewater) helped me to realize the importance of networking with researchers from other disciplines for the sake of environmental sustainability. I'm more aware now of the importance of networking for sustainable application of technology than ever before."

Another Dalhousie Ph.D. candidate, Meaghan Gibbons, says working with the CWN allowed her to attend a CWN conference, participate in proposal writing for the arsenic treatment project and travel to a partner lab to learn new water analysis techniques.

"The CWN conference that I attended in 2004 was actually the first conference that I had attended, and I found it to be a very welcoming and encouraging environment," she says.

The networking skills developed through the CWN become a career-building skill for many students, adds Dr. Gagnon. "I see many students who are intelligent, but don't know how to make connections, how to network, which they need when they enter the marketplace."

www.cwn-rce.ca

The Networks

Emerging Dynamic Global Economies Network (EGGE)

New network aims to keep Canada competitive in global markets

With the emerging powerhouses of China, India and Brazil rapidly changing the global economy, the Networks of Centres of Excellence (NCE) is funding a new national initiative to help keep Canadian businesses competitive.

The Emerging Dynamic Global Economies (EDGE) Network brings together top Canadian and international scholars in economics, political science, public policy, business and law to work with industry, business associations and governments.

Together, they will identify key economic and social impacts these important new global players increasingly will have on Canada and the world, and help to develop strategies to ensure that Canada plays a leadership role in the new world economy.

"The changes taking place in these emerging economies are so massive that they will affect the international economy in ways we haven't even begun to think about," says the EDGE Network's Director, Debra Steger, Professor at the Faculty of Law, University of Ottawa. "This is the biggest thing since the Industrial Revolution in the 19th century or the introduction of the Marshall Plan at end of the Second World War."

> In much of Asia and in key economies in Latin America, rapid economic and social change domestically has made these regions dynamic partners for trade and investment. We need to develop sound strategies to anticipate change and realize opportunities as they emerge.
>
> Emerging Dynamic Global Economies (EDGE) Network

Already, about 50 research institutions and think tanks from across the country and internationally have agreed to participate in the EDGE Network, giving it a critical mass of expertise. They were drawn to this unique opportunity for large scale, public and private sector collaboration on issues relating to the emerging economies.

"There is an urgency about this," says Prof. Steger. "We must move quickly to develop a strategic plan to guarantee our prosperity and standard of living into the future."

In June 2005, the Standing Committee on Foreign Affairs and International Trade released a report warning that Canada's economic activity is too dependent on the United States, which accounts for 85 per cent of Canadian exports and 64 per cent of our foreign investment. It recommended that Canada expand its trade and investment relationships with emerging markets in China, India and Brazil, as well as Russia, the Arabian Peninsula and Southeast Asia.

The EDGE Network can play a critical role in moving Canada closer to this goal. As part of the NCE's New Initiative program, the EDGE Network is receiving $800,000 over the next two years to build a pan-Canadian network, launch a communications campaign designed to encourage informed public debate on these issues, and develop practical training and exchange programs for students, business professionals and government officials. The NCE funding supports the networking activities of established researchers to develop new partnerships with business and government communities.

Research priorities

The EDGE Network will also work with federal, provincial and local governments, as well as the private sector, to determine the practical questions researchers should address. They could include business opportunities in emerging markets, regulatory barriers both here and abroad, and Canada's future role in the World Trade Organization, the International Monetary Fund and other international organizations.

"The product that we will be producing at the end of the day from this Network will not be a patent or a new vaccine. Our goal is to help Canada develop coherent and effective public policies and business strategies that respond to this new phenomenon in a very pragmatic way," says Prof. Steger, who was the first Director of the Appellate Body Secretariat of the World Trade Organization.

The private sector will play a key role in the new network. Leading companies involved in energy, natural resources, financial services, telecommunications and aerospace have already agreed to participate in the Network, which also has support from several influential business associations.

The energy sector will be a major focus of the Network. China's insatiable appetite for oil and gas, for example, raises significant opportunities and challenges for business as well as environmental and national security issues. China could also provide a challenge for North America's automotive industry, which is already facing fierce competition from Japanese and Korean imports.

"China will have a car that's as good in terms of quality and performance as Japanese and Korean cars within five to ten years. Responding to this requires long-term strategic planning, and too often, businesses tend to focus on short-term results."

Leveraging Canada's Strengths

These emerging economies also create opportunities for Canada to market its know-how. Sustainable development, domestic rule of law, human rights, protection of intellectual property rights, and corporate social responsibility are all issues that countries must address if they want to do business with the rest of the world.

"I don't hear major Canadian companies saying we need new trade or investment agreements. To protect their investments, they're saying that China needs to develop a well-functioning legal and government system that provides security, stability, predictability, transparency and due process of law to protect foreign investment. These are areas where Canada has the expertise, the systems and the models that we can share with the developing world. We need to make these types of contributions that can really help businesses on the ground in those countries."

www.edgenetwork.ca

The EDGE Network Founding Partners

- Asia Pacific Foundation of Canada
- Brazil-Canada Chamber of Commerce
- Canada Eurasia Russia Business Association
- Canadian Association of Importers and Exporters
- Canadian Foundation for the Americas (FOCAL)
- International Trade Canada
- Shastri Indo-Canadian Institute
- York Centre for International and Security Studies
- University of Ottawa, Faculty of Law

The Networks

Geomatics for Informed Decisions (GEOIDE)

What's killing Atlantic salmon?

New tracking and mapping technologies may provide answers

A diverse team of Canadian experts is studying the movement and habitat of young salmon as they migrate through the St. Jean, Dartmouth and York rivers in Quebec and across the Bay of Gaspé. The knowledge could help governments mitigate the effects of a worldwide decline in wild Atlantic salmon.

How do juvenile salmon move through rivers and estuaries to make their way to the sea? What is the best freshwater habitat for increasing their chances of survival during the first years of life? A first-of-its kind geomatics project – called Geosalar – is looking for answers.

With funding from the GEOIDE Network of Centres of Excellence (NCE), researchers and graduate students from Université Laval, the Institut national de la recherche scientifique (INRS), McGill University, Université de Montréal, University of British Columbia and the University of Durham in the U.K. are working with industry, government and conservation groups to develop new tools for tracking young salmon and constructing detailed maps of their habitats.

"We're developing one of the clearest geographic pictures ever taken of what's going on over the entire river landscape," explains Dr. Julian Dodson a biologist at Laval. "Our goal is to understand how fish exploit this mosaic of habitats across changing seasons as they grow, and if changes in the habitat are contributing to a decline in the salmon stocks. If so, we can look at what actions can be taken to ensure those nursery grounds continue to be viable."

First, the team needed an efficient and effective way to track young salmon while measuring the fluvial environment around them, including substrate size, water current speed and salinity levels. Until Geosalar, little was known about how much territory fish covered in a day, what conditions influenced their survival during the winter or what impact floods have on their mortality.

The challenges were far too complex for any one researcher, or single scientific discipline. Finding a solution would require the collective skill of experts from geomorphology (the study of landforms), fish ecology, oceanography, geomatics, resource management, telemetry and software programming, all working in close collaboration with industry, government, NGOs and conservation groups.

"Internationally, I think we're well out in front in taking such a multidisciplinary approach to these challenges," adds Dr. Dodson. "And the NCE, with its focus on networking and collaboration, makes this type of solutions-oriented research possible."

Dr. Dodson and Dr. Normand Bergeron of the INRS are the principal investigators of the Geosalar project, which began five years ago. The multidisciplinary team existed prior to Geosalar, but it lacked the necessary tools to take their research to the next level. They found their opportunity with GEOIDE.

"With the tools we had, we couldn't characterize the habitat over long river reaches or effectively track fish throughout their lifecycle," explains Dr. Bergeron, an expert in fluvial geomorphology (landforms created by running water) at the Centre Eau, Terre et Environment of INRS. "It was at this time that we heard of the GEOIDE Network and the fit seemed perfect because we needed to use or develop geomatic approaches to help us rapidly characterize the habitat over long river reaches and to track fish."

One of the project's first breakthroughs was by a post-doctoral student now working as a professor at the University of Durham. Dr. Patrice Carbonneau developed computer software that automatically translates high resolution aerial photos into maps that provide detailed measurements of the physical environment below, including water depth and even the size of pebbles on the riverbed. The maps can cover over 80 kilometres of river. "We were amazed at how precise we could get with this technology," says Dr. Bergeron. "This was the first time these types of maps had ever been generated. They provide a much better handle on habitat quality and the distribution of habitat quality over the riverscape."

The next challenge was to determine how juvenile salmon move through this physical environment during different periods of their life cycle and in real-time. With conventional tagging, researchers only knew where the fish was released and later caught – where it travelled in between was a mystery.

The Geosalar team used acoustic transmitters to track young salmon as they abandon their freshwater nursery streams and venture out to sea. They also moored instruments to measure current, salinity and temperature. The data were then plugged into a hydrodynamic model, which government agencies and environmental consulting companies will be able to use to predict fish migration patterns and sediment movement.

Passive Integrated Transponder (PIT) technology was used to track even younger salmon, called parr. Dr. Bergeron's team developed a portable antenna to increase the detection range of parr from about

Research Participants

- * Université Laval
- * Institut national de la recherche scientifique
- McGill University
- University of British Columbia
- University of Durham
- Université de Montréal
- ALCAN
- Aquasalmo R&D Inc.
- Atlantic Salmon Federation
- Fisheries and Oceans Canada
- Fondation pour le saumon du Grand Gaspé
- GENIVAR
- Hydro-Québec
- Ministry of Natural Resources and Wildlife, Quebec

* Lead institutions

30 centimetres to about 1 metre, and a new 5-metre long portable antenna that can more rapidly scan large stream areas. They also modified the design of commercially available transponders in order to be able to mark fish as small as 8.5 cm.

The team is currently burying a wired network of 256 PIT antennas in the substrate of a small river in eastern Quebec. "This will provide continuous coverage of where the tagged fish are and when they move, over a 100-metre section of the river. This will be our major breakthrough for the year," says Dr. Bergeron.

The tools developed in the Geosalar project will help Canada and other countries to manage salmon stocks more effectively through better habitat management.

www.geoide.ulaval.ca

Tools will help companies produce better environmental assessments

Companies will be able to provide more comprehensive environmental impact assessments of fish habitat – faster and for a fraction of the cost – as a result of new tools developed by GEOIDE researchers. The geomatic tools for the measurement of fluvial habitat, hydrodynamic models and improved fish-tracking technology will also enable companies and conservation groups to conduct environmental assessments over much larger geographic areas.

One of the first companies to benefit is expected to be GENIVAR, one of Canada's largest environmental engineering firms and the industry partner on the Geosalar project. One of its major clients is Hydro-Québec, whose regulation of water flow on rivers for electricity generation can have an impact on the quality and quantity of salmon habitat.

"A lot of companies would be happy to use these geomatic tools because they will help to improve the quality of the impact studies and reduce the cost of doing the studies," says Dr. Bergeron. "Rather than having to send crews for months on the river, you can just hire a company to do a fly over which automatically collects the data to provide a more comprehensive picture of the riverscape."

The new tools can also be used by the aquaculture industry to monitor changes in substrate conditions or temperature fluctuations.

The Networks

Intelligent Sensing for Innovative Structures (ISIS Canada)

ISIS steps up efforts to promote use of "space-age" polymers and sensors

Canada's global expertise in new construction materials and monitoring equipment won a further vote of confidence from the Network of Centres of Excellence in March with news that the ISIS Canada Research Network would be renewed for another three years.

Established in 1995, ISIS provides civil engineers with smarter ways to build, repair and monitor structures using high-strength, non-corroding, fibre reinforced polymers (FRPs) and fibre optic sensors (FOSs). The Network has brought together 13 universities, 276 researchers, 92 associated organizations to collaborate on 36 multidisciplinary demonstration projects.

On March 28, the NCE announced $9.6 million in renewed funding for the ISIS Canada following an in-depth review of its scientific accomplishments, future research priorities and training and knowledge transfer activities. The funding will take the Network through to the end of its 14-year mandate.

ISIS will spend much of the next three years working with standards associations and civil engineers to promote the use of these technologies in structures throughout Canada and the world.

"Our focus now shifts from the research side to field projects where we can demonstrate how practical and useful this research is to real-world structures," says Dr. Aftab Mufti, President of ISIS and a Professor of civil engineering at the University of Manitoba. "We also want to work with Canadian universities to have our research findings included in the undergraduate curricula of civil engineering programs."

ISIS has won international praise for its expertise in developing FRP and FOS technologies. FRPs offers many advantages over conventional steel reinforcements in bridges, dams, pipelines, buildings and other structures. The material is six-to-ten times stronger than steel and it is non-corrosive, resulting in a structure that lasts longer and requires less maintenance. The technology is currently used in over 50 structures in Canada, including the Confederation Bridge.

ISIS Canada spearheads launch of new discipline

Google the term "civionics" and you will get nearly 450 hits. Within a year, it will likely be in the thousands.

Civionics is an emerging new discipline being promoted by ISIS Canada to describe the interaction between civil engineering and electronics. Similar to the way aerospace engineering has developed avionics, civionics would be able to monitor the health of civil engineering structures.

The successful integration of intelligent sensing of innovative structures will allow civil structural engineers to expand the design envelope by taking risks to introduce new design concepts, materials and innovation in civil engineering.

Its other breakthrough technology, FOS, is fueling rapid advances in the emerging field of structural health monitoring (SHM). Miniature fibre optic sensors installed in structures during construction can measure – in real-time – the effects of stress, wind, precipitation and even temperature. The research has already led to commercial products, including two readout instruments and a sensor system component. ISIS is now looking at developing a wireless equivalent of the technology.

Influencing design, codes and policy

ISIS design manuals are now used by hundreds of engineers in 34 countries. The Network is also influencing design policy through its association with Public Works and Government Services Canada, engineering consultants and bridge design offices in several city and provincial highway departments across the country. In addition, ISIS research and demonstration projects are resulting in upgrades to the Canadian Highway Bridge Design Code. Internationally, ISIS was instrumental in helping to form the International Society for Health Monitoring of Intelligent Infrastructures and the International Institute for FRP Construction.

"Many Canadians are in key positions in these two societies and are taking a lead to ensure that our research is discussed at the international level. Canada is considered a leader in the use of FRPs, fibre optic sensors and how we monitor these structures. The whole international community, including the United States, views us as experts in the field," says Dr. Mufti.

Priorities for next three years

As ISIS Canada enters its final phase as an NCE, planning is underway to establish a new entity, called Civionics Canada Research Network. ISIS coined the word "civionics" to explain the application of electronics to civil structures.

As a first step, user manuals for civionics have been prepared and a SHM Support Centre has been established in Winnipeg to meet the needs of ISIS researchers. Over time, ISIS hopes to open support centres in Atlantic Canada, Quebec, Ontario, the Prairies and British Columbia to provide professional consulting on the installation and use of sensors and other equipment, as well as data management services.

"We are also creating ISIS associates," adds Dr. Mufti. "These would be ISIS researchers and former students who have worked on ISIS projects who could carry on the research work of these technologies, perhaps moving structural health monitoring into new areas such as hazard mitigation."

While proud of his Network's research accomplishments over the past decade, Dr. Mufti says their greatest achievement has been in training a new generation of engineers who are open to using new materials and technologies.

"Civil engineers are very conservative by nature when it comes to embracing new ideas, but here in Canada we're training a new breed of professional who is more open to using space-age materials like fibre reinforced polymers and fibre optic sensors to monitor the health of a structure, right from the design to its maturity and aging. This will be one of the NCE's greatest legacies."

www.isiscanada.com

The Networks

Mathematics of Information Technology and Complex Systems (MITACS)

Mathematics sheds new light on the best approach to antibiotic therapy in agriculture

MITACS and Quebec pork industry join forces to support innovative research

The power of advanced mathematical tools is being applied to an important agricultural and societal challenge – the need for the safe and effective use of antibiotics in animal production. A partnership between the Mathematics of Information Technology and Complex Systems (MITACS) network and the Fédération des producteurs de porcs du Québec (FPPQ) is supporting a new area of research, which combines the sciences of mathematics, pharmacology, animal behaviour and veterinary medicine to determine the best strategies for feed-administered antibiotics in hog production. The mathematical sciences also hold potential for novel applications in human antibiotic research.

The need to preserve the long-term efficacy of antibiotics for both animals and humans is a growing imperative. Limited options for the development of new antibiotics make it increasingly important to guard against resistance to medications currently in use. That means bringing the highest degree of precision to the design and delivery of antibiotic therapies.

Safe and efficacious use of antibiotics is certainly a priority for the FPPQ, which represents more than 4,050 pork producers in Quebec. The pork industry is one of the economic backbones of the province, with production valued at more than $3.1 billion a year.

The FPPQ dedicates considerable resources to R&D to continually advance standards in animal health and welfare, food safety and meat quality. The association has partnered with MITACS to fund a multidisciplinary project headed by mathematics researcher Fahima Nekka of the Université de Montréal. Dr. Nekka and her team are breaking new ground using complex mathematics,

Building a mathematical model based on "life on the farm"

An experimental farm in Quebec, CDPQ, Deschambeault, which is equipped with a computerized feeding station, is providing the MITACS project team with key data to model swine feeding behaviour. The feeding station, known as IVOG, records the identification of each animal, how long it feeds and the weight of the feed that is ingested during the visit.

The researchers are also videotaping the social behaviour of the swine when they feed in groups, as well as taking blood and fecal samples to measure antibiotic concentrations in the animals' systems along with antibiotic resistance. So the real-life experience of animals feeding on the farm is fuelling the creation of a complex mathematical model.

supported by in vivo research, to predict the impact of swine feeding behaviour on the animals' exposure to feed-administered antibiotics.

"Our objective as an industry is to achieve the best use of antibiotics for animal health and to lower the risk of antibiotic resistance," says Claude Miville, Manager, Research & Development, with the FPPQ. "We were very interested in this research because it is a new field and a novel way of studying antibiotics in our sector. Through this MITACS project, we are accessing the expertise of mathematical modelling to find new solutions for one of our major priorities."

As MITACS project leader, Dr. Nekka is working with a cross-disciplinary team of researchers with backgrounds in pharmacokinetics, veterinary medicine, animal sciences, pharmacy and mathematics. The veterinary component is led by her university colleague Jérôme del Castillo and animal scientist Renée Bergeron from Université Laval.

To design the best antibiotic therapy, it is important to consider all the factors affecting the therapeutic efficiency of the antibiotics and the risk of resistance. There are some variables, however, which are complex and which exhibit random features. One such variable is feeding behaviour.

"Studies by animal behaviour scientists have demonstrated that there are wide variations in swine feeding behaviour both individually and while feeding in groups," Dr. Nekka explains. "For the first time, Dr. del Castillo raised the potential problem that can be induced by these feeding variations on the fate of feed-administered antibiotics in the body."

Here's where the mathematical sciences enter into the picture. "The challenge is to quantify this complex, highly variable behaviour and this cannot be done without very advanced mathematical tools," says Dr. Nekka. "We use mathematical methods to generate the random features and to establish predictions based on probabilities."

The team has made considerable progress toward building the model to achieve the short-term project objective of characterizing and predicting the pharmacokinetic effects of the various feeding behaviours.

There have been some interesting findings already, says Dr. Nekka. Data collected from an experimental farm helped the team to classify swine into different social groups: dominates, intermediates and subordinates, determined by their ability to access feed. The feeding scenarios will be combined with other factors such as animal weight, daily consumption and stages of growth. The long-term objective is to develop new guidelines for antibiotic therapy control that will be safer and more efficient.

This type of mathematical modelling also has applications in human medicine, says the project leader. "There is an emerging concern about compliance in human antibiotic use, and mathematical approaches will allow us to address that problem as well."

This project clearly demonstrates how close collaboration between researchers in mathematics and other disciplines provides novel solutions to important societal challenges.

www.mitacs.ca

The Networks

National Initiative for the Care of the Elderly (NICE)

"The NCE is giving gerontology the biggest opportunity it's had in a long time to make a real difference in the care of the elderly."

Dr. Lynn McDonald

Scientific Director

National Initiative for the Care of the Elderly (NICE)

New network to address shortage of doctors, nurses and social workers in gerontology

The Networks of Centres of Excellence has launched a new national network of community practitioners and researchers to help Canada care for its fastest growing population group – aging babyboomers.

The National Initiative for the Care of the Elderly (NICE) is one of five New Initiative Networks funded by the NCE. Headquartered at the University of Toronto's Institute for Life Course and Aging, NICE brings together more than 40 researchers, doctors, nurses and social workers from across Canada who specialize in gerontology. It's the first network of its kind in Canada, and comes at a time when the country is facing a critical shortage of trained professionals able to care for a greying population, and with few students enrolling in these specialties.

Health Canada expects the senior population to hit 6.7 million by 2021, ballooning to 9.2 million by 2041 – or nearly one in four Canadians.

"We're facing a wave of older Canadians and a shortage of the three main professions that provide care for the elderly: doctors, nurses and social workers," says Dr. Lynn McDonald, NICE's Scientific Director and Director of the U of T institute. "In 2000-2001, only seven new students in all of Canada went on to do a specialty in geriatric medicine and there are also only two programs in Canada for gerontological social work, one at the University of Calgary and a new one at U of T."

Gerontology is the study of the elderly and the aging process. It differs from geriatrics which is the study of the diseases of the elderly. Gerontology is by its nature multidisciplinary, bringing together professionals from different disciplines to address the social, psychological and biological aspects of aging and to translate this knowledge into policies and programs.

"Taking a team-approach to care-giving is essential for older adults who require more complex care," explains Dr. McDonald. "They have more chronic illnesses, drug interactions and serious falls. No single person can solve these problems. You need a national network that can help make team training a standard practice in Canada, and that's the opportunity the NCE is giving us with NICE."

The new network has laid out an ambitious agenda for the next two years. Its main priorities are to:

1. Establish links between university researchers and community practitioners in medicine, nursing and social work to improve senior care practices
2. Develop and improve educational initiatives, including the introduction of basic geriatric knowledge into core courses in medicine, nursing and social work
3. Develop training programs for practitioners already in the field to develop and refine skills in caring for older adults
4. Influence policy makers in development of policy for care of seniors

Connecting science and practice

A wealth of research exists on how to effectively care for older adults. Unfortunately, little of this knowledge is being used by professionals who care for the elderly.

NICE will work to change that. Dr. McDonald says they hope to bridge the gap between science and practice through professional education and better student training.

NICE Partners

University Support

- Brock University
- University of British Columbia
- University of Manitoba
- University of Sherbrooke
- University of Toronto

Industry Support

- Chartwell Seniors Housing REIT

Federal Government Support

- Canadian Institutes of Health Research: Institute of Aging
- Public Health Agency of Canada

Other Institutional Support

- Baycrest Centre for Geriatric Care
- Canadian Academy of Geriatric Psychiatry
- Canadian Association on Gerontology
- Canadian Geriatrics Society
- Canadian Gerontological Nursing Association
- Réseau québécois de recherche sur le vieillissement
- The John A. Hartford Foundation
- Toronto Rehabilitation Institute

"Across the country we're putting together clusters of academic teams of geriatrician doctors, gerontological nurses and social workers. There will be mirror teams in the community that they interact with. It will be a two-way street. Academics will help educate people on the ground who, in turn, will share their practice wisdom," she says.

Through experience, community caregivers may have learned what works and what doesn't work in dealing with people with cognitive disabilities, for example. If NICE is successful in becoming a full fledged NCE in the future, it would then be able to work with researchers to validate that practice wisdom, and then share the results with other community partners to develop and improve practices for the care of Canada's seniors.

"I believe this will really benefit older people if people start to use some of the knowledge we know works."

NICE will also work with academic institutions to introduce basic geriatric knowledge into undergraduate and graduate courses in medicine, nursing and social work. As Dr. McDonald points out, the goal is to train new professionals to understand the complexities of elder care, and the importance of working with interdisciplinary teams to find solutions.

Mentorship programs aimed at masters and doctoral students will be established to encourage more young people to consider a career in gerontological and geriatric care. These students will also join the cluster teams to learn how to get people to use research.

"We want them to learn from the ground up that it's not enough just to publish the results of your research," she adds. "It needs to be put into practice."

nicenet.aging.utoronto.ca

The Networks

Promoting Relationships and Eliminating Violence Network (PREVNet)

"Bullying is a significant social and health problem for children and young people in Canada. In recent years, there have been many severe cases where children have died or been seriously injured due to bullying. These tragedies have helped us understand how serious these problems are, and we recognize the need for a national strategy to address them."

Dr. Debra Pepler

Co-Scientific Director, PREVNet

York University

Canada's top scholars join forces to address bullying and children's relationships

A new Canadian network of 23 university researchers and 34 non-governmental organizations has launched a national imitative to help schools and communities adopt more scientific – and proven – approaches to combat bullying, victimization and aggression among children and youth.

Led by York and Queen's Universities, PREVNet is one of five national initiatives to receive federal funding from the Networks of Centres of Excellence. It represents the first time that Canada has worked on a national level to provide standardized training materials, assessment tools, intervention strategies and national policies to address relationship problems. It will lay the groundwork for a national strategy to reduce the use power and aggression in relationships.

The need for a national strategy on bullying is underscored by a recent World Health Organization survey, which ranked Canada a disappointing 26th in bullying, and 27th in victimization, among the 35 countries assessed. Across all ages and categories of bullying and victimization, Canada consistently ranked at or below average among those countries.

"Canada is playing catch-up compared to a lot of other countries in dealing with these problems, but I believe we are on track to take a very different, and hopefully more effective approach," says Dr. Wendy Craig of Queen's University. PREVNet is headed by Dr. Craig and Dr. Debra Pepler of York University's LaMarsh Centre for Research on Violence and Conflict Resolution, both renowned international experts on bullying.

Where other countries have launched national campaigns targeted at schools, PREVNet views bullying as a community-based problem, not a school problem. As such, it is focusing on places where children and youth live, work and play, including local sporting groups, girl guide troops, churches and recreation programs.

"Although schools play a key role, we believe that bullying is a community problem, and that's why we have assembled such a range of agencies and non-governmental organizations, along with educators, to address the problem," says Dr. Pepler.

Putting science to work in local communities

There is no shortage of programs across Canada to address bullying. The problem, says Dr. Craig, is that few are empirically based or evaluated. Surprisingly, researchers found that 15 per cent of these programs actually made the problems worse.

Partner Organizations

- Canadian Principals Association
- Canadian Coalition for the Rights of Children
- Kids Help Phone
- Girl Guides of Canada
- Canadian Association of Social Workers
- Canadian Parks and Recreation
- The Hospital for Sick Children

Linking researchers with each other and with national NGOs, schools and community groups is where the NCE's new initiatives program can help. Dr. Craig describes it as the "perfect vehicle" for PREVNet because of its emphasis on networking, partnerships and knowledge translation.

"The NGOs are much more effective at knowledge translation and dissemination than we as researchers could ever be," she explains. "What they lack, though, is the empirical information and the skills to set up an evaluation or assessment tool. As researchers, we can provide that for them."

One of PREVNet's main goals over the next two years is to create a web-based tool where people can log on to assess their particular bullying problem. They would then receive a list of recommendations for what to do, based on what has been proven to work in similar situations.

PREVNet researchers will also create training manuals, support materials and research communiqués that people can download. For national organizations, such as the Kids Help Line, researchers have developed more tailored information to assist counselors in providing advise to children who call about bullying. "We're trying to train the national organizations to provide them support and the tools to train their own provincial and municipal levels," says Dr. Craig.

Research exists on what works and what doesn't work, but Dr. Craig insists more is needed to determine how effective programs are over the long-term and to develop new programs that better understand the dynamics between individuals, peer groups and the family. While most studies have focused on school-aged children, she says more research into pre-school children would help to identify early risk factors.

PREVNet brings together researchers from 17 Canadian universities from diverse disciplines including psychiatry, social work, psychology, epidemiology and pediatrics. Students will be invited to join the network, where they will have an opportunity to participate in program evaluations and intervention programs through an internship with an NGO.

"We want to create a second generation of researchers who are really interested in addressing relationship problems in this applied way," says Dr. Craig.

www.PREVNet.ca

The Networks

PrioNet Canada

New NCE breaks new ground in prion research

Canada launches national effort to accelerate BSE research

Top prion researchers from across the country are pooling their laboratory resources, students and expertise to strengthen Canada's efforts to diagnose, treat and hopefully prevent bovine spongiform encephalopathy (BSE) and other prion-related diseases.

On November 24, the Networks of Centres of Excellence (NCE) awarded $5 million per year over seven years to PrioNet, a national network that will accelerate Canada's understanding of and response to BSE ("mad cow" disease) in cattle, chronic wasting disease (CWD) in elk and deer and Creutzfeldt-Jacob disease (CJD), which is fatal to humans.

Funding is being used to establish an administration headquarters at Vancouver Coastal Health on the Vancouver campus of the University of British Columbia (UBC). It will also facilitate collaboration between experts from several research areas, universities and government departments within Canada and other countries. PrioNet plans to award the first research grants by next spring, and has already hired an experienced CEO to head the network – Dr. Ying Gravel, former CEO of the NCE's Canadian Bacterial Diseases Network.

Most of the funding will be used to develop an intellectual infrastructure for dealing with these diseases, including operating funds for lab facilities, training, meetings and recruitment of high level prion scientists into Canada," says Dr. Neil Cashman, PrioNet's scientific director and one of the world's leading prion researchers.

"We will fund research, but we're not a typical granting council," he adds. "Our success will be defined as the application of basic research and social research to the socio-economic problems posed by prion diseases."

PrioNet will pool the collective expertise of virtually every prion researcher in Canada – more than two dozen from nine Canadian universities. The goal is to triple that number over the next four years, through graduate training and recruiting internationally renowned scientists to Canada. PrioNet expects to train about 75 students, postdoctoral fellows and research associates over the first four years.

PrioNet's Main Goals:

1. To identify cattle genes that participate in BSE susceptibility
2. To develop novel methods for detection and cost-effective elimination of environmental prion contamination, especially from BSE
3. To determine strategies to eradicate CWD
4. To develop treatments for CJD
5. To elucidate mechanisms of prion protein misfolding in TSEs
6. To develop novel models of experimental prion infection to complement global research on prion disease pathogenesis and bioassay
7. To develop a targeted strategy for risk communication and mitigation of BSE and other socio-economic stressors

"The training through PrioNet will be more comprehensive than what can be offered by a single lab. Students will have an opportunity to train on specialized equipment and facilities available only at certain institutions across the country," says Dr. Cashman, who also holds a Canada Research Chair in Neurodegeneration and Protein Misfolding Diseases at UBC.

PrioNet represents the most significant step Canada has taken to date to build the country's research capacity in prions, and to use this research to safeguard animal and human health. PrioNet will also measure the sociological and economic impact of prion diseases, data that could prove valuable in developing risk management strategies for other disaster scenarios.

Around the world, governments, industries and scientists are scrambling to unravel the mystery of prions and to somehow mitigate or avoid their devastating consequences. A single BSE-infected cow from an Alberta farm in May 2003 has already cost this country an estimated $8 billion to date, and an incalculable human cost of failed farms and industries. More than two years later, there are still restrictions on the export of Canadian beef to the United States.

Partnering with Alberta

PrioNet's closest partner will be the newly formed Alberta Prion Research Institute, which has $38 million available from the Alberta government for prion research. The two organizations will work together to recruit top scientists, deliver a training program for universities, governments and the private sector, and co-fund research projects, as well as share management.

"This is a very comprehensive partnership that will see a total $70 million made available for prion research in Canada. This will be an amazing kick-start to prion science and prion research in Canada," says Dr. Cashman.

Internationally, PrioNet will partner with the Prion Centre for Excellence (NeuroPrion) in France, as well as the TSE Research Platform in Germany on joint research and training. Within Canada, the new NCE will work with Agriculture and Agri-Food Canada, the Public Health Agency of Canada, the Canadian Food Inspection Agency and Health Canada, along with industry groups, including agricultural and biotechnology companies.

Dr. Cashman says they also hope to collaborate with other NCEs, including the Advanced Food and Materials Network. AFMnet's scientific director, Dr. Rickey Yadda, sits on PrioNet's management committee as there are common elements between the two networks' strategies in risk mitigation and public education.

Unlocking the mysteries of prions

Prion diseases, or transmissible spongiform encephalopathies (TSEs), are a group of fatal neurological diseases of humans and animals characterized by deterioration of the central nervous system which causes vacuoles (sponge-like holes) in the brain. They progress rapidly, are untreatable and almost always fatal.

PrioNet themes:

1. BSE
2. Chronic wasting disease and scrapie
3. Creutzfeldt-Jacob disease
4. Prion protein structure and function
5. Prion disease risk management

These infectious agents are not conventional microbes, such as viruses and bacteria. Prion infection does not require nucleic acid (DNA or RNA) and spreads through a process more akin to crystallization than biological reproduction.

"The prion protein is intimately involved in the infectious activity of prions," explains Dr. Cashman. "This is a normal protein that can go awry by adopting a rogue form which is toxic to brain cells. On the basic science plane, PrioNet will try to understand how this protein becomes subverted in disease, and develop novel diagnostics and therapeutics from this knowledge."

Developing practical research results that can help industry and governments is a priority for PrioNet. As part of its BSE research, the network wants to identify which genes in cattle make them susceptible to BSE, and develop cost-effective ways to detect and eliminate BSE contamination on farms.

Another prion illness, chronic wasting disease, is spreading through Canada's elk and deer populations. There is growing concern that Aboriginal people who rely on these and related animals for food could be at risk of contracting a human variation of the disease.

"Although we don't know for sure if CWD can infect human beings, we want to come to grips with this disease in Canada and attempt to eradicate it as soon as possible."

CJD provides proof that prion diseases in animals can sometimes have fatal consequences for humans. A type of CJD can be contracted through eating products from a BSE-infected animal. This type of CJD is still relatively rare, infecting less than 200 people to date. New alarms were raised last year, however, after scientists discovered that CJD can be transmitted through blood transfusions. Canadian Blood Services is among those supporting PrioNet's NCE application.

"CJD is a challenge we need to be able to face in Canada. Through PrioNet, we will pursue strategies for being able to treat or perhaps even cure this disease," says Dr. Cashman.

Putting this knowledge into the hands of policy makers is a key priority for the new NCE. Working with provincial and federal bureaucracies, it will set up a government policy regulation committee to develop risk assessments to better manage and prevent such outbreaks.

As Dr. Cashman notes: "It is possible that best intended risk analysis could be siloed without some sort of impact on government policy. A major thrust of PrioNet is to ensure that our research is effectively translated to the authorities that can use this knowledge."

www.prionetcanada.ca

The Networks

Stem Cell Network (SCN)

Building bridges: Trading up from basic science

A $300,000 investment in collecting gene expression data grew into a $140-million international collaboration

This is the story of how the Stem Cell Network built a bridge to the future of stem cell research.

It started with a $300,000 investment that brought together 25 Canadian scientists who rolled up their sleeves and created StemBase, the largest stem cell gene expression database in the world. The original investment burgeoned into the $12-million Gene Expression Project that, in turn, became the foundation for the $140-million International Regulome Consortium (the bridge), a Canadian-led initiative that will unite the world's leading stem cell scientists to create a comprehensive understanding of the genetic circuits that regulate life.

"The Gene Expression Project started in 2002," says William Read, who managed the project through to its successful conclusion in the spring of 2006. "If the Stem Cell Network hadn't stepped up with the seed money, none of this would have got off the ground."

Ultimately, the Network contributed $1 million, an 11-to-1 ratio of matching funds from four federal and provincial agencies: the Canada Foundation for Innovation, the Ontario Innovation Trust, the Ontario Research and Development Challenge Fund and Genome Canada.

StemBase is a key end product of the project. It is internationally recognized as an authoritative source of gene expression information and ranks as the world's seventh-largest contributor to the U.S. National Center for Biological Information's GEO database, the most comprehensive pool of gene expression data in existence.

Gene expression demystified

Gene expression is the process that converts the coded information in a gene into the molecules that allow a cell to operate. Scientists need this information to identify and isolate stem cells, understand how they function and discover how they may be used – for instance, to repair tissues damaged by diseases such as muscular dystrophy, blindness and Parkinson's.

"Think of the human genome as a big sheet of plywood with 25,000 light bulbs on it," explains Rudnicki. "Each light bulb corresponds to a cell connected to a dimmer switch. Different cell types have different patterns of light and different levels of brightness. At the International Regulome Consortium, we are turning over that piece of plywood, looking at the wires and trying to understand the circuitry."

"And it's extensive." adds Miguel Andrade, Network bioinformatician. "StemBase includes more than 600 samples of stem cell gene expression."

The database is now available to commercial users whose annual fees help to maintain it.

The project led to the creation of a team (building the database involved 22 highly qualified people, including four post-doctoral fellows) that will help establish the International Regulome Consortium.

"The linkage is the people," says Read. "The project team will be the core of the international effort."

Michael Rudnicki, the Stem Cell Network's Scientific Director, describes the international effort arising from the Gene Expression Project as potentially revolutionizing the understanding of how cells function at the genomic level and helping to develop novel therapies in regenerative medicine.

"This is the third generation of the human genome project," explains Dr. Rudnicki, who also leads the International Regulome Consortium. "The first generation was discovering the sequence of the human genome. The second generation was annotating it, understanding where the different genes are. This third generation will allow us to understand how genes function."

Already $65 million of international funding is in place. The work will be done by 37 investigators at 18 institutions in seven countries.

"It's out of the gates," says Rudnicki. "We've had five international workshops to consider everything from technological approaches to bioinformatic standards. There has been tremendous support and enthusiasm internationally for working on this."

In Canada, applications have been submitted for $35 million of funding for infrastructure from agencies such as the Canada Foundation for Innovation. Rudnicki is optimistic.

"Only a country like Canada could broker something like this," he declares. "It speaks to our capacity to bring people together."

And to the Network's ability to build bridges to the future.

www.stemcellnetwork.ca

The Networks

Sustainable Forest Management Networks (SFM)

NCE renewal reaffirms need to balance forestry and sustainability

Dr. James Fyles says the Networks of Centres of Excellence has accomplished a feat that few in the world have been able to achieve - bringing governments, industry, academia, Aboriginal groups and NGOs to the same table to develop more sustainable forest management practices.

"Much of our research has focused on trying to understand this incredibly complex process that is sustainable forest management, which involves everything from the behaviour of microorganisms in the soil to the behaviour of policymakers at every level of government, and everything in between," says Dr. Fyles, Scientific Director of the Sustainable Forest Management Network (SFM) and a forest ecologist at McGill University.

"There's a huge amount of fragmentation in the forest sector with overlapping jurisdictions and competing interests. The SFM Network is beginning to be viewed as an honest broker who can bring everyone together to promote dialogue and learning in a non-confrontational environment," he adds. "This is an amazing accomplishment that will have a longstanding impact on how our forests are managed in Canada."

On March 28, the NCE announced $12.3 million in renewed funding for the SFM following an in-depth review of its scientific accomplishments, future research priorities and training and knowledge transfer activities. The three-year funding will take the Network through to the end of its 14-year mandate.

Since its last renewal in 2001, the number of SFM partners has grown significantly. It now includes 160 researchers and over 200 graduate students from 35 universities working collaboratively with three federal departments, seven provincial/territorial governments, 12 companies, seven Aboriginal groups, and one non-governmental organization – Ducks Unlimited Canada.

"We have also developed a more critical mass of expertise within universities to address this issue, both with established researchers and graduate students from multiple disciplines who now see an opportunity to work in this field," says Dr. Fyles.

To date, 26 Network graduates have accepted academic appointments at universities across Canada. Six are principal investigators on projects funded by the Network and five are focused on issues involving Aboriginal communities.

Sustainable forest management is fundamentally concerned with relationships among people and between people and the non-human environment. Potential for conflict is immense and grows with every road built or tree cut. The potential for economic fallout and social unrest is concomitantly large. The Sustainable Forest Management Network has demonstrated that conflict can be effectively reduced if an open and visionary forum is available to the diversity of stakeholders.

There has been an appreciable increase in the number of social science researchers working in sustainable forest management. During the SFM Network's first years, research on Aboriginal forest issues, for example, typically involved a few anthropologists and sociologists. Current projects involve researchers with expertise in economics, anthropology, public policy, political science, operations management and law. The shift is reflected in the Network's research spending, which has seen social sciences and humanities content of research projects increase from 20 per cent in 2002 to more than 40 per cent in 2006.

SFM Network Conference
4th International Conference - Sustaining Canada's Forests: Building Momentum

Edmonton, June 20-22, 2006

Presentations will focus on important sustainable forest management issues throughout Canada and the world. Among the many themes to be covered are integrated land management, evolution of sustainable forest-dependent communities, water management strategies, public participation in planning processes, natural disturbance management and emulation, climate change adaptation, and tenure reform. The conference will feature keynote presentations, implementation showcases, research presentations (papers and posters), and numerous discussion forums.

Accomplishments to date

SFM Network research is improving forest management practices across Canada, and having a direct impact on public policy. Network findings have helped to support sweeping changes for forest management in Quebec (the Coulombe Commission) and provided significant input to the Ontario Forest Management Guide for Natural Disturbance Pattern Emulation.

In Western Canada, Alberta-Pacific Forest Industries Inc. (Al-Pac) is using Network research results to better understand the cumulative effects of human activities in one of Canada's busiest corners of the boreal plain, and helping them to understand the interactions of land use and hydrology in the boreal plain.

Several aspects of Louisiana-Pacific Canada's proposed 20-year Forest Management Plan in Manitoba are based on Network research. In Manitoba, Ducks Unlimited is using Network research findings to provide input into changing buffer and riparian guidelines in Manitoba. In New Brunswick, J.D. Irving is continuing to work with Network researchers to determine the range of silviculture intensity that is compatible with the persistence of forest bird populations on the lands it manages.

Next research priorities

The SFM's research program is constantly evolving. In its early years, Network research focused on ecological aspects of forests and forestry to understand how managed forests differ from natural forests.

Today, the focus has broadened to examine the entire forested landscape and the multitude of players who have a stake in how it is managed and protected.

"You can't look at protecting biodiversity or water in a forested land, for example, without taking into account that there are other people out there, such as oil or gas companies who are building roads in and out," he explains. "That change in focus has come into clarity in the last couple of years, and this will be influencing the kinds of research we're looking at and the kinds of partners that we will be looking for in our next cycle."

At a meeting in May, the Network will seek to identify the research priorities that its partners feel are the most urgent as part of the input the Network receives regarding its next funding competition slated for Fall 2006.

"As part of this exercise, we will examine the research that's been done to date and lay some foundation for future questioning," adds Dr. Fyles. "That will involve looking at the complex linkages between the natural, social and economic systems to understand how we approach the management of that whole land base to be sustainable. It's a different kind of research than what we've funded before."

www.sfmnetwork.ca

Participating Universities

When it comes to its partnerships with universities across Canada and around the world, the NCE program truly enhances value.

It is a mutually beneficial relationship. The individual institutions hire and remunerate the researchers. The universities' provide the infrastructure and the administration needed to conduct the research. Their students and postdoctoral fellows help carry out the work.

The NCE program, however, ensures that things don't stop there. By fostering partnerships and cooperation between the various departments in a university, between universities across Canada and between Canadian institutions of learning and academic centres around the world, the NCE program enhances the value of that research by ensuring that it is shared, built upon, and put to good use as life-enriching products and protocols or as prudent government policies.

Fiscal Year 2005-06

PARTICIPATING UNIVERSITIES

British Columbia

	AFMNet	Allergen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CDRN	CGDN	CIPI	CLLRNet	CON	CSN	CWN	EDGE	GEOIDE	IRIS	ISIS	MITACS	NICE	PENCE	PREVNet	PRIONET	SCN	SFM
Malaspina University College			•																						
Okanagan University College																			•						
Royal Roads University																									•
Simon Fraser University	•	•	•	•	•			•		•	•	•		•	•	•	•		•		•	•			•
Thompson Rivers University			•																						•
The University College of the Cariboo			•																						
University of British Columbia	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•
University of Northern British Columbia				•	•											•			•						•
University of Victoria	•	•	•	•	•					•	•	•			•	•	•		•	•	•	•		•	•

Fiscal Year 2005-06

PARTICIPATING UNIVERSITIES

Alberta

	AFMNet	Allergen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CDRN	CGDN	CIPI	CLLRNet	CON	CSN	CWN	EDGE	GEOIDE	IRIS	ISIS	MITACS	NICE	PENCE	PREVNet	PRIONET	SCN	SFM
University of Alberta	•	•		•	•	•	•	•	•	•	•		•	•		•	•	•	•		•	•	•	•	•
University of Calgary	•	•		•	•	•		•	•	•	•	•	•	•		•	•	•	•	•	•		•	•	•
University of Lethbridge											•		•	•					•					•	

Fiscal Year 2005-06

PARTICIPATING UNIVERSITIES

Saskatchewan

	AFMNet	Allergen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CDRN	CGDN	CIPI	CLLRNet	CON	CSN	CWN	EDGE	GEOIDE	IRIS	ISIS	MITACS	NICE	PENCE	PREVNet	PRIONET	SCN	SFM
University of Regina					•									•			•		•	•					•
University of Saskatchewan	•	•	•	•	•	•	•			•		•	•	•		•	•	•	•		•	•	•		•

Fiscal Year 2005-06

PARTICIPATING UNIVERSITIES

Manitoba

	AFMNet	Allergen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CDRN	CGDN	CIPI	CLLRNet	CON	CSN	CWN	EDGE	GEOIDE	IRIS	ISIS	MITACS	NICE	PENCE	PREVNet	PRIONET	SCN	SFM
University of Manitoba	•	•		•	•	•	•	•	•	•		•	•	•			•	•	•	•	•		•		•
University of Winnipeg				•												•			•			•			•

Fiscal Year 2005-06

PARTICIPATING UNIVERSITIES

Ontario

	AFMNet	Allergen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CDRN	CGDN	CIPI	CLLRNet	CON	CSN	CWN	EDGE	GEOIDE	IRIS	ISIS	MITACS	NICE	PENCE	PREVNet	PRIONET	SCN	SFM
Brock University											•			•						•		•			
Carleton University				•	•			•		•	•					•	•	•	•		•	•			
Huron University College											•														
Lakehead University	•				•												•								•
Laurentian University																•									•
McMaster University	•	•	•		•	•	•			•	•	•	•	•		•	•		•	•		•		•	
Nipissing University					•																				
Northern Ontario School of Medicine		•																							
Queen's University		•		•	•	•				•	•	•	•	•		•	•	•	•	•	•	•		•	
Royal Military College of Canada				•	•									•		•			•						
Ryerson Polytechnic University	•			•	•			•				•		•		•									•
Trent University				•	•									•											•
University of Guelph	•	•	•	•	•	•					•	•		•			•		•						•
University of Ontario Institute of Technology					•														•						
University of Ottawa	•	•	•	•	•	•	•		•	•	•	•	•	•	•		•	•	•			•	•	•	•
University of Toronto	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
University of Waterloo	•		•	•	•	•		•		•	•	•		•		•	•	•	•	•				•	•
University of Western Ontario	•	•		•	•	•				•	•	•	•			•	•		•			•		•	•
University of Windsor					•									•		•	•		•						
Wilfrid Laurier University		•		•						•	•			•		•			•						•
York University				•	•					•		•			•	•	•		•			•			

Fiscal Year 2005-06

PARTICIPATING UNIVERSITIES

Québec

	AFMNet	Allergen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CDRN	CGDN	CIPI	CLLRNet	CON	CSN	CWN	EDGE	GEOIDE	IRIS	ISIS	MITACS	NICE	PENCE	PREVNet	PRIONET	SCN	SFM
Concordia University			•		•			•		•	•						•	•	•					•	•
École des Hautes Études Commerciales					•														•						
École Polytechnique de Montréal					•	•				•				•			•	•	•						
Institut national de la recherche scientifique			•	•		•				•				•		•									
McGill University	•	•		•	•	•	•	•	•	•	•	•	•	•		•	•		•	•	•	•		•	•
Université de Montréal	•	•	•	•	•	•	•		•	•	•		•			•	•		•		•	•		•	
Université de Sherbrooke	•	•			•	•			•	•		•	•	•		•	•	•	•	•					
Université du Québec—École de technologie supérieure								•		•						•									
Université du Québec à Chicoutimi		•																							•
Université du Québec à Montréal				•							•								•			•			•
Université du Québec à Rimouski			•	•							•					•								•	•
Université du Québec à Trois-Rivières				•	•											•	•		•						•
Université du Québec en Abitibi-Témiscamingue																•									•
Université du Québec en Outaouais										•															•
Université Laval	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•		•			•		•	•

Fiscal Year 2005-06

PARTICIPATING UNIVERSITIES

New Brunswick

	AFMNet	Allergen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CDRN	CGDN	CIPI	CLLRNet	CON	CSN	CWN	EDGE	GEOIDE	IRIS	ISIS	MITACS	NICE	PENCE	PREVNet	PRIONET	SCN	SFM
Mount Allison University			•											•					•						
St. Thomas University					•														•	•					
Université de Moncton	•		•								•								•						•
University of New Brunswick	•		•	•	•					•	•			•		•			•	•					•

Fiscal Year 2005-06

PARTICIPATING UNIVERSITIES

Nova Scotia

	AFMNet	Allergen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CDRN	CGDN	CIPI	CLLRNet	CON	CSN	CWN	EDGE	GEOIDE	IRIS	ISIS	MITACS	NICE	PENCE	PREVNet	PRIONET	SCN	SFM
Acadia University											•			•					•						
Cape Breton University			•																						
Dalhousie University	•	•	•	•	•	•		•			•	•		•		•	•	•	•	•		•		•	•
Mount Saint Vincent University											•														
Nova Scotia Agricultural College														•											
Saint Mary's University		•																	•						
St. Francis Xavier University	•		•			•																			

Fiscal Year 2005-06

PARTICIPATING UNIVERSITIES

Prince Edward Island

	AFMNet	Allergen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CDRN	CGDN	CIPI	CLLRNet	CON	CSN	CWN	EDGE	GEOIDE	IRIS	ISIS	MITACS	NICE	PENCE	PREVNet	PRIONET	SCN	SFM
University of Prince Edward Island			•			•					•	•	•	•			•		•						

Fiscal Year 2005-06

PARTICIPATING UNIVERSITIES

Newfoundland and Labrador

	AFMNet	Allergen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CDRN	CGDN	CIPI	CLLRNet	CON	CSN	CWN	EDGE	GEOIDE	IRIS	ISIS	MITACS	NICE	PENCE	PREVNet	PRIONET	SCN	SFM
Memorial University of Newfoundland			•	•		•					•		•	•		•	•		•					•	•