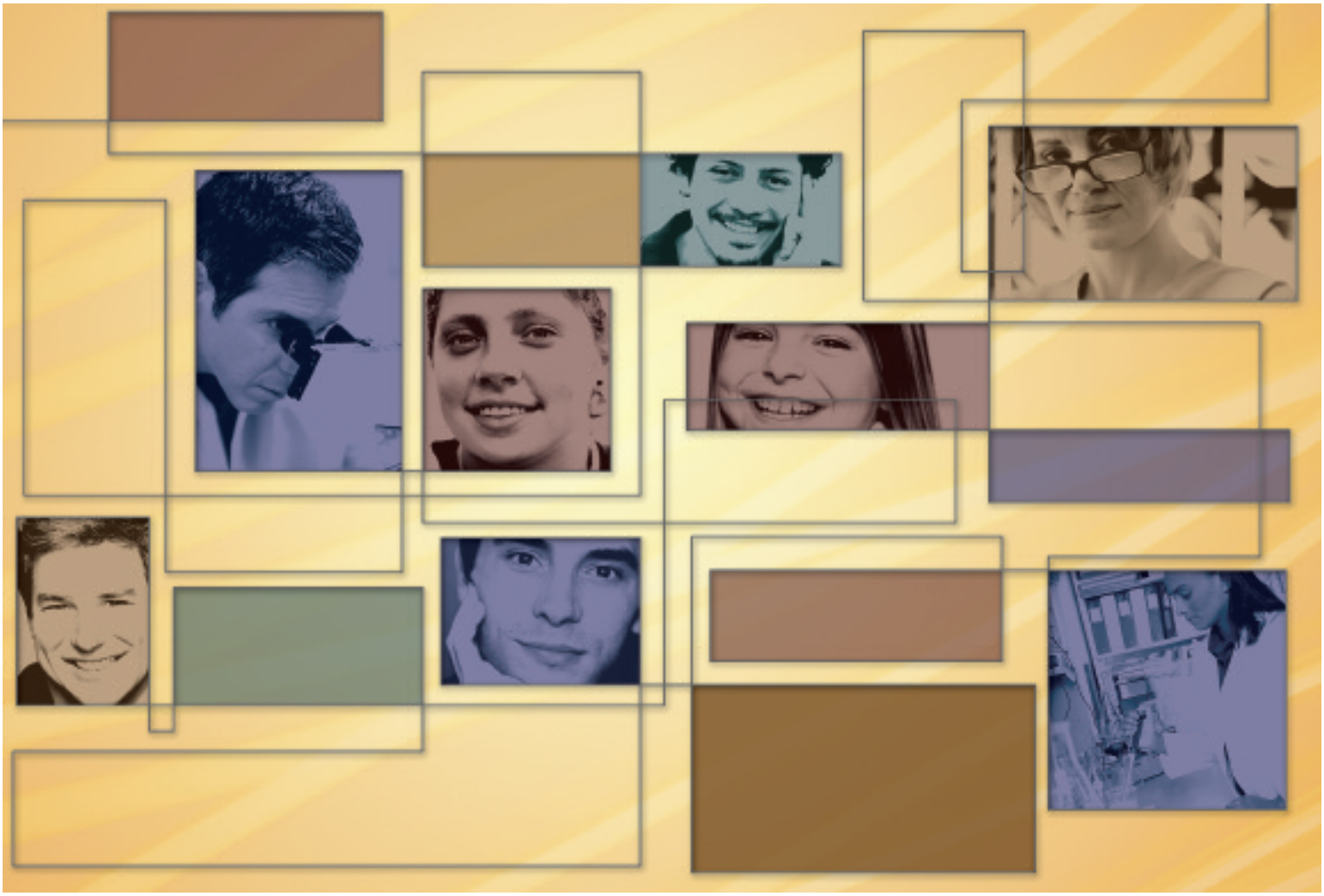
NETWORKS OF CENTRES OF EXCELLENCE



ANNUAL REPORT 04/05 MOBILIZING EXCELLENCE

Canada

NETWORKS OF CENTRES OF EXCELLENCE
ANNUAL REPORT 2004/2005
Mobilizing Excellence

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

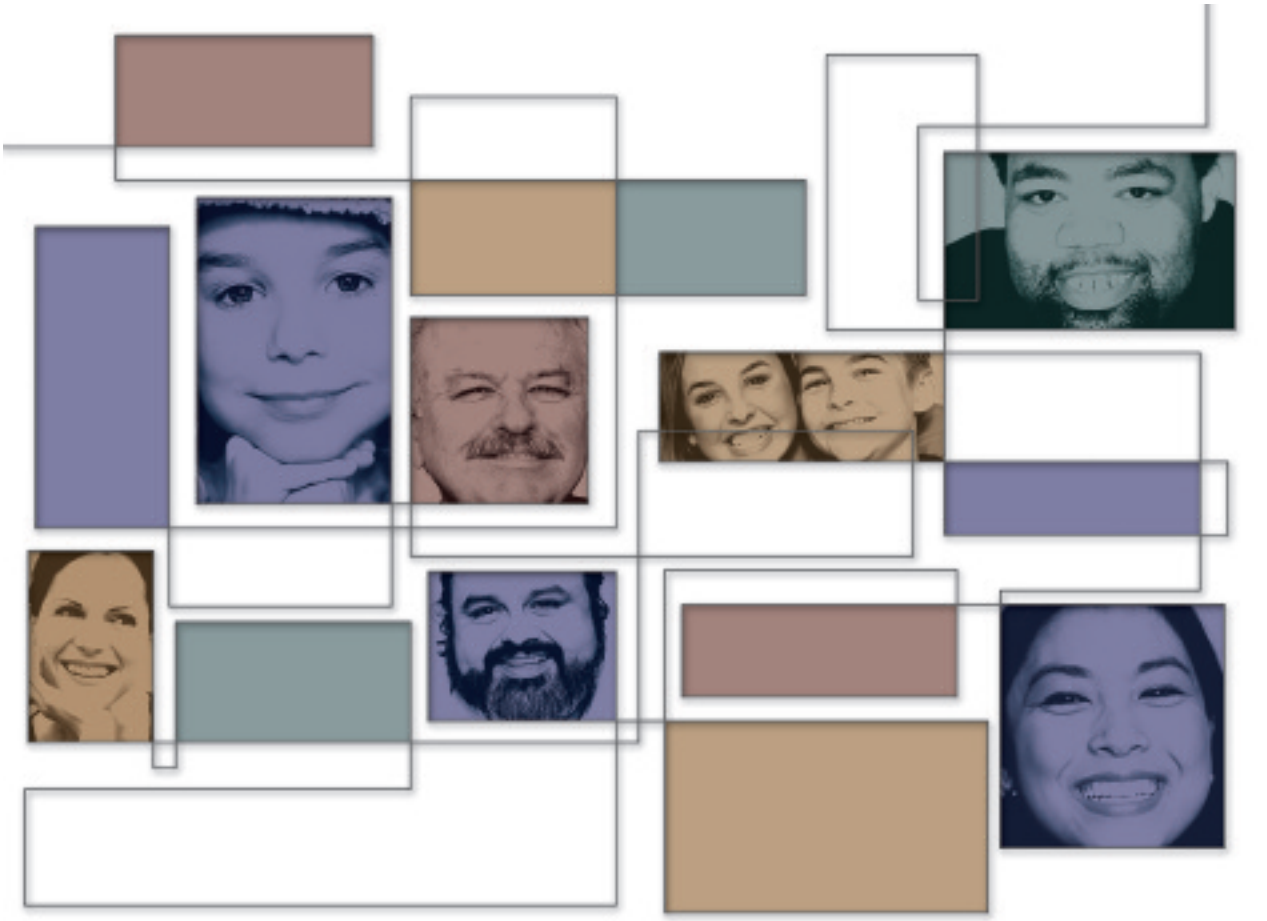
Each network builds partnerships between academia, industry and government to put new knowledge, research and technology to work to create a better Canada. Highly qualified personnel – from graduate students and postdoctoral fellows to world leaders in their particular fields – work co-operatively through NCE-sponsored initiatives in both 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.

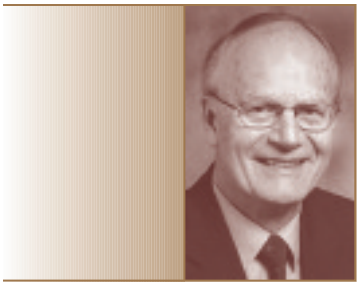
This 2004-2005 Annual Report illustrates how this outstanding work, undertaken for the benefit of all Canadians, is accomplished.

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.



MESSAGE FROM THE CHAIR



Welcome to the 2004-2005 Networks of Centres of Excellence (NCE) Annual Report, the theme of which is *mobilizing excellence*. It is a simple theme, but one we chose carefully. Mobilizing excellence is what the NCE program has done for a decade and a half. It is what we did exceptionally well in 2004-2005. And it is what we will continue to do in the future to encourage innovative, enterprising research.

Over the past year we marked the 15th anniversary of the NCE, which, given the program's history of achievement, was something worthy of celebration. Our recent performance, however, provided an even greater sense of accomplishment: Using any yardstick, the past year was one of strong growth and solid gains.

The NCE program stimulated outside investments of more than $71 million in 2004-2005, including $28 million from private sector companies. This represents an increase of almost 22% in partnership funding over 2003-2004 and is a clear indication of how the NCE creates investment synergies. When NCE funding is included, almost $150 million was channelled into research, training and commercialization.

Overall, 830 companies, 266 provincial and federal government departments and agencies, 51 hospitals, 194 universities, and 365 organizations from Canada and around the world were linked through NCE-enabled activities. More than 7,000 researchers and HQP (highly qualified personnel such as research associates and technicians, postdoctoral fellows, and graduate students) were involved in NCE projects.

NCE scientists were issued 37 patents (up from 31 in 2003-2004) with 5,673 papers published in refereed scientific journals (up by more than 2,000 from the previous year). In total, 48 licences were granted or are being negotiated, while 13 new Canadian companies owe their existence to NCE-supported research.

The past year also saw the fruition of changes initiated in 2000, when the NCE program revised its selection criteria to put more emphasis on the social sciences. In 2004-2005, NCE-sponsored projects were just as likely to be about producing evidence to support the efficacy of early-childhood literacy programs as proving the durability of fibre-reinforced polymer in construction. In other words, we are as actively involved in improving Canada's social structures as we are our physical ones.

It was also a year of change. AllerGen – Allergy, Genes and Environment Network was successful in its application and has commenced the task of building a network of researchers and partners to investigate causes of and potential treatments for allergies – an increasingly important health concern. Meanwhile, four of the original networks successfully completed their funding cycles. The work done by the Canadian Bacterial Diseases Network (CBDN), IRIS – The Institute for Robotics and Intelligent Systems, Micronet – Microelectronic Devices, Circuits and Systems, and PENCE – The Protein Engineering Network of Centres of Excellence will be carried on in the networking structures they have created and by the thousands of talented young people they have trained.

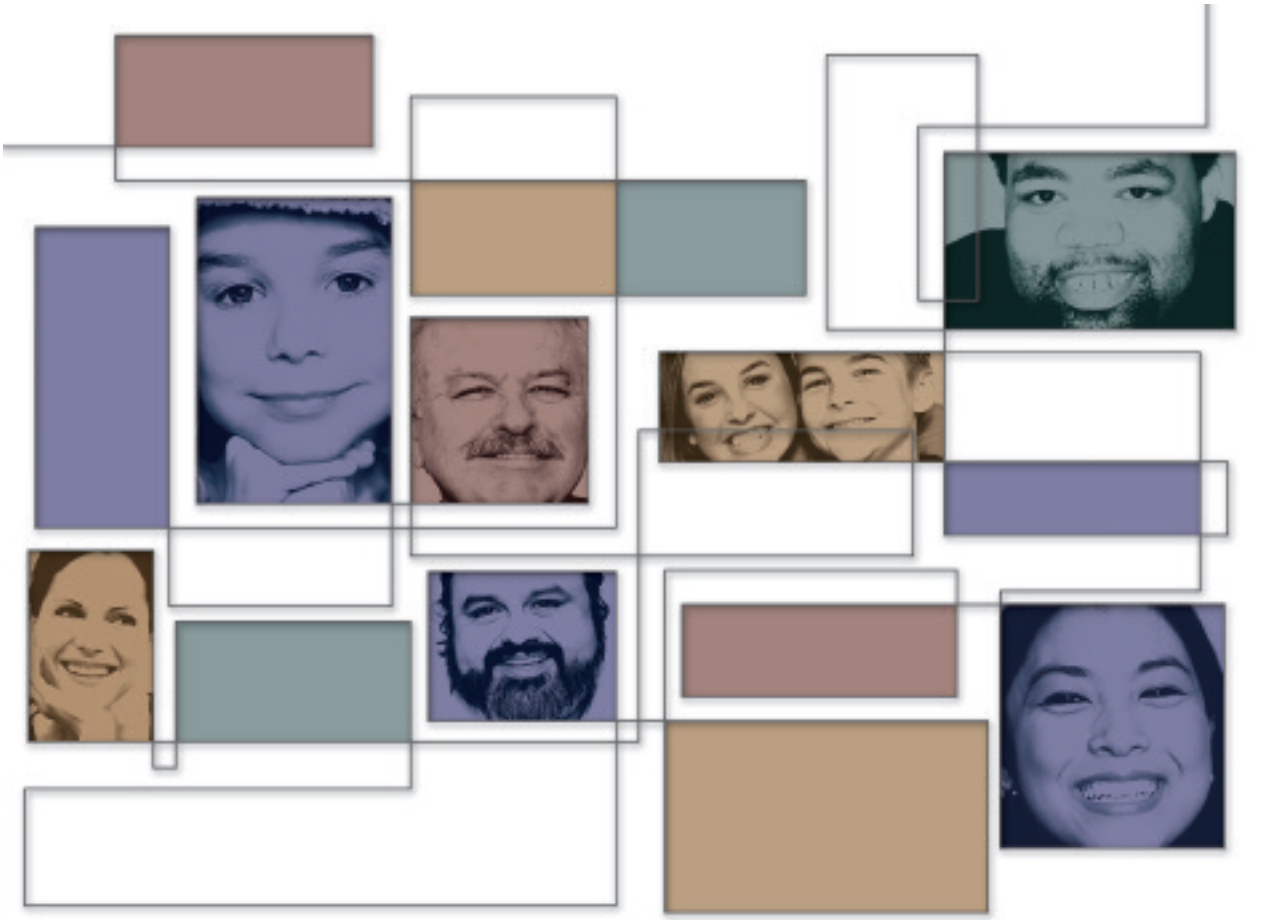
It was also a year of change for me. Having chaired the NCE steering committee for 10 years as part of my role as President of Science and Engineering Research Canada (NSERC), I am stepping aside to return to academia to take up challenging new teaching and consulting roles. As the NCE Chair, the past decade has provided me with the opportunity to come to know well some of the most innovative scientists in the world who are hard at work across Canada. I leave both humbled by and appreciative of that opportunity.

In conclusion, let me restate that the NCE program was created to mobilize excellence. It was designed as a Canadian initiative of Industry Canada and is funded by 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. This is made possible through the support of Canada's universities, which provide the networks with the infrastructure and research personnel they require. We are truly grateful for their co-operation.

The achievements realized over the past year – and over the past 15 years – stand as a testament to the energy, enthusiasm and enterprising nature of the scientific directors and the leadership teams of the individual networks. They have built bridges between academia and industry. They have connected scientists from diverse disciplines and challenged them to find new solutions to old and emerging problems. On behalf of myself and Dr. Alan Bernstein, President of the CIHR, and Dr. Marc Renaud, President of SSHRC, I thank them for their vitally important contributions.

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

Thomas A. Brzustowski
Chair
NCE Steering Committee



THE NCE PROGRAM

WHAT DOES IT MEAN TO MOBILIZE?

Good things happen when talented people come together.

But how, exactly, does that occur? How does Canada become a better country through the best use of its brilliant research talent? How do we make sure that the great ideas born in our universities and research institutions grow into great innovations that enhance our lives?

To *mobilize* means to assemble a variety of talents to accomplish a goal. It involves marshalling sometimes far-flung forces to achieve an objective. It requires co-ordinating the activities of different groups of diverse people to bring about a desired change.

That is precisely what the Networks of Centres of Excellence program does. We *mobilize excellence*. The individual networks bring together talented researchers from a variety of fields and disciplines. They operate across the country, encouraging gifted people to pool their resources to solve problems. And they link those researchers with the industry partners who can turn promising breakthroughs into profitable solutions.

That is how good things happen for research, for industry and for Canada.

THE NCE PROGRAM

THE YOUNG INNOVATORS

"The Government of Canada is pleased to see the results of its investment in research and development in Canadian universities and the Networks of Centres of Excellence. "These young innovators are Canada's best and brightest and what we need to succeed in the global race to accelerate commercialization and achieve economic wealth and the social well being of all Canadians."

*– **David L. Emerson**, Minister of Industry*

In a knowledge economy, countries that have the best talent succeed.

To build a better future for Canada – one in which our economy grows stronger, our people become healthier and our quality of life improves – means making sure that today's young, gifted people get every opportunity to gain the skills and experience they will need to become tomorrow's leaders in their chosen fields.

As part of the overarching goal to mobilize excellence, each network looks for ways to encourage its trainees to transform their bright ideas into economic and social benefits. This is not an add-on or an afterthought; it is written into each network's mandate. The individual NCEs kindle the spark of entrepreneurship among their talented young researchers to help them make their mark in the country and in the world.

Making a mark can be accomplished in a number of ways – from filing a patent or starting up a company, to establishing a new health protocol or having an impact on public policy. Over 15 years, thousands of NCE trainees have gone on to improve the way Canada works.

To celebrate that accomplishment and the NCE program's 15th anniversary, the Young Innovator Awards program was established in 2004. It honours those outstanding individuals who, with the help of their networks, have been exceptionally successful in transferring their innovative research to a business, process or service to benefit society at large.

The Criteria

The 2004 Young Innovator Award recipients were selected by a panel of judges on the basis of: The excellence and leadership of the nominee; the excellence of the nomination, including the research carried out and the quality of results being transferred; the socioeconomic impact of the transfer of knowledge; and challenges encountered in transferring that knowledge. The judges panel consisted of:

- Derek Gratz – Westlink Innovation Network Ltd.
- Réjean Landry – Université Laval
- Ron Freedman – The Impact Group
- Bill Cheliak – Galileo Genomics
- Armand Lavoie – Foragen Technologies Management Inc.

THE NCE PROGRAM

HIGHLY ENTREPRENEURIAL PEOPLE

Dr. Jolanda Cibere

Nominated by the Canadian Arthritis Network, Dr. Jolanda's Cibere's innovative research has had an important impact on current thinking and practice in treating osteoarthritis, a common form of arthritis that affects about 3,000,000 Canadians.

Her research into diagnosis and prevention of osteoarthritis led to the development of a standardized knee exam for early detection that has become standard practice in clinics and is being adopted by the U.S. National Institutes of Health. Her widely read study of glucosamine sulphate showed that the popular over-the-counter supplement – regarded by many as a natural cure for osteoarthritis – offers no long-term improvements.

A research scientist at the Arthritis Research Centre of Canada in Vancouver, Dr. Cibere, 43, is leading an investigation into how knee osteoarthritis progresses among different people and how to predict which patients' conditions will worsen over time. The findings will help guide how to best direct therapy.

Dr. Mohamed Hafed

Dr. Mohamed Hafed's big breakthrough came from thinking small.

As a trainee with Micronet – Microelectronic Devices, Circuits and Systems at McGill University in Montreal, he was intrigued by the idea of shrinking the cumbersome multi-million-dollar machines used to test semiconductors down to something more manageable and less expensive. The work he did with his supervisor, Dr. Gordon Roberts, led directly to the creation of DFT Microsystems Canada Inc. in 2002. The successful Micronet spin-off company has patented technology to test microchip semiconductors – such as those used in cell phones, hearing aids, hand-held computers and auto parts – with much greater ease, at much lower costs.

The innovations introduced by Dr. Hafed, 29, not only made the testing of analog/mixed-signal microchips more-efficient and less-expensive, it made it better: Fewer faulty microchips now make it to the market. His ingenuity and entrepreneurial spirit has enhanced Canada's role in the international semiconductor industry.

"It is a great honour and I feel very flattered. I'm doing the same line of work that I did for my PhD and I am progressing through it and evolving with the industry."

*– **Dr. Mohammed Hafed**, Young Innovator Award winner (quoted in the Montreal Gazette)*

Dr. Monisha Scott

Named one of the world's Top 100 Young Innovators by the Massachusetts Institute of Technology's *Technology Review*, Dr. Monisha Scott, 34, is doing world-class work in finding ways to defeat infectious bacteria that are ever-increasingly resistant to traditional antibiotic therapies.

Instead of taking on the bacteria directly, which could then become resistant to its new attacker, her strategy is help the host, boosting the body's immune system with antimicrobial peptides. She calls them *non-antibiotic antibiotics*. Her groundbreaking research led to the creation of Inimex Pharmaceuticals Inc. of Vancouver, which has ranked among the Top 10 Investment Prospects for Canadian life-sciences companies for four years running.

Dr. Scott was nominated for the Young Innovator award by the Canadian Bacterial Diseases Network. She is a strategic consultant at Inimex, which is in the process of developing a portfolio of clinical programs to address a range of antibiotic-resistant infections.

THE NCE PROGRAM

WALKING INTO THE SUNSET

When the NCE program began operations 15 years ago, the horizon, though far off, was always in clear view.

It was decided at the outset that networks could qualify for two terms of seven-year funding after which, having successfully built enduring avenues of co-operation between researchers, industry and government, their work would be done. They would have reached the end of their horizons.

In 2004, four original networks successfully completed full-term funding. The work they undertook has been successfully completed. But it is not over. In each case, the collaborations they created will carry on well into the future. While they may be walking into the sunset, their work has made a brand new day.

The Canadian Bacterial Diseases Network

Living up to its credo of "putting science to work," the Canadian Bacterial Diseases Network (CBDN) has forever changed how microbiology research is conducted in this country.

In 1990, the landscape consisted of isolated areas of excellence from which sprang occasional attempts to transfer knowledge into commercial applications. By 2004 that scenario had been replaced by one in which a network of universities (14 per year, on average) had linked with more than three dozen industrial allies, 17 federal or provincial partners and 14 foundations or organizations. In all, CBDN projects attracted about $133 million – almost $10 million per year – in cash or in-kind support.

Perhaps more importantly, CBDN created a culture shift in which competitors became co-operators.

"All of us had a long history of being fierce competitors," said Dr. Donald Woods, CBDN Scientific Director from 1996 to 2002. "For years we had competed against each other for funding, for jobs, for students, for postdoctoral fellows, for everything. What was clear was that there had been a shift in attitudes about research. It took some years for it to happen, but my laboratory benefited from this. I have looked back over my Annual Reports for CBDN and come up with a list of collaborators that looks like a Who's Who of Canadian Science."

IRIS – The Institute for Robotics and Intelligent Systems

Precarn Incorporated, the national not-for-profit consortium that manages IRIS, plans to continue to build on the successes the network generated from 15 years of NCE funding.

During the current transition year, IRIS is focusing its efforts on ensuring that the value of its research is not lost. It has extended some existing activities, such as the highly successful T-GAP program to fund spin-off technologies and the Precarn-supported Scholars Program. In addition, IRIS is enabling technology diffusion workshops and the marketing of early-stage technologies. Finally, Precarn is examining ways to continue supporting the university research network it built over 15 years.

During its network lifespan, IRIS generated more than $26 million in cash or in-kind contributions from industry – an amount equal to about one-third of its NCE program funding. IRIS linked, on average, 120 professors at 22 universities across Canada each year. In all, IRIS supported some 3,000 students, postdoctoral fellows and other highly qualified people. More than 80% of graduating students stayed in Canada, with most applying their skills in academia and industry.

Commercially, IRIS succeeded beyond all expectations: A total of 37 spin-off companies were started, 28 of whom are still in operation.

What is the IRIS legacy?

"There are, of course, new technologies and new products and services. There are many highly skilled professionals contributing to Canada's economic growth," said Paul Johnston, President and CEO of Precarn Incorporated. "But, beyond that, there is a much stronger integration between universities that are doing research and the companies that are the receptors of that research."

Micronet–Microelectronic Devices, Circuits and Systems

Probably no network witnessed as much rapid change in its field of excellence as Micronet, which worked co-operatively with universities, industry and government to advance microelectronics in Canada.

When Micronet began operations in 1990, fewer than five in 100 Canadians used cell phones. Now, at the conclusion of Micronet's full term of NCE funding, cell phones are ubiquitous, as are hand-held personal computers and all manner of microchip-empowered wireless electronic devices.

Clearly Micronet, which took a "system on a chip" approach to enabling microelectronic technologies, was a network in the right place at the right time.

It also had the right people: Founded by Dr. André Salama, who remained its Scientific Director throughout the network's lifespan, Micronet linked 25 universities with 78 companies across Canada. Each year it engaged some 75 professors and more than 300 graduate students in its project work. Micronet led to the creation of 12 spin-off companies.

"Micronet contributed significantly to bringing focus to research, particularly an industrially relevant focus to research," said Dr. Salama.

All told, more than 700 students went on to graduate as Masters of Science while almost 300 more acquired doctorates. It's important to note that 80% of Micronet's grads are now employed in Canada, where they are helping to improve productivity and fuel economic growth.

PENCE – The Protein Engineering Network of Centres of Excellence

Founded by the late Dr. Michael Smith, the 1993 Nobel Prize winner for chemistry, PENCE has reason to be proud of its past.

PENCE carried on in the tradition of its founder, who developed a system for making mutations at any location along a DNA molecule, thereby allowing the engineering of proteins. This development underpins much of the current biotech industry and has provided a valuable tool for academic scientists to probe both healthy and diseased cells.

Like Dr. Smith, PENCE was unafraid to shift the focus of its investigations when a new area of discovery with strong potential opened up. In 2001, having already established itself as the country's research leader in proteins and protein engineering, PENCE took on a leadership role in the emerging field of proteomics, which involves global analysis of the structure, function, and interactions of the proteins produced by genes. As a result, PENCE's annual Canadian Proteomics Initiative conference has become a national clearinghouse for new thinking on proteomics. And it will carry on – the 2006 conference in Edmonton will draw more than 300 participants.

While PENCE produced more than 55 issued patents (120 filed), numerous licence agreements and was responsible for the establishment of seven new companies, its strongest legacy is in the more than 900 highly qualified personnel that were trained over 14 years.

"What we could do through the network was attract students who were interested in a bigger picture," said Stephen Withers, PENCE's Scientific Director. "The network gave those students the opportunity to see how collaboration works, it gave them the opportunity to travel and learn from the experts, rather than just reading about it in the published papers. And it became easier for them to be exposed to interfaces with industry."

THE NCE PROGRAM

A TRIBUTE TO DR. THOMAS A. BRZUSTOWSKI

"He and his colleagues figured out that Canada's great chance at advancing its economy lay not so much in its resources but in developing synergies among its various silos. This led to the revolutionary concept that academics, industrialists, NGOs and government agencies could work together, focused on a single goal, and the goal could be any issue relevant to Canada. This country and its citizens owe Tom a great deal of debt and gratitude."

*– **Dr. Antoine M Hakim**, Scientific Director of the Canadian Stroke Network*

One of the most significant events of the past year at the NCE has been the departure of Dr. Thomas Brzustowski as Chair of the Steering Committee. Dr. Brzustowski, who has been a beacon illuminating the importance of robust scientific research, has returned to academia to help two universities establish innovative new programs.

Dr. Brzustowski's career spans academia, government and the making and funding of science policy. He taught and researched aeronautical engineering, serving as the Chair of Mechanical Engineering at the University of Waterloo and as its academic vice-president. He then moved to government to become a deputy minister for Ontario. In 1995 he was appointed President of Science and Engineering Research Canada (NSERC) and Chair of the NCE Steering Committee and immediately set to work improving and expanding the NCE program.

Under his guidance, the NCE was made a permanent program by the federal government. In 1998, he made the case that the NCE's budget ceiling of $47.4 million was hampering the creation of new networks and discouraging the best and busiest researchers from undertaking the rigorous application process. The government responded by increasing the budget by $30 million.

On his watch, the NCE extended its reach in health care and social sciences, with networks dedicated to literacy, Arctic climate change, stem cells, allergies, arthritis, and stroke. It has built strong networks in mathematics, geomatics and photonics. He has led the NCE in the creation of what he calls "new groupings of research talent to address emerging issues as well as emerging opportunities for Canada."

Dr. Brzustowski has clearly articulated the connection between intensifying research and development and increasing Canadian-made innovation and Canadian success in the world market. That, he has stressed, leads to more value-added economic activity and wealth creation for Canada. Wealth, however, has never been the end to Dr. Brzustowski. It has always been the means: Prosperity simply gives us more options and more opportunities to invest in health, children, education and the environment.

Dr. Brzustowski is a scientist's scientist. A gifted research engineer in the field of thermodynamics and combustion, he understands the crucial importance of scientific discovery, but also sees the need to make best use of discovery for the greater good. In fact, he draws no distinction between basic research and applied science. To him, there is only good science and bad science – "and the latter isn't worth talking about."

We wish him the very best in his new positions at the University of Ottawa's School of Management, where he will be the inaugural chair holder of the RBC Professorship in Technology-Based Innovation, and at the University of Waterloo's Institute for Quantum Computing where he is establishing an international strategic advisory committee to ensure the institute becomes a world leader. We thank him for his enormous contribution to the NCE program.

THE NCE PROGRAM

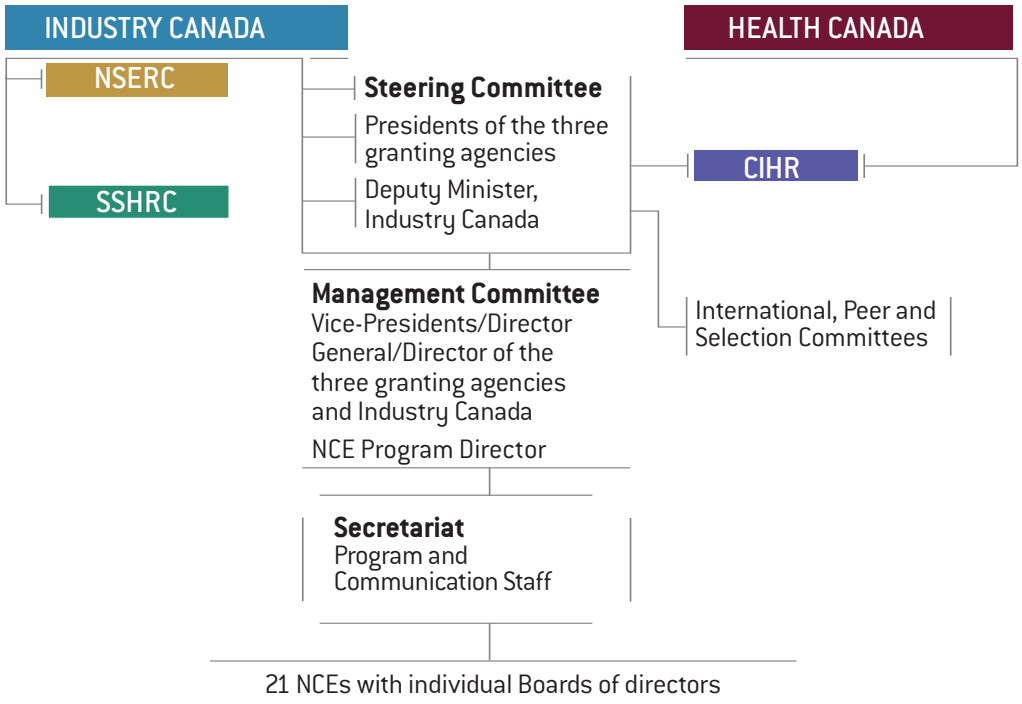
HOW THE NCE IS GOVERNED

The NCE program is jointly administered by Canada's three granting agencies: The Canadian Institutes for Health Research (CIHR), Science and Engineering Research Canada (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.

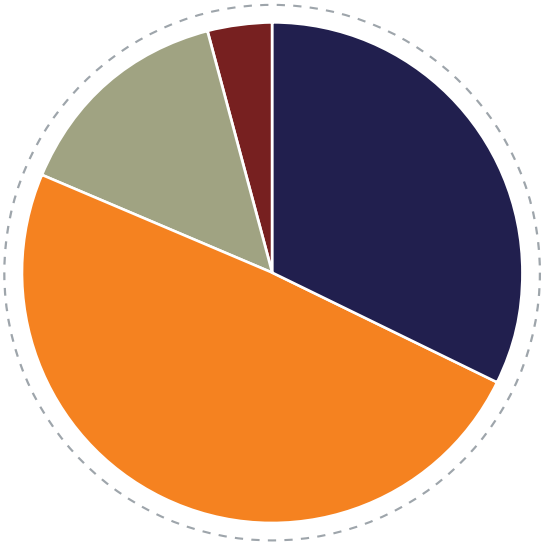
The NCE was made a permanent program of the Government of Canada in 1997. It receives $77.4 million in annual funding which is channelled through the three granting agencies.

GOVERNANCE STRUCTURE

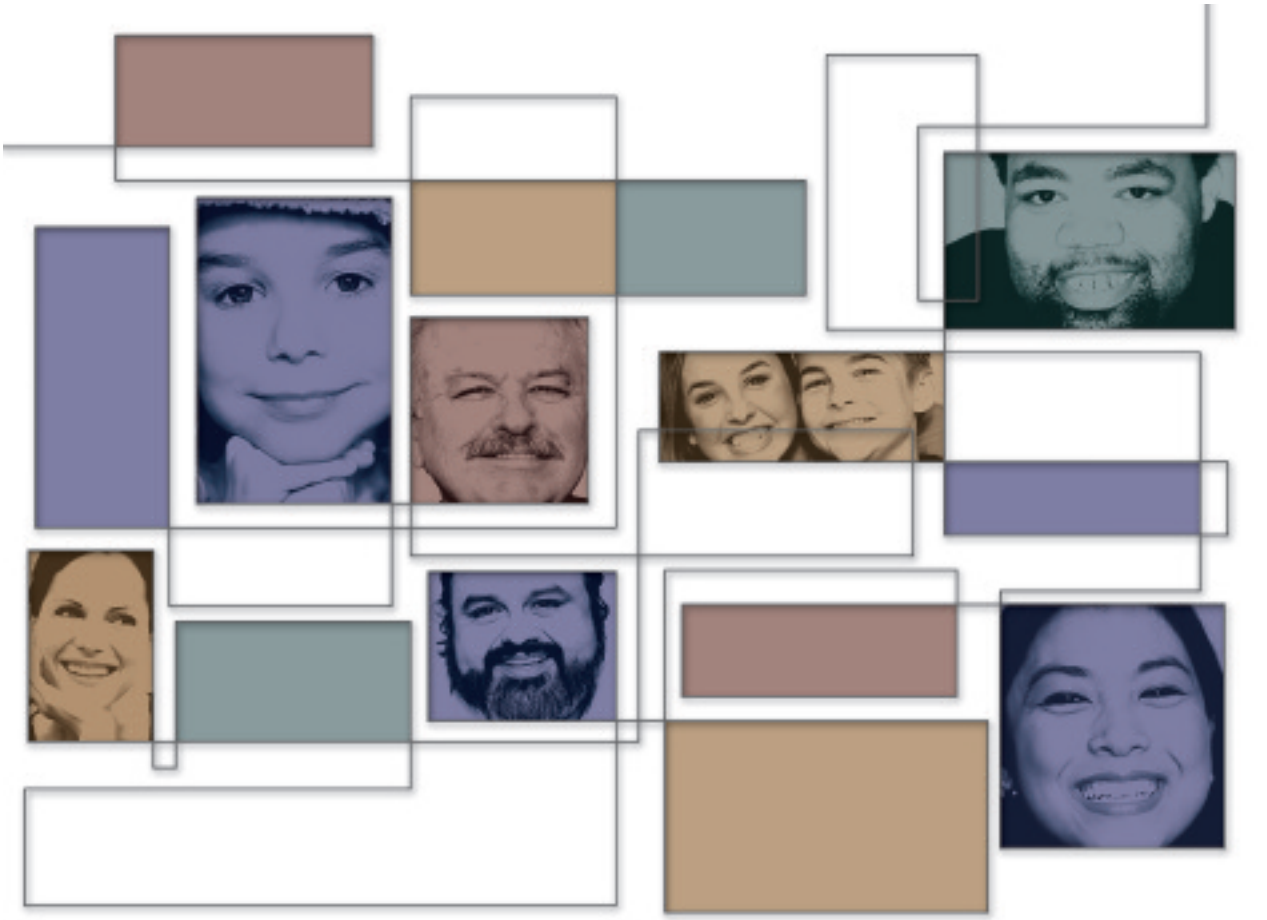


Fiscal Year 2004-05

PATHS THROUGH WHICH NCE PROGRAM FUNDS FLOW TO THE NETWORKS



- CIHR $25,000,000
- NSERC $38,200,000
- SSHRC $11,300,000
- NCE Admin. $2,900,000
- **Total $77,400,000**



THE YEAR'S HIGHLIGHTS

HOW WE MOBILIZED EXCELLENCE

Accomplishment comes in assorted shapes and sizes. A variety of forms.

It can be a colourful calendar that helps a day-care teacher spark an interest in letters and words among her pre-school charges. It can be a new, important partnership forged between university researchers and business leaders to accelerate the use of geomatics for advanced information solutions. It's a new robot to tend the ocean's floor or a solution for more sustainable fish farming.

Over the past year, NCE investigators have found a mathematical formula to help deal more effectively with the next viral pandemic. They have helped the world build better bridges – without using steel. They have led the way in the refocusing of the photonics industry and found a gene that could forever change the treatment of diabetes. They have shown that by mobilizing excellence we can accomplish a great deal.

THE YEAR'S HIGHLIGHTS

A RECORD OF ACCOMPLISHMENT

From winning awards and co-ordinating national projects to building stronger partnerships for commercialization, the NCE program accomplished much throughout 2004-2005. Here are a few of the highlights:

March, 2005

Industry Minister David Emerson announces the investment of up to $55 million over three years to further the research activities of **AUTO21 – The Automobile of the 21st Century**, the **Canadian Language and Literacy Research Network**, the **Canadian Water Network (CWN)**, and the **Stem Cell Network (SCN)** following their successful mid-term reviews.

MacDonald, Dettwiler & Associates Ltd. (MDA) becomes a corporate member of **GEOIDE – Geomatics for Informed Decisions** to "benefit from an increased research presence," according to an official of the company that does world-class work in advanced information solutions for decision making.

February, 2005

Dr. Jane E. Aubin, the Scientific Co-Director and CEO of the **Canadian Arthritis Network (CAN)** wins the **William F. Neumann Award** for 2004 from the **American Society for Bone and Mineral Research**.

An **AquaNet** research team from the University of New Brunswick presents findings at the **American Association for the Advancement of Science** in Washington, D.C that show a more sustainable and less polluting way of farming fish is achieved by growing salmon, mussels, and seaweed together.

January, 2005

Researchers with **IRIS – The Institute for Robotics and Intelligent Systems** test a prototype of a water robot that someday could monitor reefs or seabed conditions or check conditions on offshore drilling rigs or dams.

December, 2004

The **Canadian Network for Vaccines and Immunotherapeutics (CANVAC)** announces the development of a new method to assess how well the thymus (an organ located at the base of the neck) works and the discovery of its functional abnormality in HIV-infected individuals – paving the way to develop immunotherapies.

November, 2004

Industry Canada announces a $90-million, four-year investment in the creation of the **AllerGen – Allergy, Genes and Environment Network** and the second cycle of funding for **CAN, MITACS – Mathematics of Information Technology and Complex Systems**, the **Canadian Institute for Photonic Innovations (CIPI)**, and **GEOIDE**.

CIPI leads the Putting Light to Work roundtable discussion in Ottawa addressing the challenges of finding and implementing strategies to move the photonics industry forward.

October, 2004

Xenon Pharmaceuticals Inc., a **Canadian Genetic Diseases Network (CGDN)** associated biotech company, announces a partnership with the global drug giant, **Novartis Pharma AG**. Under the arrangement, Xenon will receive up to $200 million to research, develop, and commercialize a novel treatment for obesity.

AquaNet hosts leading scientists and sector partners in aquaculture in a Quebec City conference.

August, 2004

SCN scientists find a pancreatic cell capable of making insulin-producing cells – a discovery that could free people with diabetes from insulin injections.

July, 2004

The **Iowa Department of Highways** uses a design concept developed by **ISIS Canada – Intelligent Sensing for Innovative Structures** to construct a steel-free bridge deck, indicative of international adoption of Canadian technological innovation.

June, 2004

The **Canadian Stroke Network (CSN)** and the **Heart and Stroke Foundation of Canada** join forces to launch the **Canadian Stroke Strategy** to maximize success in controlling risk factors to prevent stroke and improving and standardizing delivery of treatment when it does occur.

MITACS unveils a universal formula to predict appropriate quarantine times to prevent the transmission of infectious diseases. It could help contain the massive costs in reining in an epidemiological disaster such as avian influenza.

CWN hosts a national symposium of researchers, students and partners to discuss ways to improve the nation's water quality and quantity.

May, 2004

The annual **Canadian Proteomics Initiative**, sponsored by **PENCE – The Protein Engineering Network of Centres of Excellence**, draws 350 participants in Montreal. The conference is the leading national forum for disseminating developments in proteomics and protein chemistry.

More than 200 students from 23 Canadian universities gather at the **AUTO21** Networks of Centres of Excellence Highly Qualified People Conference in Windsor to discuss innovations to enhance the automobile industry.

In a conference co-sponsored by **CAN**, leading medical researchers, clinicians, policy makers, patients and pharmaceutical industry representatives gather in Toronto to identify research priorities for inflammatory joint diseases that affects approximately 300,000 Canadians.

April, 2004

The **Canadian Network for Vaccines and Immunotherapeutics (CANVAC)** begins an 18-month trial of a therapeutic HIV vaccine – the first such clinical trial designed and driven by academic Canadian researchers.

The **Canadian Language and Literacy Research Network** distributes a calendar that translates cutting-edge research on language and literacy development into fun, practical activities for child-care professionals to use with children in their care.

THE YEAR'S HIGHLIGHTS

MOBILIZING PARTNERSHIPS: AN OVERVIEW

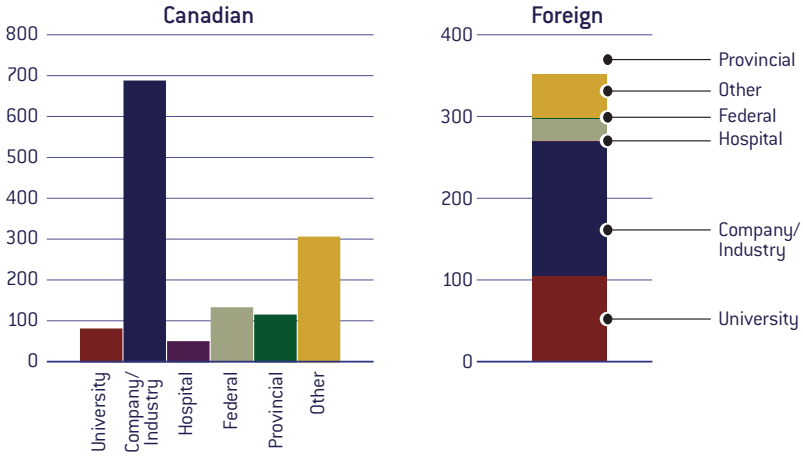
The NCE program exists to mobilize partnerships between academia, federal and provincial departments and agencies, and the private sector. The 2004-2005 fiscal year was an outstanding example of partnerships in action, with a total of 830 companies, 266 public sector departments and agencies, 51 hospitals, 194 universities, and 365 other organizations from Canada and abroad involved in NCE activities.

Building partnerships creates synergies for funding research. Combined, the individual networks' partnership efforts leveraged more than $71 million in cash and in-kind investments – almost double the NCE program funding of $77.4 million.

Fiscal Year 2004-05

NCE PARTICIPATING ORGANIZATIONS

PROVINCE/ TERRITORY	UNIVERSITY	COMPANY/ INDUSTRY	HOSPITAL	FEDERAL	PROVINCIAL	OTHER	TOTAL
NWT, Nunavut & Yukon	0	2	0	5	2	18	27
British Columbia	10	103	5	12	16	37	183
Alberta	6	76	3	5	14	28	132
Saskatchewan	3	9	0	5	3	3	23
Manitoba	2	13	0	3	8	6	32
Ontario	21	299	23	76	30	123	572
Quebec	23	131	17	13	26	65	275
New Brunswick	5	23	0	6	6	14	54
Nova Scotia	5	24	0	5	1	5	40
Prince Edward Island	3	1	0	0	3	2	9
Newfoundland and Labrador	1	5	0	1	4	3	14
Total Canadian	**79**	**686**	**48**	**131**	**113**	**304**	**1,361**
Total Foreign	**115**	**144**	**3**	**22**	**0**	**61**	**345**
Grand Total	**194**	**830**	**51**	**153**	**113**	**365**	**1,706**



THE YEAR'S HIGHLIGHTS

MOBILIZING PARTNERSHIPS: INDUSTRY

The essence of a good partnership is mutual benefit. Nowhere is this truer than in the relationships between the NCE program networks and their receptor industrial partners.

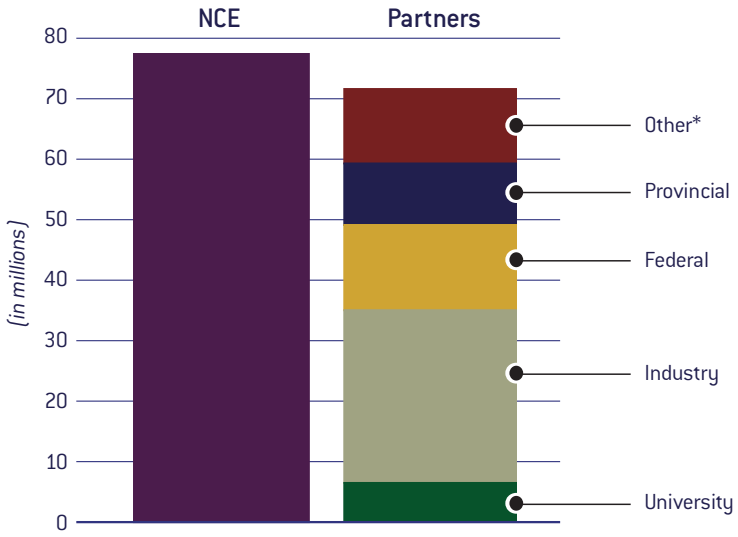
"This is a two-way street," said Dr. Eric Atkinson, Director of Corporate Development at Vancouver-based firm, StemCell Technologies. His company works in partnership with the Stem Cell Network and the benefits flow back and forth: "A lot of the network's scientists use our products already. But sometimes, if they are doing cutting edge research, they need products that we don't have yet. They are developing their own tools that could be 'productized' by us to help their colleagues elsewhere do similar experiments. We help them move forward with the tools we already have and they help us develop new tools for the future."

As the chart below indicates, cash and in-kind contributions by industry alone were over $28 million in 2004-2005, significantly more than one-third of the NCE program's annual budget of $77.4 million.

Fiscal Year 2004-05

CONTRIBUTIONS TO THE NETWORKS OF CENTRES OF EXCELLENCE

SOURCE	CASH	IN-KIND	TOTAL
NCE	$ 77,400,000	$ –	$ 77,400,000
PARTNERS			
University	$ 2,810,118	$ 3,635,568	$ 6,445,686
Industry	$ 9,307,436	$ 19,248,123	$ 28,555,559
Federal	$ 8,419,252	$ 5,676,046	$ 14,095,298
Provincial	$ 9,038,922	$ 1,126,974	$ 10,165,896
Other	$ 7,829,263	$ 4,476,782	$ 12,306,045
Partner's Total	$ 37,404,991	$ 34,163,493	$ 71,568,484
Grand Total	**$ 114,804,991**	**$ 34,163,493**	**$ 148,968,484**



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

THE YEAR'S HIGHLIGHTS

MOBILIZING INNOVATION: BRINGING IDEAS TO THE MARKET

"This (adult stem cells) is certainly one of the more exciting research areas I've worked in and it has direct application to treatment of cancer patients. We've had to do a lot of basic science. It's time – now that we know as much as we do – to get down to the translation of our basic knowledge and, in this case, develop drugs to treat cancer patients."

– Dr. John Hassell, Director of the Centre for Functional Genomics at McMaster University and Stem Cell Network Investigator

What is knowledge translation? It is the process by which "what we now understand" becomes "what we can now put into practice." It has been described as navigating the distance from the laboratory bench to the hospital bedside. It is also the process of moving an innovation from conceptual design to the factory floor. It is the introduction of a better, more efficient procedure, or the implementation of a smarter or fairer policy.

The NCE program exists to mobilize knowledge translation. In 2004-2005, there were more than 7,000 researchers and highly qualified personnel involved in NCE projects and activities. NCE scientists were issued 37 patents (up from 31 in 2003-2004), published 5,673 papers in refereed scientific journals (up from 3,564) and were granted or were negotiating 48 licences. Six spin-off companies were created to translate NCE-generated knowledge into practice.

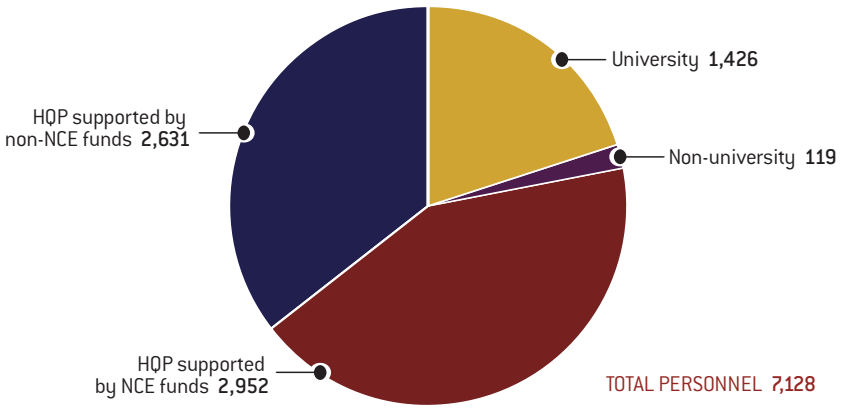
Fiscal Year 2004-05

REGIONAL DISTRIBUTION OF NCE RESEARCHERS AND PERSONNEL

	NCE RESEARCHERS*			HQP**			
PROVINCE/ TERRITORY	UNIVERSITY	NON-UNIVERSITY	TOTAL RESEARCHERS	SUPPORTED BY NCE FUNDS	SUPPORTED BY NON-NCE FUNDS	TOTAL HPQ	TOTAL PERSONNEL
NWT, Nunavut & Yukon	0	0	0	1	2	3	3
British-Columbia	205	7	212	350	325	675	887
Alberta	188	0	188	392	383	775	963
Saskatchewan	27	0	27	34	38	72	99
Manitoba	40	0	40	87	50	137	177
Ontario	516	93	609	1,193	969	2,162	2,771
Québec	304	19	323	677	734	1,411	1,734
New Brunswick	51	0	51	74	46	120	171
Nova Scotia	58	0	58	104	46	150	208
Prince Edward Island	13	0	13	22	18	40	53
Newfoundland	24	0	24	18	20	38	62
Total Canadian	**1,426**	**119**	**1,545**	**2,952**	**2,631**	**5,583**	**7,128**
Total Foreign	**48**	**48**	**96**	**5**	**3**	**8**	**104**
Grand Total	**1,474**	**167**	**1,641**	**2,957**	**2,634**	**5,591**	**7,232**

** An NCE researcher is a researcher from the academic, public or private sector responsible for certain aspects of a network-funded research project.*

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



The following chart shows the regional distribution of NCE funds by each participating network institution in 2004-2005. These expenditures are drawn against NCE program funds provided in 2004-2005 and carried over from previous years.

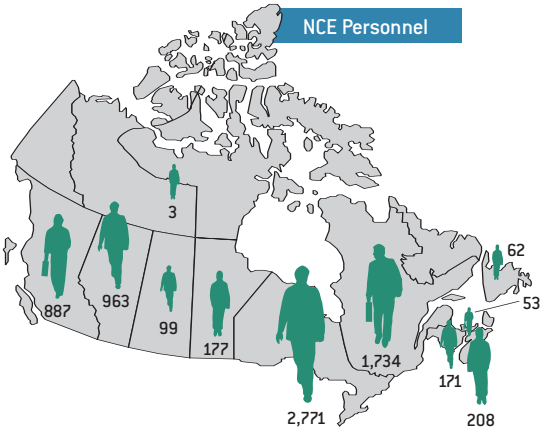
Fiscal Year 2004-05

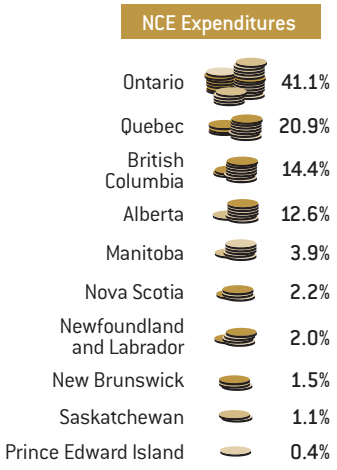
REGIONAL DISTRIBUTION OF NCE PERSONNEL AND FUNDS

	NCE RESEARCHERS*		HIGHLY QUALIFIED PERSONNEL**		NCE EXPENDITURES	
PROVINCE/ TERRITORY	# TOTAL	PERCENTAGE	# TOTAL	PERCENTAGE	$ TOTAL	PERCENTAGE
NWT, Nunavut & Yukon	0	0%	3	0%	$ 0	0.0%
British-Columbia	212	13%	675	12%	$ 11,920,955	14.4%
Alberta	188	11%	775	14%	$ 10,410,719	12.6%
Saskatchewan	27	2%	72	1%	$ 935,564	1.1%
Manitoba	40	2%	137	2%	$ 3,211,357	3.9%
Ontario	609	37%	2,162	39%	$ 34,001,026	41.1%
Québec	323	20%	1,411	25%	$ 17,300,948	20.9%
New Brunswick	51	3%	120	2%	$ 1,220,363	1.5%
Nova Scotia	58	4%	150	3%	$ 1,809,986	2.2%
Prince Edward Island	13	1%	40	1%	$ 327,909	0.4%
Newfoundland & Labrador	24	1%	38	1%	$ 1,649,308	2.0%
Total	**1,545**	**94%**	**5,583**	**100%**	**$ 82,788,135**	**100%**
Total Foreign	96	6%	8	0%	$ 0	0.0%
Grand Total	**1,641**	**100%**	**5,591**	**100%**	**$ 82,788,135**	**100%**

** An NCE researcher is a researcher from the academic, public or private sector responsible for certain aspects of a network-funded research project.*

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





THE YEAR'S HIGHLIGHTS

MOBILIZING HIGHLY QUALIFIED PEOPLE ACROSS CANADA

"The demographics of retirement from the baby boomers are incredible. We'll have to help our next generation in new ways to not only fill the void, but to advance the face of research as we know it."

*– **Dr. Rickey Yada**, Scientific Director of AFMNet*

As Dr. Thomas Brzustowski, Chair of the Steering Committee, remarked at the Annual General Meeting, the NCE program "is about helping to solve big and complex problems important to Canada that require new perspectives and new understanding."

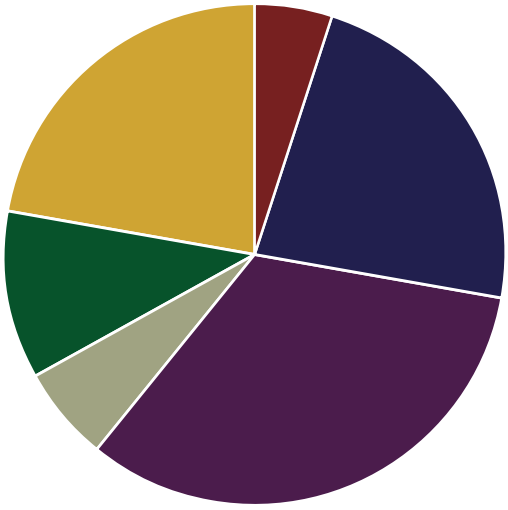
To do that, Dr. Brzustowski stressed, we need highly qualified personnel who can bring fresh approaches to problem-solving: "If the problem is really important and we don't know how to deal with it today, then we must educate the people who will know how to do a better job of it tomorrow."

Mobilizing highly qualified personnel is a key requirement for each NCE to secure its funding. In 2004-2005, the NCE program directly supported 2,952 research associates and technicians and research trainees such as postdoctoral fellows, graduate students and summer students. Another 2,631 were involved with NCE project work, though supported through other means. These young scientists will be the leaders in their fields in a few years and will be solving those "big and complex problems."

Also, the active involvement of industry in NCE-enabled research strengthens employment opportunities for these trainees: 88% are successful in finding jobs.

Fiscal Year 2004-05

POST-NETWORK EMPLOYMENT BY SECTOR



- Government 5%
- Industry 23%
- University 33%
- Other 6%*
- Unknown 11%
- Outside Canada 22%

** Other sectors included hospitals, research insititutes, and not-for-profit organizations.*

THE YEAR'S HIGHLIGHTS

ALLERGEN: A NEW NETWORK ARRIVES

To meet its mandate of delivering economic and social dividends through scientific research, the NCE program is in a constant state of renewal.

As older networks shift into self-sustainability, new networks are born to take up new challenges, to address emerging concerns. In the fall of 2004, the NCE program launched AllerGen – Allergy, Genes and Environment Network to mobilize a multidisciplinary team of scientists to deal with what has become the number one chronic health concern for Canadians over the age of 12.

"Allergy and allergic diseases such as hay fever, asthma, and anaphylaxis are affecting children and their families in truly epidemic proportions," said Dr. Judah Denburg, a professor at McMaster University's Michael G. DeGroote School of Medicine. "This has led to loss of productivity in the school and workplace, and places a tremendous burden on Canada's economy."

Dr. Denburg is the Scientific Director for AllerGen, which has begun co-ordinating the work of 100 researchers at 20 Canadian universities and has enlisted the support of more than 70 Canadian and international partners. The goal is to improve life for people with asthma and allergies by developing new diagnostic tests, better medications and more effective public health policies. An important first step will be to address the critical shortage of allergists and allergic disease researchers in Canada. AllerGen is creating 100 new research trainee positions and doubling the number of clinical specialists and research scientists.

How new networks are born

For the 2005 competition, 31 letters of intent were received and reviewed by the NCE Selection Committee, with five groups invited by the Steering Committee to submit full applications. AllerGen was selected from that group of five.

Program Criteria

Proposals for funding are assessed against five criteria:

- The excellence of the research program
- The opportunity for developing highly qualified personnel
- The networking and partnership possibilities
- The opportunity for knowledge exchange and technology exploitation
- The quality of the management of the network

The NCE peer-review process

To ensure excellence and fairness, the NCE uses a peer-review system in which a Selection Committee of experts works with an expert panel to make recommendations to the Steering Committee to decide which networks are funded.

Eligible research

Competitions are open to all research areas, however the Steering Committee may target specific areas, taking into consideration:

- The amount of funding available
- The broad areas already represented in the existing networks
- The need to develop specific areas in accordance with national needs

THE YEAR'S HIGHLIGHTS

RENEWING THE COMMITMENT TO EXCELLENCE

Along with constantly renewing itself to stay relevant, the NCE program seeks to ensure that the individual networks stay on course in their pursuit of excellence, their dedication to training the next generation of researchers, and their commitment to transforming new knowledge into social and economic benefits. Each network undergoes a mid-term renewal during their seven year funding cycles, with their past work and future plans reviewed by the same Selection Committee that advises the NCE on the funding of new networks. In April of 2004, four networks were successfully renewed:

- The Canadian Arthritis Network (CAN)
- The Canadian Institute for Photonic Innovations (CIPI)
- GEOIDE – Geomatics for Informed Decisions
- MITACS – Mathematics of Information Technology and Complex Systems

Also, at the request of the federal government, the NCE program launched a targeted competition to create a network to investigate bovine spongiform encephalopathy (BSE) and other transmissible spongiform encephalopathies (TSE). While the risk of so-called Mad Cow disease infecting humans is small they are still significant. Also, fears surrounding the disease have huge economic impacts: The Canadian cattle industry has lost $7 billion in exports since the BSE was discovered in an Alberta cow in 2003.

Information sessions about the new network, which will receive $5 million in funding in 2006, were held in late 2004 and early 2005 and applications were sought. As a result, PrioNet Canada, based at the University of British Columbia, was invited to submit a full proposal.

Membership of the 2005 NCE Selection Committee

Chair:

Dr. Verna Skanes
Consultant
NF, Canada

Members:

Dr. Patricia Baird
Consultant
BC, Canada

Dr. John Clement
QLT Inc.
BC, Canada

Dr. Khadiyatoulah Fall
Université du Québec à Chicoutimi
QC, Canada

Dr. Cathy Garner
Centre for the Management of Intellectual Property in Health R&D
England

Dr. Camille Limoges
Consultant
QC, Canada

Mr. David Lynch
Gennum Corporation
ON, Canada

Dr. Renée Lyons
Dalhousie University
NS, Canada

Dr. Ian McDowell
University of Ottawa
ON, Canada

THE YEAR'S HIGHLIGHTS

THE LIFE CYCLE OF FUNDING

Throughout the life cycle of each network, funding allocations are reviewed and revised. New networks' budgets are set by the Steering Committee based on the recommendations of the Selection Committee. Existing networks are reviewed at the midpoints of their seven-year funding cycles to ensure they are meeting NCE program objectives. Networks that are leaving the program can apply for Research Management Funding to help them make the transition to sustainability.

CURRENT NETWORK ROADMAP FY 2004-05

	COHORT	2004-05	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
CGDN	1989	RMF																
IRIS	1989	RMF																
AQUANET	1999		RC				MT			RMF								
CANVAC	1999		RC				MT			RMF								
CSN	1999		RC				MT			RMF								
AUTO21	2000	MT			RC				MT			RMF						
CLLRNet	2000	MT			RC				MT			RMF						
CWN	2000	MT			RC				MT			RMF						
SCN	2000	MT			RC				MT			RMF						
ISIS	1994		MT			RMF												
SFM	1994		MT			RMF												
AFMNet	2003				MT			RC				MT			RMF			
ArticNet	2003				MT			RC				MT			RMF			
CAN	1997	RC				MT			RMF									
CIPI	1997	RC				MT			RMF									
GEOIDE	1997	RC				MT			RMF									
MITACS	1997	RC				MT			RMF									
Allergen	2004					MT			RC				MT			RMF		
BSE	2004					MT			RC				MT			RMF		

1st funding cycle *2nd funding cycle* *RMF Funding* *Future funding if successful in mid-term review and/or competition for last funding cycle*

RC: Renewal Competition MT: Mid-term review RFM: Research Management Fund Competition

THE YEAR'S HIGHLIGHTS

A MEETING OF MINDS TO MOBILIZE EXCELLENCE

"Knowledge and Innovation for a Better Life" was the theme of the 2004 NCE Annual General Meeting held in Ottawa in December.

As Director Jean-Claude Gavrel said, the theme captured the essence of the NCE program: Mobilizing the best talents to turn research results into benefits for Canadians. Those "better life" benefits can come in the form of new products or services. They can be new policies or legislation. Or they can be new or improved practices or protocols in health or education.

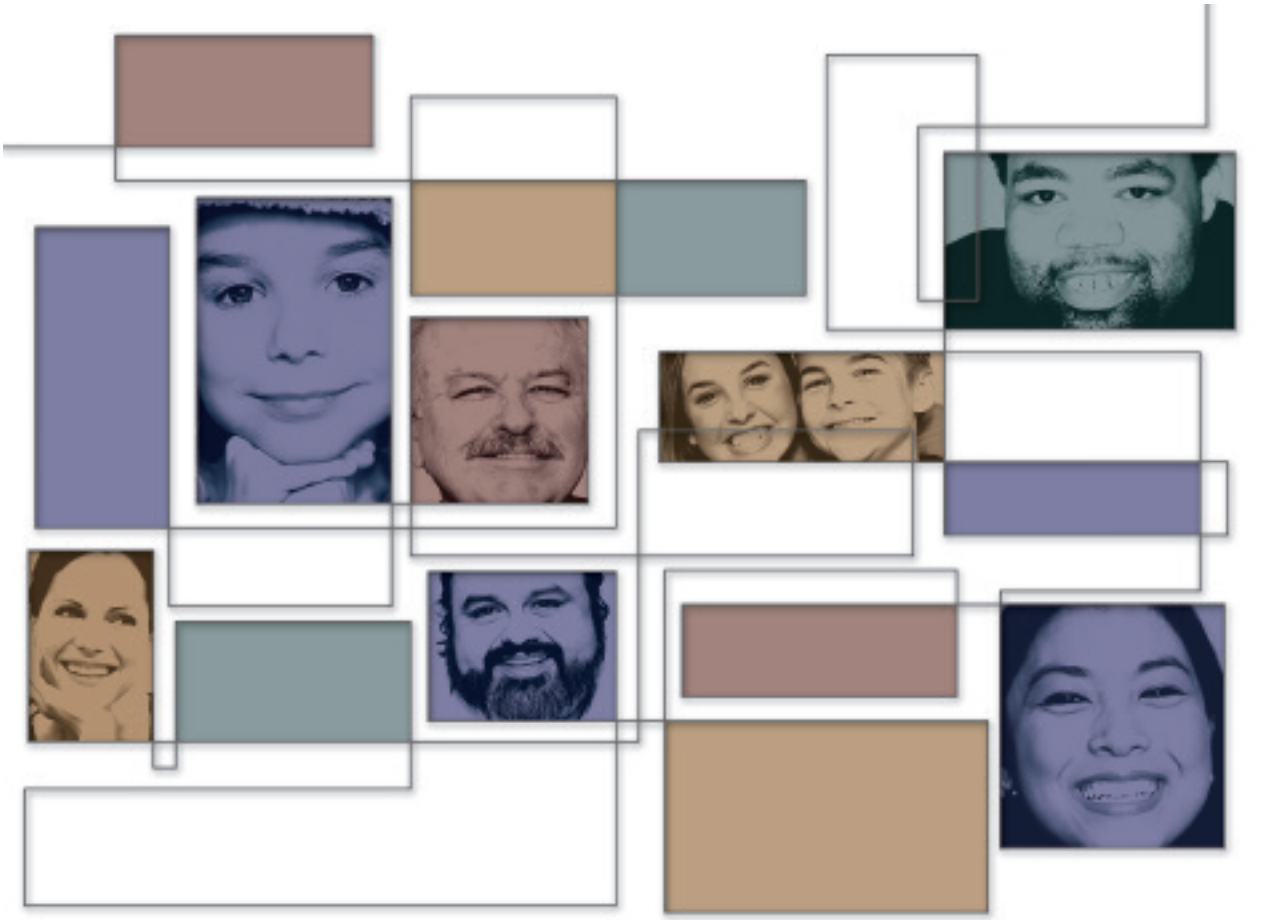
Addressing the issue of just how important research can be to make life better, Dr. Steve. E. Hrudey, Program Leader with the Canadian Water Network, gave a presentation on safe drinking water in Canada. Dr. Hrudey, whose book *Safe Drinking Water – Lessons from Recent Outbreaks in Affluent Nations* is in its second printing and is being sold in 25 countries, told a Parliament Hill breakfast meeting that water-contamination disasters like what happened at Walkerton, Ontario in 2000 are eminently preventable.

"We know how to treat and disinfect water to prevent disease from these pathogens," he told the gathering of MPs, senators, and NCE leaders. "We are developing new technologies to do so more efficiently and effectively."

While Canada has a long history of excellence in water research, scientists have been isolated in their own particular areas of expertise. According to Dr. Hrudey, the NCE program has provided a vehicle to bridge disciplines, harness excellence and bring research and knowledge into practice.

At the Ottawa meetings, network managers, communicators and scientific directors from across Canada exchanged ideas on everything from how to best affect policy change to best practices in knowledge transfer approaches. It included a presentation by John ApSimon, vice-chair of the board of directors for Vitesse Re-Skilling on models for advanced knowledge development.

Speaking on the "Power of Partnerships," Dr. Arthur J. Carty, National Science Advisor to the Prime Minister, predicted a future in which the NCE program becomes an even stronger integrating force for collaborations and partnerships across disciplines ranging from natural sciences and engineering to health sciences, social sciences and the humanities. "The result will be lasting economic, environmental, health and social benefits to Canadians for generations to come," said Dr. Carty.



BENEFITS

HOW MOBILIZING EXCELLENCE PAYS DIVIDENDS

"What the networks have done is enable some of the country's best researchers to work together on challenging problems that they would not have been able to undertake separately."

*– **Dr. Michael Smith**, Winner of the 1993 Nobel Prize in Chemistry and President of PENCE, quoted in 1994*

The NCE program is a uniquely Canadian creation that for 15 years has been playing a critical role in improving quality of life for Canadians. With its multidisciplinary and multisectoral approach, the NCE program is able to bring broad range of expertise to bear on solving complex problems. Its stable funding (the NCE is a permanent federal government program) allows investigators to engage in long-term planning and leverage additional resources from industry and government partners.

Managing outcomes

Every year, 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 multidisciplinary 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 NCE investment in the areas of social development, health, education and the economy. Benefits can come in the form of improved diagnostic techniques for osteoarthritis or a better understanding of why young people steal automobiles and how to prevent it from happening. Cleaner and safer drinking water, better preserved forests and improved care stroke patients are all linked to the research work that NCE-supported scientists are doing.

BENEFITS

BENEFITS FOR GOVERNMENT

The NCE program assists its federal and provincial government partners in developing astute public policy that is underpinned by excellent scientific research. The work being done by NCE researchers today will help policy makers make informed decisions tomorrow. For example, NCE-supported research into understanding and dealing with outbreaks of viral infection is helping governments prepare for the potential avian influenza pandemic.

BENEFITS

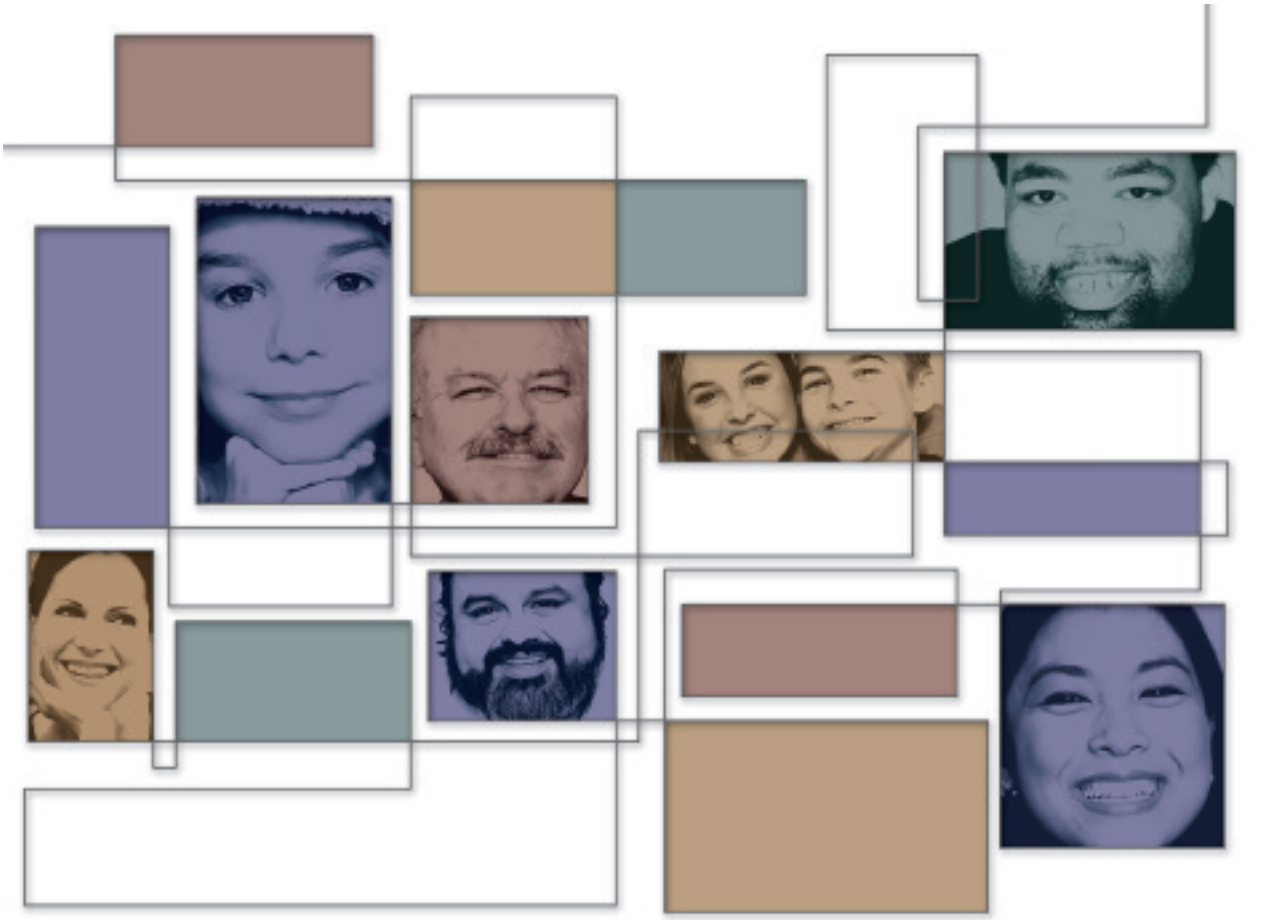
BENEFITS FOR INDUSTRY

Improving productivity is the key to survival in the 21st century global economy. With 830 private sector partnerships, the NCE is an active participant in helping Canadian industries improve production processes and develop new products lines. The pharmacological industry, for example, looks to the NCE researchers to help develop next-generation therapeutics, while the information technology industry relies on NCE work being done in geomatics, photonics, and intelligence systems.

BENEFITS

BENEFITS FOR RESEARCH

The networking model pioneered by the NCE program – and admired around the world – allows researchers to work co-operatively instead of competitively. It also encourages them to forge bonds and make connections beyond their own disciplines to solve complex problems. It fosters a cross-Canada cross-pollination of ideas and innovations.



THE NETWORKS

SUCCESS STORIES FROM ACROSS THE COUNTRY, ACROSS ALL DISCIPLINES

There were 21 NCEs across Canada in 2004-2005, working in fields as diverse as automobile engineering, photonics, genetics and mathematics. The networks' researchers were investigating everything from the social and economic impacts of the Arctic melt to fighting deadly diseases by developing better vaccines.

- Advanced Foods and Materials Network (AFMNet)
- Allergy, Genes and Environment Network (AllerGen)
- AquaNet (Network in Aquaculture)
- ArcticNet
- AUTO21 (The Automobile of the 21st Century)
- Canadian Arthritis Network (CAN)
- Canadian Bacterial Diseases Network (CBDN)
- 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 Stroke Network (CSN)
- Canadian Water Network (CWN)
- 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)
- Micronet (Microelectronic Devices, Circuits and Systems)
- Protein Engineering Network (PENCE Inc.)
- Stem Cell Network (SCN)
- Sustainable Forest Management Network (SFM)

THE NETWORKS

THE NETWORKS AT A GLANCE

SUMMARY OF THE 21 NETWORKS – 2004-05

NETWORKS	FUNDING PERIOD	NCE AWARD	NETWORK RESEARCHERS*	HQP**	UNIVERSITIES***	INDUSTRIES***	GOVERNMENT DEPARTMENTS/ AGENCIES AND OTHERS***	TOTAL ORGANIZATIONS
AFMNet	2003-2010	$ 3,422,000	65	51	25	14	17	**56**
AllerGen	2004-2011	$ 500,000	n/a	n/a	7	9	9	**25**
AquaNet	1999-2006	$ 3,600,000	98	165	33	41	47	**121**
ArcticNet	2003-2010	$ 3,965,000	67	118	45	16	75	**136**
AUTO21	2000-2008	$ 5,234,000	177	441	42	80	54	**176**
CAN	1998-2012	$ 3,130,000	56	832	28	59	68	**155**
CANVAC	1999-2006	$ 4,700,000	41	240	15	39	85	**139**
CBDN	1989-2005	$ 3,423,000	101	182	50	22	40	**112**
CGDN	1989-2007	$ 4,052,000	54	116	11	33	79	**123**
CIPI	1999-2012	$ 2,940,000	108	206	30	42	19	**91**
CLLRNet	2000-2008	$ 3,216,000	70	166	40	11	46	**97**
CSN	1999-2006	$ 4,700,000	80	394	25	22	48	**95**
CWN	2000-2008	$ 3,374,000	92	236	71	58	84	**213**
GEOIDE	1998-2012	$ 2,683,000	93	376	70	37	31	**138**
IRIS	1989-2006	$ 3,938,000	62	210	32	106	23	**161**
ISIS	1995-2009	$ 3,200,000	45	226	14	49	23	**86**
Micronet	1989-2005	$ 2,073,000	55	385	22	71	17	**110**
MITACS	1998-2012	$ 3,259,000	168	618	49	122	59	**230**
PENCE	1989-2005	$ 4,207,000	81	121	16	62	32	**110**
SCN	2000-2008	$ 4,784,000	59	229	28	21	38	**87**
SFM	1995-2009	$ 4,100,000	69	279	35	36	48	**119**
TOTALS:		**$74,500,000**	**1,641**	**5,591**	**688**	**950**	**942**	**2,580**

Health, Human Development and Biotechnology — *Natural Resources and Environment* — *Engineering and Manufacturing* — *Advanced Technologies*

* *Network researchers includes Canadians and foreigners*

* *two networks in first year of operation, yet to fund researchers*

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

*** *including Canadian and foreign organizations*

*** *Organizations are counted for each appearance, ie. If an organization participates in multiple networks, they will be counted more than once.*

THE NETWORKS

ADVANCED FOODS AND MATERIALS NETWORK (AFMNET)

Seeking a solution to a billion-dollar crop problem

An AFMNet team is developing technology to use peptides to boost plants' immunity

In just over a year, researchers have developed a method for making large number of peptides for use in everything from pharmaceutical to additives to prevent food spoilage.

Around the world, bacteria and fungi cause billions of dollars worth of crop losses every year, with more than 25% of plant food production lost to microbial diseases.

University of British Columbia researcher Dr. Robert Hancock and his Advanced Food and Materials Network (AFMNet) colleagues are tackling the global problem with peptides – protein fragments with powerful antimicrobial properties.

Essentially, it works like this: By taking genes – which express proteins – that occur naturally in a plant's defence system and supplementing them with the disease-fighting peptides, the plants can become more resistant to diseases that attack them.

Dr. Hancock's approach involves a new method of making large numbers of peptides with altered sequences of amino acids and screening the resulting "peptide arrays" for good antimicrobial activity. This is allowing highly effective, small peptide antibiotics to be made that could be used in everything from pharmaceuticals to additives that inhibit food spoilage.

"This process has allowed us to make an effective peptide that is only eight amino acids long," Dr. Hancock says, "which would mean it's the smallest peptide ever documented with considerable activity."

Dr. Hancock and his colleagues are making significant progress: After only one year in operation, they have developed two technologies and applied for patents for them. As well, Dr. Hancock's research is being published in the prestigious journal *Nature Biotechnology*.

"This is a lot of success to realize after just one year of collaboration," says Dr. Allan Paulson, Associate Scientific Director of AFMNet. "The team made quite a presentation at our annual meeting."

Dr. Hancock's project partner, Dr. Santosh Misra, a professor in the Department of Biochemistry and Microbiology from the University of Victoria, has been working on the plant side of the research, trying to help plants fight off disease.

Already, she has produced a peptide with the aid of a wound inducible expression system – a gene that is expressed by the occurrence of a wound – from poplar trees that will fight off Fusarium, a common fungal contaminant and a well-known plant pathogen that may cause various infections in humans.

While Drs. Hancock and Misra were both involved in the Canadian Bacterial Diseases Network (CBDN), which successfully completed its last year of eligible funding, it was the creation of AFMNet that made this project possible. In particular, Dr. Hancock would not have considered the possibility of using peptides as food additives.

"My research with CBDN has definitely helped us to rapidly develop this technology and patent application, but this project is entirely novel to AFMNet," says Dr. Hancock. "The network supported a productive collaboration with Santosh, as well as much-needed trainees."

The two industry partners on this project, SynGene Biotek Inc of Victoria, which Dr. Misra founded in 1996, and Inimex Pharmaceuticals, Inc, of Vancouver, which Dr. Hancock founded, provide a potential commercial outlet for the team's research.

Without the formation of AFMNet, the likelihood of industry partnerships would be slim, he says. Dr. Hancock also credits AFMNet funding for bringing postdoctoral fellow Dr. Kai Hilpert into his lab. Dr. Hilpert brought in the peptide array technology.

"We would not have started to try to make small, effective peptides without the funding from AFMNet and the NCE rationale – networking, development of intellectual property for building Canadian companies, and training of young researchers – and without the collaboration of Santosh's lab that provided a potential route to plant production of these peptides," says Dr. Hancock.

www.afmnet.ca

THE NETWORKS

ALLERGY, GENES AND ENVIRONMENT NETWORK (ALLERGEN)

Nothing to sneeze at

Three years of preparation went into creating AllerGen

New network sets to work investigating causes of – and therapies for – allergic/immune diseases that affect up to 40% of Canadians. It will also address the critical shortage of allergy experts across the country.

Given the range of expertise required, organizing the Allergy, Genes and Environment Network (AllerGen) was no easy task.

"For the past three years, we've had researchers meet from all across the country and from very different backgrounds," says Dr. Judah Denburg, AllerGen's CEO and Scientific Director. "Now, we have them all on the same page."

Dr. Denburg, Director of the Clinical Immunology and Allergy Faculty of Health Sciences at McMaster University, has brought together more than 100 researchers at 20 universities and research facilities, along with more than 70 national and international partners. He has recruited leaders in the fields of epidemiology, population health, immunology, biology, genetics, and social sciences to form AllerGen.

"We were networking from the starting gate," Dr. Denburg says.

As it begins its work, AllerGen has already formed partnerships with Environment Canada, the Canadian Institutes of Heath Research (CIHR) and its Institute of Human Development, Child and Youth Health, and the National Research Council.

Research projects are grouped in five broad-based themes that reflect the "from cell to society" approach the network is taking to better understand and deal with allergies and asthma:

- **Theme I** examines the interaction of early-life events and environmental exposures that may impart susceptibility to allergies. The potential outcome of this work is the development of allergy/asthma "gene chips."
- **Theme II** focuses on food, water and air quality and their effects on mothers and infants, families and special Canadian populations, including Aboriginal communities. This could lead to developing bio-analytic tests for airborne pollutants and allergens, and new hypo-allergenic food products.
- **Theme III** researchers will investigate biological mechanisms to aid the development of new diagnostic aids.
- **Theme IV** comprises unique therapeutic and drug discovery programs for new allergy, asthma and anaphylaxis medications for clinical use. This will be done in partnership with the biopharmaceutical and biotechnological industries.
- **Theme V** involves research to integrate knowledge of allergies, especially in schools and the workplace, towards the development of specific preventive and control measures, leading to significant public policy debate and change.

"The NCE has given us the glue to bond this network, bringing clinicians together with scientists to study not just whether a drug works, but how it works," says Dr. Denburg. "This will also lead to testing for new drugs in the future."

AllerGen also will stress education and training, setting aside funds to match monies available for strategic training initiatives through the CIHR. "We don't have enough trainees in clinical fields and the long waiting lists (of patients) show a critical shortage of allergists in the country," says Dr. Denburg.

Only five out of 16 medical schools in Canada have training programs for doctors to study allergies, while studies show up to 40% of Canadians are affected by allergies. Specific training programs are available in select cities nationwide, but there is a clear need to create a hub where centres can share innovative research and allergy information.

AllerGen is bringing the leaders of these specific programs together and offering additional trainees for specific programs for students studying allergies. By creating 100 new research trainee positions, AllerGen plans to double the number of highly qualified clinical specialists and research scientists currently in the field.

"Investing in training will allow us to involve more students and more researchers in future AllerGen projects," Dr. Denburg says.

Dr. Denburg is enthusiastic about collaborating with other specialists; his own research has led him to believe allergies and asthma affect the entire body and treatment, therefore, should involve a variety of experts with different approaches to understanding science.

"There is a tremendous amount of interest in allergies," he says. "This is seen in the large amount of networking already done by AllerGen and projects already underway by eager scientists who have yet to receive funding."

www.allergen-nce.ca

THE NETWORKS

AQUANET – NETWORK IN AQUACULTURE

Building a model for aquaculture success

Integrated approach incorporates range of data and viewpoints

Researchers are developing a support tool for decision makers that will allow them to better understand the collective effects of marine activity on an ecosystem.

While coastal aquaculture has great potential for the production of food and the generation of wealth, its success lies in the intricate interactions of people, resources and ecosystems.

Aquaculture is vulnerable to poor water quality and pollution from industrial, domestic and agricultural wastes. In turn, some early aquaculture successes have been tarnished by environmental and resource use issues, social problems, fish diseases, and marketing setbacks.

It comes as no surprise, then, that an integrated approach is required to incorporate all of these issues into decision making to promote sustainable development in coastal zone aquaculture.

To help achieve this, a team of natural and social scientists from across the country is measuring the effects of marine activities on an ecosystem. AquaNet Principal Investigator Dr. Dan Lane and Co-Investigator Wojtek Michalowski, both from the School of Management at the University of Ottawa, are working with Department of Fisheries and Oceans (DFO) scientists at the St. Andrews Biological Station in New Brunswick to develop a model that will act as a decision-support tool for aquaculture-related marine site evaluation and problem solving.

Using a computer-aided framework that can display the resources of marine areas on maps, the decision-support tool is designed for establishing marine recreational areas, locating new fish farms, resource habitat and fishing locations and assessing the coexistence of commercial and community uses of marine sites.

Part of the research deals with the strategic aspects of fish farming throughout Grand Manan Island in the Bay of Fundy. DFO researchers Drs. Rob Stephenson and Fred Page supplied marine resources information for the model such as the level of resources and their habitat, and the number, location and productivity of fish farms.

These data were translated into a geographical model by Drs. Lane and Michalowski to evaluate the ecosystem value of selected marine sites. The model shows how fish farms interact with other ecosystem components, indicates what the ecosystem might be like if marine activities (e.g., recreation, fishing or fish farms) were relocated, and evaluates the overall impact on the ecosystem.

The model can be used to evaluate the potential impacts of new fish farming operations along coastal regions by identifying marine sites that would be more economically profitable and less environmentally sensitive.

"You must first find out where the resources are and what potential ecosystem impacts alternative sites may have, and then match up the largest ecosystem and economic benefits with the lowest ecosystem and economic costs to uncover candidates for best sites," Dr. Lane explains.

The model uses data from multiple sources to identify the important ecosystem characteristics of local marine resources, marine habitat, natural and man-made effluents, and human commercial and recreational activities including aquaculture sites.

Of prime importance, it also incorporates the perspectives of all who participate in setting coastal marine policy, including inhabitants of the coastal communities, native peoples, fishing and aquaculture industries, provincial managers and federal scientists, as well as non-governmental environmental organizations.

"Fish farms bring employment and positive economic value to the industry and community, but for some constituents of the coastal zone they may also interfere with a non-interventionist viewpoint," Dr. Lane says.

Including all views in the decision-support model helps decision-makers in their negotiations. It allows them to more easily consider compromise positions, such as changing the location of a proposed farm site to avoid affecting a traditional recreation area.

According to Dr. Lane, this approach – using input from an interdisciplinary team of researchers to create a model that evaluates the cumulative effects of marine activity on an ecosystem – is novel. While the model provides a decision-support framework, the challenge continues to be obtaining and analyzing large amounts of data to better understand coastal marine systems.

"There are so many factors to take into account that we can't seek to optimize the solution entirely," says Dr. Lane. "Rather, we attempt to come up with new ideas and suggestions using the model that are based on the decision makers' own objectives and then let the decision makers choose the opportunities that fit them best."

This way of negotiated problem solving also ensures that each party takes what it needs from the model. As Dr. Lane explains, decisions depend on who is making them. Federal and provincial governments, along with commercial, environmental and community groups all have different perspectives. The best solutions lie in embracing all the different viewpoints and developing the most acceptable opportunities.

www.aquanet.ca

THE NETWORKS

ARCTICNET

Bridging the gap between Arctic researchers and residents

Scientists listen to Inuit explain how global warming is changing their lives

Where previous research has often stuck to the facts of climate change, ArcticNet is investigating the social, cultural and economic implications it has on the people it affects most directly.

Scientists have been researching Arctic climate change for years, but too frequently there has been a disconnection between the researchers studying global warming and the people whose lives are directly affected by it.

Dr. Barry Smit, a Professor of Geography and Canada Research Chair in Global Environmental Change at the University of Guelph, is determined to change that: "Humans have been left out of natural science research, but we must learn from their perspective, to see how sensitive they really are to changes in their environment."

Dr. Smit notes that while research has been conducted into the rate at which ice is melting in the Arctic, scientists have not considered how people fit into the equation. For the Inuit who hunt or fish on the ice, for example, the impact is profound. Historically, weather patterns have taught them that when an ice floe breaks off from an ice field, the wind likely will blow it back to fuse again. But now, with the climate changing, the floe is just as likely to be blown out to sea, requiring helicopters to rescue a stranded hunter.

"Climate is only part of the picture," Dr. Smit says. "It must be in context with everything else. The Inuit people are facing many economical changes with technology and their food supply that go hand-in-hand with climate."

So far, four Canadian students have travelled to Arctic communities to conduct focus groups, while Dr. Smit also employs two or three local citizens in each community to help bridge the gap between researchers and residents. Tristan Pearce and James Ford, two graduate students, say the work has made them aware of the challenges faced by the people they visit.

"What we are trying to do is learn from the community about what risks they feel are present and what they are doing to cope with these risks," says Mr. Pearce.

Working with the people in Ulukhaktok, Mr. Pearce found out about a number of concerns, including the unpredictability of weather and ice conditions, the rapidly changing seasons, the change in the Peary caribou migration, thinner and lower-quality seals, and changes in wind direction and ocean levels. Ice break-up is happening earlier and more rapidly, creating risks for spring travel and preventing hunters from using snowmobiles.

Some people have adapted to this change by using boats. However, those without boats are at a loss in poor ice conditions and are left without the access to traditional hunting grounds. Mr. Pearce says in this case, household economy, local geography and social conditions are all connected to how people deal with climate change and the impact it has on their lives.

Opportunities exist to address the social issues faced by many Inuit communities and strengthen their ability to cope with change. These opportunities include adopting policies to promote and preserve traditional Inuit knowledge and to improve the safety of hunting among youth.

While visiting Igloolik, Mr. Ford found the Inullariit Society, established in 1993, is working to preserve and promote culture, language, heritage, and traditional values. This society now offers "Land Camps" during which elders teach young Inuit hunting, survival, and safety skills. Because such knowledge forms the basis for Inuit cultural identity, spirituality, and values, its preservation and promotion is key to addressing concerns at the community level, according to Mr. Ford.

"We are not trying to force governments to drastically change the way people deal with climate change in the Arctic," says Mr. Ford. "But we are trying to facilitate change through collaboration."

Through discussions between researchers and members of these communities, the people become empowered to make decisions, with the option of lobbying for change. For example, Kik Shappa, one of the trained community members, was invited to the United Nations Conference on Climate Change to share his ArcticNet experiences and explain how his community is being affected.

ArcticNet brings together a broad range of skill sets to address the challenges of climate change from many perspectives, says Dr. Smit. "With a big research group, we are able to blend physical and social science, giving us the opportunity to address many issues and break new ground."

www.arcticnet.ulaval.ca

THE NETWORKS

AUTO21 – THE AUTOMOBILE OF THE 21ST CENTURY

Aluminum gets tough

Aluminum would be an outstanding material for engine blocks and their associated components. It is light, versatile, easy to work with, and cost effective. Now if only it did not fail at the high temperatures and pressures to be found under the hood.

That shortcoming has overshadowed the virtues of aluminum for most manufacturers. However, Dr. Jerry Sokolowski and his team are well on their way to solving this problem. As leader of the project *Advanced Light Metal Casting and Materials Development*, he is guiding research into a new generation of aluminum alloys that are ready to be used in the most hard-working engines.

"We have a process that has exhibited profound improvements in all as-cast structures, to a level that has never been seen in any sand-casting to date," he says. More specifically, the Nemak plant in Windsor was recently able to turn out aluminum engine blocks with 70 per cent less porosity than before, and a 40 per cent improvement in high cycle fatigue.

"It was very impressive," says Dr. Sokolowski, who notes that the result caught the attention of representatives from Volkswagen, one of the few manufacturers currently using aluminum in engines.

This success follows some intensive studies of alloys using varying amounts of copper and silicon, as well as different cooling rates for the castings. The centrepiece of this work has been a collection of alloys known as the 3xx.x series, which proved durable enough to be used in cylinder liners.

This considerable volume of analyses was made possible by Dr. Sokolowski's use of a compact, self-contained workstation designed and built on campus, turning out small batches of each alloy with maximum efficiency. "It allows us to melt, treat the melt, solidify the melt, and do the heat treatment – the complete cycle," he explains.

Through the AUTO21 Network of Centres of Excellence, this particular project is able to incorporate the efforts of researchers from the University of Windsor, McMaster University, and the CANMET Energy Technology Centre in Ottawa, a research branch of Natural Resources Canada. Sokolowski holds the NSERC/Ford-Nemak/University of Windsor Industrial Research Chair (IRC) in Light Casting Technology, enabling him to bring industrial partners such as Nemak to this work.

Nemak, based in Monterrey, Mexico, is one of the world's leading makers of cast aluminum components. The company, which provides cylinder heads and engine blocks to Ford plants across North America, has also established a major plant in Windsor.

www.auto21.ca

THE NETWORKS

CANADIAN ARTHRITIS NETWORK (CAN)

Easing a painful problem

Canadian-developed gel helps arthritic knees heal themselves

Injectable polymer stimulates the regeneration of new cartilage by forming "adhesive scaffolding" onto which the body's own cartilage rebuilds, which could avoid the need for total knee replacement surgery.

One in five Canadians will be diagnosed with arthritis in the next 20 years, adding to the more than 4 million who currently deal with the chronic disease.

Included in that 20% figure are those people with joint disorders – especially worn-out knees and hips – from damaged cartilage. Such disorders are second only to cardiovascular disease for the financial strain they put on the health care system.

Often, the only way to restore mobility and relieve pain is through joint replacement surgery. According to a 2004 *Medical Post* report, the number of total hip and knee replacements in Canada rose by almost 40% in seven years, with doctors performing more than 45,000 such operations annually.

Meanwhile, wait times have become daunting: In Ontario in 2005, patients waited an average of 33 weeks for knee replacement surgery and 24 weeks for hip replacements.

The surgery is costly, painful and often temporary. Many replacement joints have a lifespan of between one and two decades, after which they must be replaced.

It was this health care challenge that drove Dr. Michael Buschmann, of the Département de génie chimique at École Polytechnique de Montréal, to look for solutions.

Eight years ago, he joined a team of social and natural scientists to develop a treatment for damaged cartilage that might postpone the need for joint replacement surgery. Now, after an intensive research and development program and with support from the Canadian Arthritis Network (CAN), he estimates the technology he and a group of scientists and engineers have created – a gel that is injected into damaged knees to help them to rebuild new cartilage – is just two years away from going to market.

"With the high prevalence of arthritis in our society, and because the human body does not have the ability to repair or replace cartilage, this issue needed to be quickly addressed," says Dr. Buschmann. "In our early trials, patients have seen clinical benefit."

He stresses that these were humanitarian trials approved through Health Canada's Special Access Program, rather than official clinical trials. They involved 33 patients with varying degrees of joint degeneration. The researchers were encouraged by the results, and look forward to the upcoming pivotal third phase clinical trials.

The technology they've created is a polymer (a chain of repeating molecules) with a composition they call BST-CarGel®. It can stimulate the regeneration of new cartilage by forming "adhesive scaffolding" onto which the body's own cartilage builds, allowing bones in joints to glide smoothly over each other.

The intellectual property rights for BST-CarGel® have been transferred to BioSyntech, a Montreal-based company specializing in injectable biomaterials for tissue repair and therapeutic delivery. BioSyntech plans to commercialize this discovery and has received Health Canada approval to proceed with clinical trials.

"We believe that BST-CarGel®is a potential solution to this growing need to repair cartilage damage and, to that end, have initiated a controlled and randomized clinical trial with a strong scientific design," said Mr. Claude LeDuc, President and CEO of BioSyntech. "Our trial data will not only support Canadian and European approval, but may be instrumental in gaining regulatory approval in the United States."

Dr. Buschmann, who leads a 19-person team of researchers at École Polytechnique, says the development of the BST-CarGel® was greatly enhanced with help from the NCE program and would have been difficult to achieve without CAN.

In the BST-CarGel® program, Dr. Buschmann worked with physicists, chemists, biologists, an orthopedic veterinary surgeon, cartilage experts and bone biologists. He has also made useful connections with social scientists who provide perspective on methodology, outcome analysis, proper design of clinical scoring systems and information about reimbursement issues for patients.

"Being involved in CAN has given me the funding to explore new ideas, plus I have the ability to collaborate with people outside the range of science that I most often work with," says Dr. Buschmann.

www.arthritisnetwork.ca

THE NETWORKS

CANADIAN GENETIC DISEASES NETWORK (CGDN)

The Pill, for the 21st century

Made-in-Canada male contraceptive could change the world of birth control

A Canadian scientist doing research in obesity found that inhibiting a gene's protein expression rendered male mice infertile. The discovery could lead to a non-hormonal birth control pill – and underwrite research in genetic disease.

More than 40 years after the Pill forever changed how men and women relate to each other, the ever-increasing possibility of a male contraceptive – one discovered and developed in Canada – could have further life-altering impacts.

Along with shifting the responsibility for birth control from women to men, the new non-hormonal contraceptive under development through the support and encouragement of the Canadian Genetic Diseases Network (CGDN) could also fund additional research on genetic disease.

The CGDN, which helped secure a patent for the contraceptive's technology, has set up a Vancouver-based startup company, RecepTide Pharmaceuticals Inc., to develop the non-hormonal pill.

"The RecepTide shares are all owned by the Canadian Gene Cure Foundation," says Dr. Ron Woznow, the CEO of the CGDN, "so any successes from the company will go back to fund research on genetic diseases. This could be an excellent example of how the translation of a basic research discovery can lead to sustainability in research."

Polling data in the United States and Europe indicate that a non-hormonal male contraceptive alternative has wide appeal because of the concern of potential side effects associated with long-term use of hormonal birth control.

"Market studies have shown there is a definite interest," says. Dr. Woznow. "The market in developed countries is men and women in committed relationships who want an alternative to female, hormone-based contraception. In the developing countries, the issue is primarily one of population control. The World Health Organization is supporting local governments in addressing this issue."

The potential pill, the result of groundbreaking research by the CGDN's Dr. Grant Mitchell and his colleagues at l'Hôpital Sainte-Justine and McGill University, is about a year away from preclinical trials. The preclinical development is funded by CONRAD, a U.S.-based contraceptive research and development program.

As with many scientific discoveries, Dr. Mitchell's discovery was part serendipity. He was studying fat metabolism diseases that affect adolescents, focusing his research on one gene associated with obesity. Knocking out this gene in a mouse failed to induce the metabolic condition but it did render the mouse infertile.

Further work in Dr. Mitchell's lab and the Biotech Research Institute in Montreal led to the identification of small molecules that inhibit the protein expressed by the gene for fertility. Inhibition by a small molecule is important, says Dr. Woznow, because it means a drug could be administered orally instead of intravenously, making it much more economical to develop and, ultimately, a more marketable commodity.

The researchers have found about 350 molecules that block the protein and are now screening them to find one to three that are effective without being toxic.

"We have a good idea as to which ones will be non-toxic and have the effect we're looking for," says Dr. Woznow.

That screening process will take one year to 18 months, after which – if all goes well – preclinical trials will begin. At that point, RecepTide will look to industry partners and/or venture capital investment – something it has not sought so far.

"We decided that it was too early to look for a venture partner for the technology, but if we got some additional results, then we would pursue partnerships," says Dr. Woznow. "We're in ongoing discussions with major pharmaceutical companies that have an interest in this." Also, CONRAD could be a continuing partner. "They are potential partners to fund clinical trials of a non-hormonal mail contraceptive."

Beyond recycling any dividends that RecepTide may earn back into research funds for genetic diseases, Dr. Woznow sees an opportunity for developing a pan-Canadian fertility company.

"There is a tremendous amount of research being done on fertility in this country and it could provide a critical mass for a successful biotechnology company. For example, a research team at the University of Calgary, led by Dr. Derrick Rancourt, has identified novel ways to enhance in vitro fertilization. A pan-Canadian fertility company would be attractive to potential investors who are often reluctant to invest in a single technology or product."

www.cgdn.ca

THE NETWORKS

CANADIAN INSTITUTE FOR PHOTONIC INNOVTIONS (CIPI)

Seeing the world in a brilliant light

Travel allows fibre optics researcher to bring home new knowledge

A bright young doctoral student has studied with world's leading scientists in Australia, the United States and Mexico. The payoff? He has acquired a broad base of expertise for use in Canadian technology.

Yannick Keith Lizé specializes in the field of fibre optics, which operates at the core of communications technology and networks.

But it is another kind of network – the human kind – that has given him personal access to expertise far beyond the laboratory at École Polytechnique de Montréal where he is a doctoral student in the engineering physics.

Mr. Lizé has travelled to Australia, the United States and Mexico, advancing his knowledge in the photonics and fibre optics field as a result of travel grants from the Canadian Institute for Photonic Innovations (CIPI). As a CIPI student researcher, he has trained with many of the world's photonics giants.

In 2004, the CIPI awarded Mr. Lizé travel grants to visit the University of Sydney and the University of Melbourne in Australia to work with renowned photonics experts Drs. Ben Eggleton and Rod Tucker, studying silica nanowires and optical signals generation. Mr. Lizé says working with those Australian experts has given him a great deal of knowledge that he is putting to use in Canada.

This year, he received support from the CIPI to do research at Bell Laboratories in New Jersey, one of the most famous research laboratories in the world. There, under the supervision of optical network pioneer Dr. C. Randy Giles, he worked for four months on optical signal generation projects, investigating novel ways to encode data and reduce the cost of building or upgrading an optical network.

"Now I know experts in different universities across the world that I can contact to discuss new ideas or brainstorm about a specific problem. You can't know everything about everything in any field, especially science, and having access to world experts that will help you out is definitely an advantage. This network (CIPI) has definitely supported me in that way."

Mr. Lizé is currently supervised by Canadian photonics expert Dr. Raman Kashyap and previously collaborated with CIPI investigators Drs. Suzanne Lacroix and Nicolas Godbout. His PhD project involves polarization mode dispersion, a detrimental effect that happens to optical fibres when they transmit over long distances.

"Because this specific type of dispersion of light is not stable, it is difficult to tell how much dispersion will be there at the end of the transmission distance," he says. "For example, if fibres are placed beside train tracks, there can be a negative impact when the train runs by and we have to be able to understand and mitigate this impact." He has built an emulator that can reproduce this effect in the lab and has come up with different strategies to mitigate the dispersion.

Mr. Lizé's knowledge base, built with the CIPI's assistance, also has allowed him to present his research results at numerous conferences, nationally and internationally.

Honoured for his research by the International Society for Optical Engineering (SPIE), who awarded him the 2005 SPIE Educational Scholarship in Optical Science and Engineering, he is a two-time recipient of the student presenter award from the Canadian Association of Physicists and was also given a student travel grant by the Optical Society of America to present his work at its annual meeting. His ideas in signal generation, optical error correction and dispersion emulation have produced three patents, and he's hoping Canadian companies will be able to take advantage of his technology in the near future.

Mr. Lizé is also a founding member of the CIPI student network, serving as its president for the past two years and getting involved in the CIPI workshops and summer schools. He applies what he has learned through his international, multiple-supervisor fellowships when he interacts with other students at CIPI events.

"Networking with other student researchers is a key aspect of the student networks. We are all the leaders of tomorrow in this field. We have lots in common and many things to learn from each other."

At the summer schools, Mr. Lizé says students meet with other students, university professors and industry experts to participate in highly focused discussions on innovative research and the latest trends in photonics. Normally, a stewardship or fellowship enables students to train with one supervisor. However with the NCE program, students can learn from many supervisors, with a variety of expertise and in different lab settings.

www.cipi.ulaval.ca

THE NETWORKS

CANADIAN LANGUAGE AND LITERACY RESEARCH NETWORK

Reading all about it

Parents now can get evidence-based answers to literacy questions

Partnership with national children's charity provides forum for transferring research results to wide, mainstream audience via web site.

Are educational computer games good for young children?

How do nursery rhymes help children develop language skills?

How is reading to my child beneficial to his language development?

These are questions parents often raise during their children's early years, but straightforward, easy-to-understand answers have not always been easy to come by. While plenty of anecdotal information is available, especially via the Internet, concerned parents have had a tougher time finding evidence-based, up-to-date answers to important questions about their child's language and reading abilities.

Now, with the help of the Canadian Language and Literacy Research Network sound scientific answers about language and literacy development are increasingly available to the public.

Partnering with Invest in Kids, a national charitable organization dedicated to the development of parenting skills, the network is transferring the results of its research to a wider, more mainstream audience.

"We're taking questions posed by parents or professionals about language and literacy and getting the answers from the experts," says Dr. Randy Lynn Newman, a postdoctoral fellow who works with Dr. Marc Joanisse in the Language, Reading and Cognitive Neuroscience lab at the University of Western Ontario. Dr. Newman worked as the liaison between network researchers and Invest in Kids.

The partnership is one of many the network is developing to share language and literacy research with practitioners and parents.

"This joint arrangement between Invest in Kids and the network is a great example of partnership in action," says Scott Wells, Manager of Fund Development for the network. "The willingness to combine our resources in pursuit of common goals will further strengthen language and literacy development and early learning for children in Canada."

Invest in Kids was founded in 1993 and launched its web site in late 2002. Answers to challenging questions concerning the social, emotional and intellectual development of young children are available at the **www.investinkids.ca** site.

Dr. Liane Comeau, Manager of Research and Programs at Invest in Kids, sees the relationship with the network as a trade-pleases-all reciprocal agreement: the network needed a channel to reach the general public with its research, and Invest in Kids was looking for research-based content focused on children's language development.

"Language and literacy is a very integral part of cognitive development," says Dr. Comeau. "It was important for us to go after some quality content to be able to give parents very current and credible information."

While many organizations provide information on children's physical growth and health on the web and some tackle aspects of children's psychological development, Invest in Kids is a comprehensive source on all aspects of development. It gives parents practical information in an easy-to-understand style on various subject areas including cognitive, social, emotional, and physical development.

"This is a unique organization in that it deals with children's pre-literacy skills and many other pre-school issues," says Dr. Newman.

For example, many parents believe the process of learning to read starts when their child begins school. But Dr. Newman says the skills that children will need to prepare for reading begin to develop at birth. Throughout their first five years, children learn to understand the flow of language, its syntax, reading from left to right, and more.

Invest in Kids seems to be catching on. As one reader puts it, "I love this site. I have found information on many issues I am currently faced with and know that this will be my first source for information in the future."

While there are currently just a few network-generated answers posted on the web site, Dr. Newman says many more are in the works. Meanwhile, to answer the initial question:

- Research shows that educational computer games can help children learn certain skills;
- Reciting nursery rhymes teaches children the rhythm of speech and intonation as well as the grammatical structure of language; and
- The latest science shows that reading to young children helps them to build a large vocabulary and a range of language skills such as good listening and comprehension.

www.cllrnet.ca

THE NETWORKS

CANVAC – CANADIAN NETWORK FOR VACCINES AND IMMUNOTHERAPEUTICS

Facing the reality of a pandemic threat

CANVAC's multi-disciplinary research into attitudes on immunization proves extremely timely

The looming threat of an avian influenza pandemic has produced a crisis-to-opportunity scenario in which the urgent need for new and better vaccines can be addressed on a global basis.

People make a fundamental leap of faith in medical science when it comes to vaccines, says Dr. Paul Ritvo, a principal investigator with the Canadian Network for Vaccines and Immunotherapeutics (CANVAC).

"When you are vaccinated, you must trust the vaccine will be beneficial and that the detriments, if any, will be minor," says Dr. Ritvo, a leading expert on public attitudes towards vaccines. "It is no small event. No one can sustain the illusion that something that will make you immune for most of your remaining days is not a powerful intervention to your immune system."

Dr. Ritvo, a researcher at Toronto's University Health Network and York University, is the lead author of the April, 2005 *Nature Medicine* paper on the challenge of making the best use of vaccine technology.

It was Dr. Ritvo's background in psychology and the CANVAC team's expertise across several fields – including health policy, anthropology, internal medicine, bioethics and epidemiology – that made the project possible. They were approached by the high-impact, prestigious journal because of the prodigious research CANVAC had done on how the public views vaccination.

"Because of CANVAC, we were able collect a unique group of researchers who all were interested in vaccines and able to contribute different expertise and perspectives. We pulled together a unique, composite of views. It is very rare for that to happen."

It is also very timely for that to happen.

Given the current threat of an avian influenza pandemic, peoples' faith in medical science and the power of vaccines to save lives are becoming critical issues. Dr. Ritvo says an avian influenza pandemic is obviously a much worse health threat than the SARS outbreak of 2003 that caused 44 deaths and "virtually paralyzed" Toronto. But given that harsh reality, there is also a chance for positive change.

"It is unfortunate that the opportunity only comes amid crisis. But because of the avian flu, there is now a great opportunity to do something very meaningful for international health."

The challenge, as CANVAC researchers point out, is a considerable one.

"Currently, only 2% of the world's pharmaceutical activity involves vaccines," says Dr. Ritvo. "A huge amount of money and activity is directed towards pharmaceutical agents, which will save a lesser number of lives than effective vaccines. We must direct more capital and labour towards vaccine development."

Unfortunately, the economics of the pharmaceutical industry work against this. There is more money to be made in creating and marketing drugs that are taken consistently, over long periods of time, than in researching, creating and delivering vaccines, many of which require few doses to be effective. What's needed, says Dr. Ritvo and others such as Dr. Jeffrey Sachs (Director of the Earth Institute at Columbia University) and Dr. Michael Kremer (Gates Professor of Developing Societies at Harvard) is a fundamental shift in how governments relate to the big pharmaceutical corporations.

"Essentially, it means creating new structures," says Dr. Ritvo, "a new hybrid of co-operative capitalism. For example, when you create a vaccine purchase fund, you have governments investing tax revenue into a fund that will ensure proper profit for companies producing effective, lifesaving vaccines useful all over the globe"

While creating new structures is a slow and difficult process, the very real concern over avian influenza – the World Health Organization has said it is not a matter of "if" the pandemic will strike but "when" it arrives – likely will speed needed changes.

"It used to be perceived that these infectious influenzas would take several months to move from one side of the world to the next, somewhat correlated with naval shipping time periods and frequencies," says Dr. Ritvo. "But with air travel, that three to six months has been revised to 12 hours. That is the standard on which we are now operating. However long it takes one person to go from one part of the globe to the other, that's how long it could take for an infection to spread. We're a global village and we haven't caught up to the vulnerability of being a village. The pandemic threat is a way of conceptualizing this."

The *Nature Medicine* paper points out the need for greater global cooperation, calling for more resources to be applied to developing HIV and malaria vaccines to reduce mortality in sub-Saharan Africa. We can't afford the luxury of thinking that something happening thousands of miles away does not concern us, says Dr. Ritvo.

"The vaccine issue is a wonderful example of the crisis-to-opportunity transition. We're in crisis for good reasons, partly because some technologies jumped out in front of other technologies. The fluidity of international travel is way out in front of our capacity to scan for and prevent outbreaks of disease. That's unfortunate. But it's not going to go away by taking an ostrich approach. We have to take on the vaccine challenge."

www.canvac.ca

THE NETWORKS

CANADIAN STROKE NETWORK (CSN)

Taking the pressure off seniors

Multi-city initiative helps prevent stroke, save lives and avoid costly care

A project to regularly measure seniors' blood pressure – done in partnership with local pharmacies – is filling a gap in the health-care system. Early successes have led to CSN-sponsored follow-up programs in Ontario and Alberta.

Sometimes an idea makes so much good sense, you wonder why no one thought of it before.

Such is the case with the Cardiovascular Health Awareness Program (CHAP), the brainchild of Dr. Larry W. Chambers, President of the Élisabeth Bruyère Research Institute, a University of Ottawa and SCO Health Service partnership, and Dr. Janusz Kaczorowski, Research Director in the Department of Family Medicine at McMaster University in Hamilton.

Several years ago, the two researchers saw a disturbing gap in Canadian health care: One in three people over the age of 65 have high blood pressure, a precursor of stroke and heart disease. Few, however, seek help because they are unaware or are unwilling to go to their doctors' office just to have their blood pressure checked.

As a result, high blood pressure – which is largely treatable with diet, lifestyle changes, and inexpensive medication – frequently goes unchecked until it escalates to a life-threatening problem requiring intensive and expensive care.

Drs. Chambers and Kaczorowski wanted to find a way of reaching this at-risk population. The light-bulb moment came in at a local pharmacy, looking at the pharmacy's blood pressure machine.

"When we talked to the pharmacists, they told us they had the machines in the corner and that, yes, people used them. We asked if the people came to the counter after they'd taken their blood pressure. They said: 'We don't have time for that; it's a popular device and it brings people into the store. And that's it, full stop.'"

Where others might have seen a barrier, they saw an opportunity. The average Ontario senior has 24 prescriptions filled a year. That's two trips a month to the drug store. Many pharmacies already have Seniors Days, so why not build on the concept and put blood-pressure clinics right in the pharmacies?

They took the idea even further. What if family physicians were enlisted to encourage their senior patients to take part in the pharmacy sessions, where trained volunteers would assist them in taking their blood pressure readings? The results would then be relayed back to the doctors and the circle would be complete: at-risk patients would have their blood pressure checked routinely and their doctors would be alerted if they showed signs treatment was required.

What began as discussions with public health practitioners five years ago blossomed into trials in five Ontario cities, including a large-scale demonstration project in Brockville and Grimsby in 2003. Funding had to be applied for and co-ordinators hired. Drs. Chambers and Kaczorowski and their research team had to acquire marketing skills to successfully recruit and retain volunteers and to mobilize communities. They had to find local leaders in the community to support program and encourage others to join in.

"It has to be a community-driven exercise," says Dr. Chambers.

The Grimsby and Brockville results were encouraging. The seniors felt comfortable in the pharmacy sessions, which became something of a social event for them. There were fewer signs of "white-coat effect" in which a patient's blood pressure reading is artificially high because of anxiety of being in a clinic. Also, the readings were more accurate because the project used state-of-the-art Canadian-made machines. The results were relayed back to the family doctors with patients with the highest readings flagged for each physician.

And the pharmacists were glad to be partners in the project. "We held the sessions Friday mornings at the store," says John Taylor, pharmacist at a Brockville Pharmasave. "It was good for the store, good for the patients, and good for the doctors. It's a win-win."

A new CSN-sponsored project is now underway in 21 Ontario communities. As with the Brockville and Grimsby pilot project, doctors and volunteers and pharmacies are being brought on board. As well, 21 communities that are not part of the project will be used to provide a comprehensive comparison of the program on health and health care.

The program also is expanding into Western Canada. Dr. Charlotte Jones, associate professor of medicine at the University of Calgary, is leading a CHAP pilot project in Airdrie, Alberta.

"The CSN suggested that we see if it was feasible to do in communities outside of Ontario," says Dr. Chambers.

www.canadianstrokenetwork.ca

THE NETWORKS

CANADIAN WATER NETWORK (CWN)

Drugs in our water

EU teams up with CWN researchers to study risks

European and Canadian researchers hope to arm their respective regulators with the knowledge they need to assess the risks posed by pharmaceuticals in our water.

Just how serious are the environmental and health risks posed by the growing volume and variety of anti-depressants, antibiotics and other pharmaceuticals showing up in our water supplies?

"That's the $60- million question now isn't it?" says Dr. Chris Metcalfe, a Canadian Water Network (CWN) researcher at Trent University in Peterborough, Ontario.

Dr. Metcalfe is working with a dozen university and government researchers from across Canada on three-year project led by the European Union. The Environmental Risk Assessment of Pharmaceuticals (ERAPharm) project combines the expertise of 14 partners from seven European countries. Canada – through the CWN – is the only non-European country participating.

Dr. Metcalfe says that having a national organization like the CWN makes it easier for Canadian researchers to participate in international studies. "For me to put together a research consortium doesn't have as much cachet as working through the CWN," explains Dr. Metcalfe. "The CWN provides credibility and a mechanism by which we can focus our research activities under a national umbrella."

Dr. Thomas Knacker, ERAPharm's co-ordinator in Florsheim, Germany says having a national Centre of Excellence "ensures that interaction is possible with a large number of Canadian colleagues."

It also gives Canadian researchers – and ultimately Canadian regulators – an opportunity to learn from European countries, which have more experience studying pharmaceuticals in water.

"Pharmaceuticals in the environment are an issue for all so-called developed countries. Since resources for research are limited, it makes sense to co-ordinate these activities across continents," says Dr. Knacker. "This approach is also important for globally active industries which would benefit from harmonized environmental risk assessment schemes."

The ERAPharm study involves Germany, France, Denmark, the United Kingdom, Switzerland, the Netherlands, Spain and Canada. It aims to improve the scientific basis and the methods for evaluating potential risks that human and veterinary pharmaceuticals pose to the environment. It will also recommend how EU regulators can better assess the risks that pharmaceuticals pose to the health of fish, wildlife and humans.

The results will be relevant to Canada as the federal government is considering approaches to regulate and assess pharmaceutical compounds. Provincial agencies also would benefit from a risk assessment process customized for pharmaceuticals.

Tests in Canada and other countries have confirmed that lakes, streams and even drinking water contain trace amounts of medications that pass through our own personal plumbing and into the sewer system. Once treated, this sewage sludge is commonly used as fertilizer on farmland. Further contributing to this bioactive stew are livestock injected with antibiotics and fertility hormones.

"We know these compounds are making their way out of sewage treatment plants and large-scale agricultural operations," says Dr. Metcalfe, who teaches environmental and resource studies at Trent. "They're getting into surface water and they're getting into drinking water in some cases. What we're missing is that risk assessment part – trying to figure out, do these compounds at low concentrations have the potential to have an impact on the environment or to human health?"

The dangers, if any, are not clear. The levels in water are small – a few parts per billion or trillion of the active ingredients found in anti-depressants, birth control pills, beta blockers, antibiotics and other commonly used medicines. But the long-term effects are unknown.

The Canadian research team is contributing to two studies. In one, researchers from Environment Canada, the University of Ottawa, University of Waterloo, University of Guelph, and Trent University are examining the effects of Prozac on fish. In the other project, Dr. Metcalfe and researchers from Agriculture and Agri-Food Canada and the University of York in the United Kingdom are studying the run-off of pharmaceuticals from sewage sludge applied to agricultural fields.

Dr. Alistair Boxall, who specializes in eco-chemistry at York University, says Canada brings valued scientific skills to the project, specifically analyses of pharmaceuticals in environmental matrices, experience in running large multidisciplinary field studies, and ecotoxicological expertise.

"By pooling resources and expertise we are able to deliver a lot more than if we both did things separately," says Dr. Boxall. "I hope this current collaboration will lead to longer term relationships in the future."

By the end of the ERAPharm project, researchers will have more detailed data on four compounds: Ivermectin (an anti-parasite compound used in farm animals); Atenolol (a beta blocker used to treat heart arrhythmias in humans); Ciprofloxacin (an antibiotic) and Fluoxetine (the active ingredient in Prozac).

"The EU is a world leader in developing specific guidelines for risk assessments on pharmaceuticals," says Dr. Metcalfe. "Canada is only beginning to come to grips with this whole issue, so there's a lot we can learn by partnering with the Europeans in this area."

www.cwn-rce.ca

THE NETWORKS

GEOIDE – GEOMATICS FOR INFORMED DECISIONS

Total situation awareness

GEOIDE-assisted company is poised to capture defence contracts

Just as a troop of soldiers needs precise information about the winding streets and towering structures it will patrol, a start-up company needs to know how to navigate its way through the streets of the marketplace.

Dr. Philippe Simard, president of the Montreal start-up firm SimActive Inc., knows very well the difference between having a great idea and having a great product. Fortunately for him, he has both.

"When you are a researcher you tend to think that because it's the first time something has been done or because what you're working on is cool, people will be willing to buy it," says the 29-year-old geomatics entrepreneur. "But people only buy something if it means they are going to save time or money or if it's going to allow them to do something that they couldn't do before."

Therein lies the difference between pure research and harsh reality: "You can't afford to spend years developing something if you're not sure who will buy it," says Dr. Simard.

SimActive, which Dr. Simard founded in 2003 with his brother Louis, recently signed a $1-million, 18-month agreement with Defence Research and Development Canada at Valcartier, Quebec to further develop software to give troops operating in sometimes hostile urban environments total "situation awareness" – precise knowledge and complete clarity about the state of the world in which they will be working.

"Situation awareness is the buzzword," says Dr. Simard. "If you want to be efficient on a mission, you want your troops to have the exact knowledge of the state of the world, of what's out there, what's happening and what's happened since the last time they were there."

It's a fitting metaphor for the help GEOIDE has provided SimActive in establishing itself as an up-and-coming geomatics contender. Through the network's help the company has total situation awareness about what it takes to survive and succeed.

A former network researcher when he completed his PhD at McGill University, Dr. Simard credits GEOIDE with helping him get his highly specialized business off the ground.

"GEOIDE provided funding for me to do research at McGill on one of the projects I was working on. I told them I wanted to start a company and they had a program called the Market Development Fund. They helped us, through this fund, to prepare the business plan and secure the intellectual property that we had developed by filing a patent. The Market Development Fund is really good because it's hard at the early stage, at the start-up of a company, to get seed money to get this done."

GEOIDE helped Dr. Simard maintain ownership and control of the company. He says that wealthy investors willing to take risks on new and unproven technologies often will come in and "for $20,000 or $40,000 basically take half of your company." The GEOIDE Market Development Fund "gives you the money to pass beyond that point," says Dr. Simard.

It also put him into contact with the right people for his software product. "GEOIDE is all about being a huge Canadian network of companies, so they helped us approach members of the network. This facilitated contact with potential customers or partners."

The defence sector is very promising but it has a long sales cycle. "We're trying to generate revenues in the short term and GEOIDE is helping us approach companies," adds Dr. Simard.

The work SimActive is doing with the military will position them to sell software licences throughout the defence sector and to Canadian allies and partners. And it will enable SimActive to develop non-military applications for civil authorities and corporations.

SimActive might well be up and running without GEOIDE's help. But it would have been a much tougher road to travel. "It's hard to measure the power of the network," says Dr. Simard. "It's really there. It would have been really difficult without GEOIDE. It helped with our defence work – they knew GEOIDE would help us and that gave us credibility."

Dr. Simard expects his company to grow to a staff of 10 to 15 over the next two to three years and then "if we do hit the defence market as we are hoping to, selling hundreds and hundreds of licences to that market will allow us to grow exponentially from there."

SimActive is expected to sign a substantial contract with a very well-known world class organization, says said Pierre Nelis, former chief operating officer at Softimage who is advising Philippe and Louis Simard get their company further established. "This will be the trigger, the stepping stone. From there they will be dealing with the top 500 companies in the world. That will be their playing field, international, world-class top 500 companies."

www.geoide.ulaval.ca

THE NETWORKS

ISIS CANADA – INTELLIGENT SENSING FOR INNOVATIVE STRUCTURES

A paradigm shift in building bridges

Five countries endorse Canadian-led design concept

Achieving consensus on the Winnipeg Principles indicates a paradigm shift in how new bridges could be designed and built and how old ones might be repaired or rehabilitated.

Forty-two internationally renowned bridge designers met at the International Workshop on Innovative Bridge Deck Technologies in Winnipeg in April to reach a consensus on the future design of bridge decks.

The result: the ISIS Canada Winnipeg Principles – endorsed by representatives from Canada, the United States, Japan, Switzerland and India – will go into the Canadian Highway Bridge Design Code, for use by civil engineers.

The agreement is nothing short of a paradigm shift for how new bridges could be designed and built, and for how old ones might be restored and rehabilitated. It represents almost a decade of work by ISIS Canada – the Network of Centres of Excellence on Intelligent Sensing for Innovative Structures.

The ISIS mandate is to advance Canadian civil engineering to a world leadership position through the development and application of fibre reinforced polymers (FRPs) and integrated intelligent fibre optic sensing (FOS) technologies.

"ISIS has been working on bridge deck design principles collectively for nine years," says Dr. Aftab Mufti, the Scientific Director of ISIS, explaining the lead-up to Winnipeg. "Four project leaders and approximately 30 researchers and staff all came to the same conclusion for change. The next progression was to present them to the international group."

For more than 75 years, steel has been used inside the concrete to support the weight of heavy cars and trucks. The problem is, steel is heavy, expensive and it corrodes over time, especially with exposure to the extreme climate conditions in Canada.

Dr. Aftab Mufti, Scientific Director of the ISIS Canada, a Network of Centres of Excellence, and other international researchers have found that the arching action of bridge decks, similar to Roman Arches, provides sufficient strength without steel reinforcement to bear the load.

"Over time, designing bridge decks based on arching action will significantly save on material costs estimated in the billions because steel will not be required for strength, and corrosion of steel will be eliminated," says Dr. Mufti.

The Winnipeg Principles also give the option of reinforcing the concrete slabs with FRPs, which are extra strong, last longer and require less maintenance than traditional construction materials. They are also more durable than steel.

The Canadian Standards Association, through the Technical Standard Committees, has issued an addendum to the code that includes the Winnipeg Principles, with final approval anticipated later this year.

The Canadian Highway Bridge Design Code is the only code in the world that permits the use of FRPs for strengthening and reinforcement on both new and rehabilitated bridges and structures made of concrete or wood. Incorporating the principles into the code will not only have an impact on the design of civil structures in Canada, but it will also influence the updating of similar codes worldwide.

Introducing these design principles into the code is just the first of several changes that will be championed by ISIS to promote innovations in bridge design and construction, says Dr. Mufti.

ISIS Canada has further broadened the scope for innovative bridge design concepts through structural health monitoring, using the "Civionics" concept that combines electronics with civil engineering.

"It has been shown in both the lab and the field that these technologies work," says Dr. Mufti.

The Winnipeg Principles

The new principles are as follows:

a. That inherent arching action is present in concrete bridge deck slabs in the transverse direction, and that in consequence, relevant deck slabs, such as those in composite slab on girder bridges, should preferably be designed in accordance with such arching action, whereby the top reinforcement is no longer required for strength and the arching action is achieved by one of:

i. internal bottom reinforcement in the concrete, which may be steel or FRP, and which should be designed by stiffness consideration and for concrete crack control; or

ii. stay in place formwork, which may be of steel, concrete or FRP, which is designed by stiffness considerations and by proper connections to the girders

iii. external straps, designed by stiffness considerations and by proper connections to the girders, along with a limited amount of steel or FRP reinforcement placed as a bottom grid for concrete crack control.

iv. suitably placed diaphragms between girders provided they are properly connected.

b. It has been demonstrated that inherent arching action is of benefit when designing for fatigue, and it is therefore recommended that, with the help of research on full-scale models and/or prototypes, one or more methods should be developed for designing deck slabs for fatigue.

c. That new provisions should be adopted into codes of practice to reflect the enhanced state of design knowledge relating to the use of FRP in concrete deck slabs.

www.isiscanada.com

THE NETWORKS

MITACS – MATHEMATICS OF INFORMATION TECHNOLOGY AND COMPLEX SYSTEMS

Making the search for oil a more exact art

Project brings together mathematicians and geologists

Improving the quality of seismic images could take the risk out of drilling for oil reserves and reduce exploration costs that are picked up by consumers.

Traditional methods for locating oil underground do not produce the kind of high-quality images that oil companies require to make important decisions about where to drill.

And if a company drills and comes up dry, the lost exploration costs ultimately are passed on to consumers.

With oil prices climbing, anything that can help lower production costs is welcome. The Mathematics of Information Technology and Complex Systems Network (MITACS) has taken up the challenge by bringing together experts from entirely different fields.

Two University of Calgary professors – Dr. Gary Margrave, of the Department of Geology and Geophysics, and Dr. Michael Lamoureux, from the Department of Mathematics and Statistics – are leading a MITACS project to build improved seismic imaging algorithms to better illustrate the Earth's subsurface.

This unique collaboration is allowing researchers in mathematics and geology to combine their knowledge. Along with the work being done at the University of Calgary, MITACS has linked geophysicists from the University of Alberta and the University of British Columbia with mathematicians from York University in Toronto and l'Université de Montréal. The project also involves American researchers from the University of Washington and the University of Texas at Austin.

Ultimately, their work will make the search for oil a more exact art.

Before MITACS, these researchers might never have come together to pool their talents to solve such an important resource industry problem. "The NCE program is unique in how you can access teams of researchers," says Dr. Lamoureux. "It is also exclusive in how it supports international collaboration."

Methods exist to produce seismic images, but they need improvement. Seismic images are created from vibrations (seismic waves) that are bounced off objects, processed through a computer program and transformed into a picture of the subsurface. When inputting the wave data in the computer, many obstacles obscure the ability to see the target – in this case, oil.

Drs. Margrave and Lamoureux have applied novel mathematics to computer imaging programs to enable better interpretation of the waves to illustrate what lies underground. Having already achieved some success – the team has made a presentation to the Canadian Society of Exploration Geophysicists – the researchers are continuing to apply mathematics to improve the quality of the images created. "It is only with more complex mathematical calculations that this problem will get closer to being solved," says Dr. Margrave.

The project involves many industry partners including BP Canada, the Consortium for Research in Elastic Wave Exploration Seismology, GEDCO, Geo-X System Ltd., Lockheed Martin Canada, Imperial Oil Resources, Sensor Geophysical Ltd., and Veritas DGC Inc.

Early this year Dr. Lamoureux and York University researcher Dr. Peter Gibson took part in a conference in Vienna, where they met with Austrian seismic researchers. In turn, the Austrians arranged to visit Canada. Last year, three researchers from the MITACS project went to Singapore to meet with colleagues there.

"When we travel to other countries, we swap knowledge – we listen and learn what they know, and teach them what we know," says Dr. Lamoureux. "The NCE program is the only supporter of these kinds of collaborations. It allows for several researchers on a project to meet with other international researchers, and then it continues to support the collaborations by funding networking opportunities like workshops and summer schools."

Dr. Lamoureux also praises MITACS for supporting the addition of more students in research projects, which he says has greatly benefited their research.

"With a network like MITACS, we have the human resources to do much more research." he says. "We can undertake more things like patent applications and produce software for use in industry. Also, our level of activity and the number of products we are developing has gone up a great amount."

www.mitacs.ca

THE NETWORKS

STEM CELL NETWORK (SCN)

Bringing basic research and biotech closer together

Stem cell science moves further, faster with industry help

Being innovative is one thing. Bringing innovation out of the laboratory and into the marketplace to solve problems is another. That takes partners.

As a member of the Networks of Centres of Excellence, the Stem Cell Network (SCN) exists to transform innovative research into economic benefit. While advancing knowledge is vitally important, transforming those academic advances into real-world applications often requires outside help.

In 2004-2005, SCN was very successful in building partnerships between researchers and industry.

"The SCN was a catalyst for me to start thinking about partnerships," says Dr. Timothy Kieffer, an SCN investigator and associate professor at the University of British Columbia who has shown that stem cells in the gut have the potential to become the pancreatic, insulin-producing beta cells that diabetics lack.

Dr. Kieffer recently received an SCN catalyst grant to do more research on gut cells. His SCN money will be matched dollar for dollar by Lifescan, Inc. of Milpitas, CA., a subsidiary of Johnson & Johnson. It will allow him to go further, faster in this important work.

"I've become increasingly aware that for a product to come out of academic research it is critical, if not mandatory, to develop a partnership," says Dr. Kieffer. "An academic institution is never going to have the resources to do clinical trials, which can cost millions and millions of dollars. At some point a product is going to have to pass from academia to the pharmaceutical industry. Having a potential partner already interested in that line of investigation is a promising step."

What's at stake is a potential therapy to relieve diabetics of having to inject insulin for their entire lives. That's why partnerships are so important, says Dr. Kieffer.

"We know diabetics are waiting patiently for us to come up with something better. The more resources we can bring to bear on the problem, the quicker we can get there. Having Lifescan involved in this effort means we've got someone interested who has a big knowledge base and a lot of resources to bring to bear on this problem and help us achieve our goal sooner."

Dr. Leo Behie, SCN investigator and professor at the University of Calgary, sees partnering with private industry as a way to save taxpayers huge amounts of money and ease the financial strain on Canadian health care.

"The idea that stem cells are going to lead to solutions for major diseases that have no cure – it's not hype. It's coming," says Dr. Behie. "Diseases like Parkinson's and Type 1 Diabetes, these cost our health-care system billions of dollars. So, the financial implications are enormous. Companies have to get involved because professors do not make good company people and good corporate decisions."

Dr. Behie is an early adapter of the partnership principle, having established business relationships between his lab and StemCell Technologies of Vancouver and Invitrogen Life Technologies. "I'm not in it for the money. I'm a professor and I have a Canada Research Chair in biomedical engineering, so my life is research. These are commercial companies, not philanthropic institutions, and the bottom line is they have to make money. We're helping them make money and, at the same time, do good in terms of addressing terrible diseases."

From the industry point of view, collaboration with SCN creates opportunities.

"It was at a Stem Cell Network annual general meeting where we found out about Dr. Behie's technology," says Eric Atkinson, Manager of Marketing and Corporate Development for StemCell Technologies. "There is so much expertise here in Canada, we need to be forming partnerships and collaborations with the best people in the various areas to expand our own knowledge and expertise. The future looks good. The area of stem cell biology and research is totally exploding, which is going to make the relationships we have developed through the Stem Cell Network even more important."

Dr. David Lillicrap, an SCN investigator at Queen's University, has a relationship with Bayer Canada Inc. that goes back to before the network was even established. It was, the SCN, however, that helped him strengthen that bond as he and a team of investigators and colleagues such as Dr. Jacques Galipeau of McGill University move closer to a stem cell-based approach for gene therapy of hemophilia.

"The involvement of the SCN and the other investigators, and the interaction with Bayer has been absolutely critically to us being able to move this project ahead and hopefully look at the potential of getting into the clinic within the next four to six years."

Dr. Bernard Chiasson, Director of Scientific Development, Biological Products at Bayer HealthCare, Canada, says his company is proud to be associated with such interesting research.

"Bayer recognizes and supports that novel strategies for hemophilia treatment must continue to undergo development," says Dr. Chiasson. "Through the Canadian Bayer/Canadian Blood Services/Héma-Québec Partnership Fund and the International Bayer Hemophilia Awards Competition we have had the opportunity to formally review the studies that are proposed by Dr. Lillicrap and Dr. Galipeau. Suffice it to say that the proposed work by these two clinicians represents cutting-edge science for the development of new therapeutic options for the hemophilia community."

www.stemcellnetwork.ca

THE NETWORKS

SUSTAINABLE FOREST MANAGEMENT NETWORK (SFM)

Not just for the birds

Knowledge transfer protects wildlife and saves money

Years of research on the trembling aspen tree is protecting birds and mammals while helping the forestry industry make its retention practices more efficient.

With its long history as one of the world's major suppliers of wood and wood products, Canada has a natural interest in protecting and preserving its forests. Since 1995, researchers at the Sustainable Forest Management Network (SFM) have been developing methods to improve forestry practices.

Ironically, one of the network's longest running projects involves a tree that is not widely used by the forest industry, but instead plays a key role in protecting wildlife. The trembling aspen, a broad-leafed deciduous tree, is much loved by the woodpeckers of British Columbia who, essentially, soften it up for a line of other creatures to call home.

Dr. Kathy Martin, an SFM researcher and professor of Forest Sciences at the University of British Columbia, has pinpointed the trembling aspen as the tree of choice for cavity nests among 20 species of birds and six species of mammals – including woodpeckers, the key players in the complex "nest web."

The woodpeckers create holes in the trees for their own use, and for other species such as songbirds, ducks, birds of prey and small mammals. Dr. Martin compares the nest web to the food web in which species are dependent on other species within the community.

Aspen are favoured by the creatures because they are more susceptible to heartwood rot, which provides a soft material to excavate while keeping a solid bark structure. While the trees are not normally sought after in large commercial forestry operations, they often are cut down during the clearing process.

Dr. Martin says the work she and her students have done is preserving aspen and helping to save critical habitat elements for the woodpeckers, songbirds, ducks and owls.

"They (forest industry companies) are retaining the aspen and leaving patches of old forest for wildlife use. This is a significant improvement because before they were knocking them all down or leaving some live trees. They now recognize the benefit of leaving some live unhealthy trees because these trees are easy enough for birds to create cavities in for nests."

The research work she and her students have done has not only saved wildlife, it helped the forestry industry refine retention practices and cut costs.

"Her research showed us there is a threshold density at which aspen is useful and that aspen in a mixed stand is more valuable than pure type," says Shawn Meisner, a senior planning forester with Tolko Industries Ltd. "It caused us to develop some rules around how to think about retention – to save aspen but leave something with it to enhance the value. It saved us money. Her research showed us to save all of the aspen didn't make a lot of sense. So we adapted our harvesting practices to save aspen as clumps."

Dr. Martin says her ongoing project has involved more than 70 students over 11 years. "This is an ideal project for students to work on," she says. "They have gathered masses of useful data and have used this experience to move on to jobs in the forest, wildlife or biodiversity sectors."

Her project students have gone on to work in Canada in government, science conservation, field ecology and education. They also have moved on to work and teach in Tasmania, Germany, Switzerland, Peru, and New Zealand. Monika Breuss, for example, is doing her PhD on grouse in old forests in Austria after gaining experience doing field work with Dr. Martin.

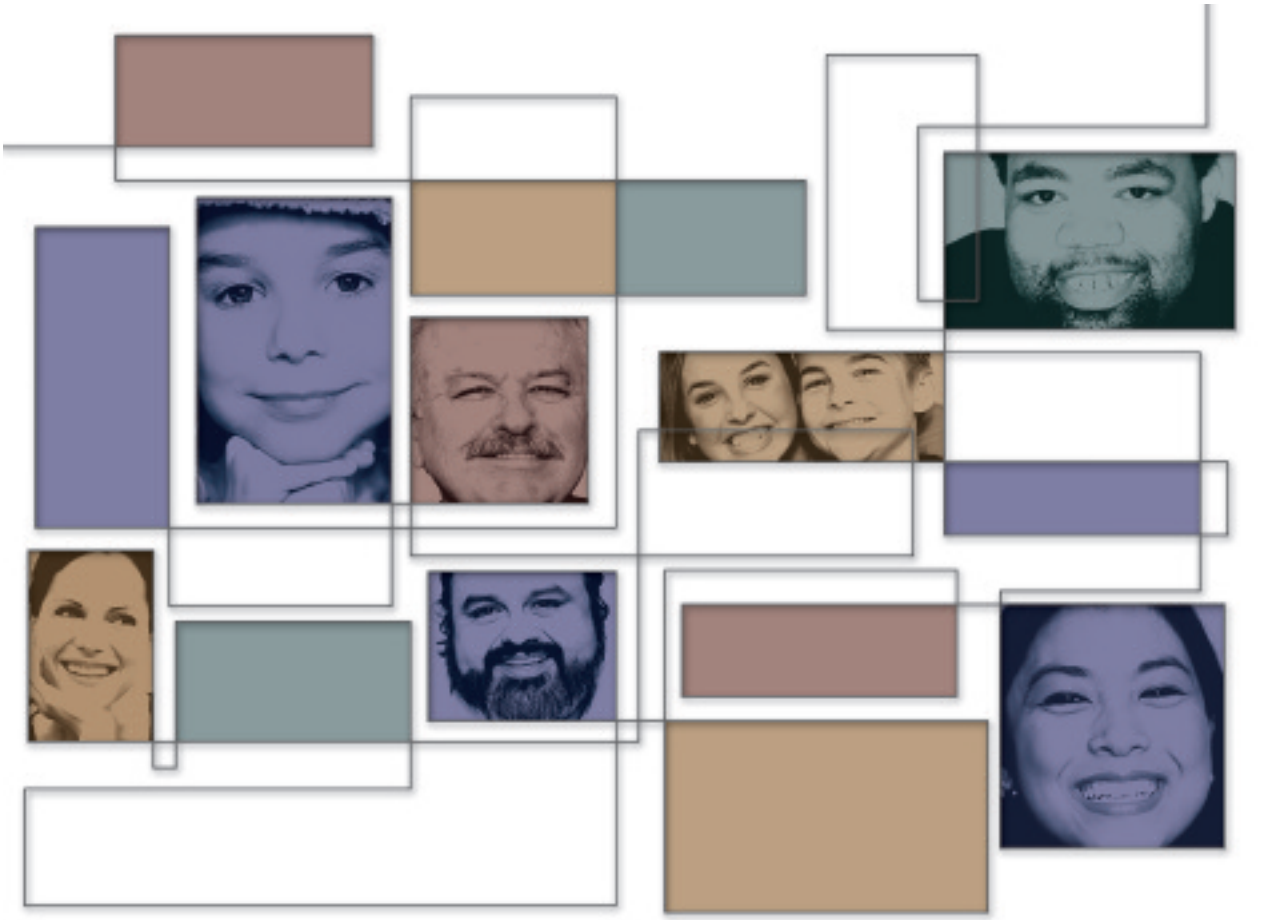
As well, the Washington State Fish and Wildlife Division frequently recruits Dr. Martin's trainees.

"We've hired several. We've very been impressed. They were excellent students and obviously have been trained well," says Matt Vander Haegen, a senior research scientist with the Wildlife Program of Washington State's Department of Fish and Wildlife.

While NCE funding of the project is complete, Dr. Martin's research is carrying on. She believes that students can find training opportunities in other SMF research projects.

"The NCE program allows students to gain experience that they wouldn't have had otherwise. It is obvious to see how intense training benefits both Canada and the world."

www.ualberta.ca/sfm



PARTICIPATING UNIVERSITIES

It takes a network of talents to meet 21st century challenges.

Dr. Peter Frise, Program Leader and CEO for AUTO21, put it best: "Whether a project focuses on child seat safety, alternative fuels or manufacturing processes, the research teams consist of people from disciplines that may not traditionally work together. Engineers, nurses, lawyers, economists, and psychologists are just a few examples of the disciplines that create AUTO21. By pairing these fields together, the scope of expertise widens and allows for innovative solutions to automotive issues."

The NCE program works in a true partnership with 194 universities across Canada and around the world. While the individual Canadian institutions pay the professors' salaries, provide facilities and administrative support, and supply a pool of talented students and postdoctoral fellows, the NCE program mobilizes project partnerships so that these academic experts – from a variety of disciplines – can interact within their own institutions and with institutions across the country.

BRITISH COLUMBIA	AFMNet	AllerGen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CBDN	CGDN	CIPI	CLLRNet	CSN	CWN	GEOIDE	IRIS	ISIS	Micronet	MITACS	PENCE	SCN	SFM	Grand Total*
Malaspina University College			✓																			1
Okanagan University College																		✓				1
Royal Roads University																					✓	1
Simon Fraser University	✓		✓		✓					✓			✓	✓	✓			✓	✓			9
Thompson Rivers University			✓																			1
University of British Columbia	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	20
University of Northern British Columbia																					✓	1
University of Victoria	✓		✓	✓	✓			✓		✓	✓			✓			✓	✓	✓			11

ALBERTA	AFMNet	AllerGen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CBDN	CGDN	CIPI	CLLRNet	CSN	CWN	GEOIDE	IRIS	ISIS	Micronet	MITACS	PENCE	SCN	SFM	Grand Total*
University of Alberta	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	18
University of Calgary					✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		15
University of Lethbridge										✓		✓	✓									3

** These figures represent the number of networks that each university participates in.*

SASKATCHEWAN	AFMNet	AllerGen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CBDN	CGDN	CIPI	CLLRNet	CSN	CWN	GEOIDE	IRIS	ISIS	Micronet	MITACS	PENCE	SCN	SFM	Grand Total*
University of Regina					✓								✓				✓	✓			✓	5
University of Saskatchewan	✓		✓				✓	✓				✓	✓	✓		✓		✓	✓		✓	11

MANITOBA	AFMNet	AllerGen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CBDN	CGDN	CIPI	CLLRNet	CSN	CWN	GEOIDE	IRIS	ISIS	Micronet	MITACS	PENCE	SCN	SFM	Grand Total*
University of Manitoba	✓			✓	✓	✓	✓	✓	✓	✓		✓	✓			✓	✓	✓	✓		✓	15
University of Winnipeg																					✓	1

** These figures represent the number of networks that each university participates in.*

ONTARIO	AFMNet	AllerGen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CBDN	CGDN	CIPI	CLLRNet	CSN	CWN	GEOIDE	IRIS	ISIS	Micronet	MITACS	PENCE	SCN	SFM	Grand Total*
Brock University											✓		✓									2
Carleton University				✓	✓					✓	✓		✓	✓		✓	✓	✓	✓			10
Lakehead University	✓				✓																✓	3
Laurentian University														✓								1
McMaster University	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓	✓	✓		16
Nipissing University					✓																	1
Queen's University			✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		15
Royal Military College of Canada					✓								✓	✓								3
Ryerson Polytechnic University	✓				✓								✓	✓			✓					5
Trent University					✓																✓	2
University of Guelph	✓		✓	✓	✓	✓		✓			✓		✓					✓			✓	10
University of Ontario Institute of Technology					✓					✓								✓				3
University of Ottawa	✓		✓	✓	✓			✓	✓	✓	✓	✓	✓			✓		✓		✓		13
University of Toronto	✓				✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	17
University of Waterloo	✓		✓		✓					✓	✓		✓	✓	✓	✓	✓	✓		✓		12
University of Western Ontario	✓			✓	✓	✓		✓		✓	✓	✓						✓			✓	10
University of Windsor					✓								✓	✓			✓					4
Wilfrid Laurier University											✓		✓	✓				✓				4
York University										✓				✓	✓			✓				4

** These figures represent the number of networks that each university participates in.*

QUEBEC	AFMNet	AllerGen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CBDN	CGDN	CIPI	CLLRNet	CSN	CWN	GEOIDE	IRIS	ISIS	Micronet	MITACS	PENCE	SCN	SFM	Grand Total*
Concordia University			✓		✓					✓						✓	✓	✓			✓	7
École des Hautes Études Commerciales					✓													✓				2
École Polytechnique de Montréal					✓	✓				✓			✓			✓	✓	✓				7
Institut national de la recherche scientifique				✓		✓																2
Institut National de la recherche scientifique – Énergie et Matériaux																	✓					1
Institut National de la recherche scientifique – Institut Armand-Frappier													✓									1
Institut National de la recherche scientifique – Télé-communications										✓											1	
Institut National de la recherche scientifique – Urbanization, Culture and Society														✓								1
Institut National de la recherche scientifique – Water, Earth and Environment			✓											✓								2
McGill University	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	17
Université de Montréal	✓		✓		✓	✓	✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		15
Université de Sherbrooke	✓				✓			✓		✓				✓		✓		✓				7

** These figures represent the number of networks that each university participates in.*

QUEBEC *(CON'T)*	AFMNet	AllerGen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CBDN	CGDN	CIPI	CLLRNet	CSN	CWN	GEOIDE	IRIS	ISIS	Micronet	MITACS	PENCE	SCN	SFM	Grand Total*
Université du Québec à Chicoutimi																					✓	1
Université du Québec à Montréal				✓																	✓	2
Université du Québec à Rimouski			✓	✓																		2
Université du Québec à Trois-Rivières				✓	✓									✓								3
Université du Québec en Outaouais										✓												1
Université Laval	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓		✓	✓	16

NEW BRUNSWICK	AFMNet	AllerGen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CBDN	CGDN	CIPI	CLLRNet	CSN	CWN	GEOIDE	IRIS	ISIS	Micronet	MITACS	PENCE	SCN	SFM	Grand Total*
Mount Allison University			✓																			1
Université de Moncton	✓		✓								✓										✓	4
University of New Brunswick	✓		✓	✓	✓					✓	✓		✓	✓				✓			✓	10

** These figures represent the number of networks that each university participates in.*

NOVA SCOTIA	AFMNet	AllerGen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CBDN	CGDN	CIPI	CLLRNet	CSN	CWN	GEOIDE	IRIS	ISIS	Micronet	MITACS	PENCE	SCN	SFM	Grand Total*
Acadia University											✓		✓					✓				3
Dalhousie University	✓		✓		✓			✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	14
Nova Scotia Agricultural College			✓										✓									2
Saint Mary's University																		✓				1
St. Francis Xavier University	✓		✓																			2

PRINCE EDWARD ISLAND	AFMNet	AllerGen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CBDN	CGDN	CIPI	CLLRNet	CSN	CWN	GEOIDE	IRIS	ISIS	Micronet	MITACS	PENCE	SCN	SFM	Grand Total*
University of Prince Edward Island			✓								✓	✓	✓									4

NEWFOUNDLAND	AFMNet	AllerGen	AquaNet	ArcticNet	AUTO21	CAN	CANVAC	CBDN	CGDN	CIPI	CLLRNet	CSN	CWN	GEOIDE	IRIS	ISIS	Micronet	MITACS	PENCE	SCN	SFM	Grand Total*
Memorial University of Newfoundland	✓		✓	✓							✓	✓	✓					✓			✓	8

** These figures represent the number of networks that each university participates in.*