



# Annual Report 2001-2002

Networks of Centres  
of Excellence

Réseaux de centres  
d'excellence



knowledge exchange and technology



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## MESSAGE FROM THE MINISTER



## MESSAGE FROM THE MINISTER

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### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"



In February 2002, the Government of Canada put forward a national strategy aimed at ensuring Canada's future as a nation of excellence, innovation and ideas.

In the Innovation Strategy, my colleague Jane Stewart, Minister of Human Resources Development, and I outlined a series of national goals for a more competitive economy, more jobs, and sustained economic growth. It also called on leaders and innovators in business, academia, and government to identify ways to ensure Canada's position among the world's most innovative nations through the next decade. The result? People and organizations across the country are rising to the challenge. They're putting forward new ideas and approaches to work together to build an innovative Canada.

Among these organizations, the Networks of Centres of Excellence Program offers the type of strategies and partnership that are required to achieve this goal. The NCE Program — and the networks of researchers and institutions it supports — represents an effective model to create and commercialize knowledge, train Canadians for the new economy, and strengthen the capacity of communities all across the country to innovate and compete in the global market.

The NCE Program is an integral component of the Government of Canada's Innovation Strategy and an important example of our commitment to university research. Over the years, the program has proven to be one the most effective mechanisms for changing the way we conduct research. The networks are turning research into products, processes, and services that enhance our prosperity and quality of life. Business partners are capitalizing on these innovations to compete and meet the demands of the global market. Governments at all levels are also making use of the knowledge generated by the network researchers to develop and improve public policies in critical areas such as water quality and literacy.

A major goal of the Innovation Strategy is to make Canada a magnet for investment and growth, and to build a critical mass of entrepreneurship and innovation capabilities. The NCEs help to achieve this goal by



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forging innovation networks between those who create knowledge, the universities, and those who apply it, industry, government and other sectors. These networks help to strengthen Canada's competitiveness in areas such as health, biotechnology and human development, information and communications technologies, biotechnology, engineering and automobile, and the natural resources and the environment.

I want to congratulate the researchers, students, and business leaders involved in the networks. Together, they contribute to creating a dynamic environment for innovation in Canada.

**Allan Rock**  
**Minister of Industry**



## MESSAGE FROM THE CHAIR



### MESSAGE FROM THE CHAIR

MESSAGE  
FROM THE MINISTER

MESSAGE FROM THE  
CHAIR

THE NCE PROGRAM

THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES -  
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Welcome to the new, on-line and interactive 2001-2002 Networks of Centres of Excellence Program annual report.

This year, we innovate by presenting the NCE Program and the networks' achievements in an electronic report and searchable database available through the Internet. welcome your comments on our annual report; you can send them to me by using the [e-mail reply](#) box at the end of this message.

Over the years, the volume of information has increased to the point where we needed to present data and success stories in a format that is more efficient and meets your needs. In this version, you will be able to search the annual report according to your areas of interest. In the success stories section, you will be presented with examples of the networks' contributions to strengthening Canada's capacity to innovate.

I am pleased to report that in 2001-2002 the Networks of Centres of Excellence have continued to contribute to the economy and the quality of life of Canadians. The networks are well positioned to help achieve Canada's innovation goals "[for a more competitive economy, more jobs and economic growth over the next decade.](#)" <sup>1</sup>

Since its creation twelve years ago and this year again, the NCE Program has demonstrated that it is possible to mobilize our country's best researchers, in universities and hospitals, to investigate areas of strategic importance to Canadians. Working together, these researchers and their partners from the public, private, and volunteer sectors are having a direct impact on our competitiveness, prosperity, and quality of life.

The NCE Program is built on excellence, multidisciplinary and multi-sectoral collaboration, skills development, knowledge exchange, partnerships, and commercialization. As Chair of the NCE Steering Committee, I want to recognize the vision and contribution of the scientific directors and chairs of the boards of directors who play a capital role in bringing together research leaders from all sectors to take on research challenges and forge partnerships.

The networks have strategies in place to commercialize research



## MESSAGE FROM THE CHAIR



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through patents, license agreements, and the creation of spin-off companies in high value-added sectors. They train young Canadians who understand both the challenges and rewards of research, and the competitive reality of the global market.

I know I speak on behalf of my colleagues on the NCE Steering Committee: Dr. Alan Bernstein, President of the Canadian Institutes of Health Research (CIHR); Dr. Marc Renaud, President of the Social Sciences and Humanities Research Council; and Mr. Peter Harder, Deputy Minister of Industry Canada, when I say that our priority is to ensure that Canadians get the best value for their investment in research. This year, an independent evaluation of the program was launched to look at the impact of the program in terms of international competitiveness of the research, training, retaining highly qualified personnel, knowledge exchange, and technology transfer. The evaluation will also look at the long-term impact of the program on the economy and on the quality of life of Canadians. The results of the evaluation will be available later this year.

In October 2001, the former Minister of Industry, the Honourable Brian Tobin, and I announced that nine NCEs in the areas of health, biotech and high tech passed an important milestone and were awarded continuing funding for the next three years. This decision was based on a thorough review of these networks' research and activities, the quality of their partnerships, and the success of their knowledge transfer and commercialization activities.

New ideas and challenges are an essential part of the program. In January 2002, a national competition was launched to create up to three new NCEs in areas that will be determined by the research community itself, in consultation with its partners. This dynamic process involves a great deal of communication, exchange, and planning among university researchers and their potential partners. In previous competitions, this process has proven to be an effective way to ensure that the proposals put forward are relevant to the needs of Canada's industry and governments. In this report, you will find a number of success stories resulting from this effort and collaboration.

The successes of the NCE have established the program's reputation beyond our borders. The European Union and countries such as Japan,



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the People's Republic of China, Sweden and France are studying the NCE Program and modeling their own R&D program on its concept of a network.

Designed as a Canadian initiative of Industry Canada and the granting agencies — the Natural Sciences and Engineering Research Council, the Canadian Institutes of Health Research, and the Social Sciences and Humanities Research Council — the NCE Program continues to meet its objective of improving the economy and our quality of life. This is also being made possible thanks to the support of universities, which are providing the networks with critical infrastructure and research personnel.

I would also like to thank the Honourable Allan Rock, Minister of Industry, and his predecessor, the Honourable Brian Tobin, for their support of the NCE Program.

I believe the NCE Program will continue to help Canada achieve its innovation objectives by mobilizing people, institutions, and sectors in winning strategies that are relevant to all Canadians.

**Thomas A. Brzustowski, P. Eng., Ph.D.**

**Chair**

NCE Steering Committee

[info@nce.gc.ca](mailto:info@nce.gc.ca)

<sup>1</sup> Government of Canada News Release, "Government of Canada launches Innovation Strategy," February 12, 2002.



## THE NCE PROGRAM



### SUPPORTING CANADA'S INNOVATION STRATEGY

MESSAGE  
FROM THE MINISTER

MESSAGE FROM THE  
CHAIR

THE NCE PROGRAM

THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES -  
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The NCE Program is an integral component of the Government of Canada's Innovation Strategy <sup>2</sup>. It is an investment in research and entrepreneurial talent that generates economic and social benefits for Canadians.

Through its strong focus on partnerships and research collaboration, the NCE Program helps to build consensus among business, academic, and government leaders. It also helps make Canada one of the most innovative countries in the world. The program strengthens our ability to innovate in four strategic areas:

- Health, human development, and biotechnology
- Information and communications technologies
- Natural resources and environment
- Engineering and manufacturing

Network researchers and their partners work in communities all across Canada to investigate research issues of importance to the people in their own region, and to the country as a whole.

Regional distribution of NCE researchers and highly qualified personnel							
Province / Territory	NCE Researchers			HQP supported by NCE funds	HQP supported by non-NCE funds	HQP Total	Total Personnel
	University	Non-university	Total researchers				
Alberta	228	17	245	348	286	634	879
British Columbia	267	47	314	353	304	657	971
Manitoba	34	9	43	74	47	121	164
New Brunswick	39	12	51	64	40	104	155
Newfoundland and Labrador	23	2	25	34	30	64	89
Northwest Territories, Yukon Territories and Nunavut	0	0	0	0	14	14	14
Nova Scotia	56	12	68	84	46	130	198
Ontario	610	248	858	953	865	1,818	2,676
Prince Edward Island	9	1	10	13	7	20	30
Quebec	354	84	438	751	676	1,427	1,865
Saskatchewan	42	4	46	44	34	78	124
<b>TOTAL</b>	<b>1,662</b>	<b>436</b>	<b>2,098</b>	<b>2,718</b>	<b>2,349</b>	<b>5,067</b>	<b>7,165</b>

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

<sup>2</sup> Government of Canada News Release, "Government of Canada launches Innovation Strategy," February 12, 2002.





## THE NCE PROGRAM



### SUPPORTING CANADA'S INNOVATION STRATEGY (CONTINUED)

MESSAGE  
FROM THE MINISTER

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THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES -  
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Regional distribution of NCE personnel and funds						
Province / Territory	NCE Researchers		Highly Qualified Personnel*		NCE expenditures	
	Total	Percentage	Total	Percentage	Total	Percentage
Alberta	245	11.7%	634	12.5%	6,266,343.72	8.3%
British Columbia	314	15.0%	657	13.0%	11,829,167.90	15.6%
Manitoba	43	2.0%	121	2.4%	1,582,816.66	2.1%
New Brunswick	51	2.4%	104	2.1%	1,173,572.45	1.5%
Newfoundland and Labrador	25	1.2%	64	1.3%	1,803,328.85	2.4%
Northwest Territories, Yukon Territories and Nunavut	0	0.0%	14	0.3%	0.00	0.0%
Nova Scotia	68	3.2%	130	2.6%	1,553,401.95	2.0%
Ontario	858	40.9%	1,818	35.9%	1,553,401.95	44.2%
Prince Edward Island	10	0.5%	20	0.4%	33,505,691.62	0.4%
Quebec	438	20.9%	20	28.2%	279,704.14	22.0%
Saskatchewan	46	2.2%	1,427	1.5%	16,659,068.23	1.5%
<b>TOTAL</b>	<b>2,098</b>	<b>100.0%</b>	<b>5,067</b>	<b>100%</b>	<b>75,786,326.15</b>	<b>100.0%</b>

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, and graduate and summer students

The regional distribution of NCE funds are expenditures reported by each participating network institution against 2001-02 NCE awards and carried-over NCE funds from previous years.

The NCEs directly contribute to achieving a number of the goals outlined in the Government of Canada's Innovation Strategy. They accomplish this by:

- creating knowledge and bringing ideas to market more quickly;
- training highly qualified people for the knowledge economy;
- supporting innovation in communities everywhere; and
- attracting investment not only from Canadian companies and organizations but also from international partners.

Overall, the networks mobilize 7,165 researchers, postdoctoral fellows, graduate students, and partners from the public and private sectors. Their knowledge and skills lead to innovative concepts, products, and services that are essential to our economic success and social development.



THE NCE PROGRAM



WORKING TOWARDS COMMON GOALS

MESSAGE FROM THE MINISTER

MESSAGE FROM THE CHAIR

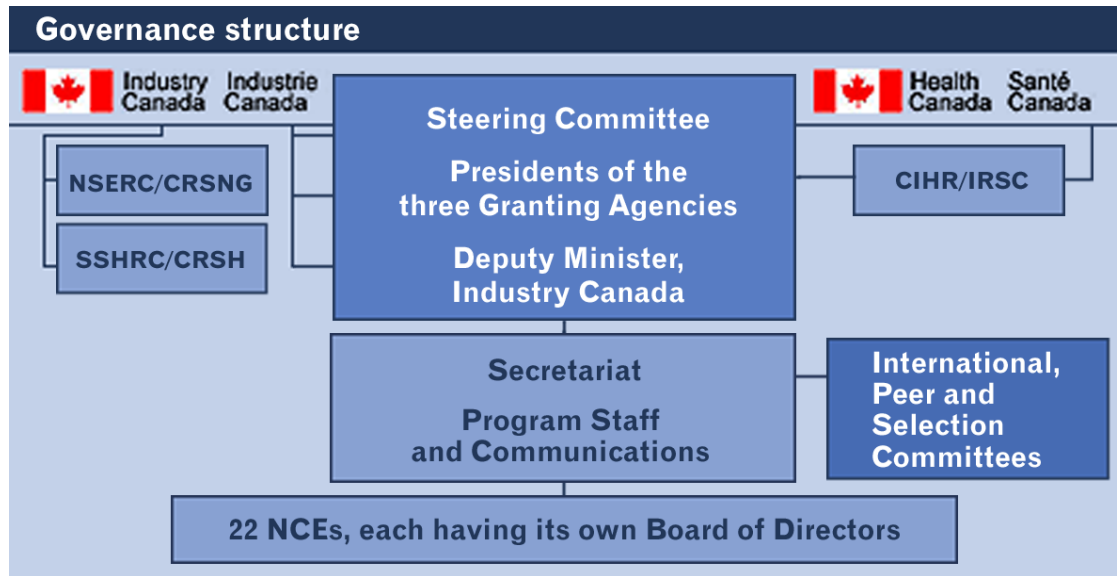
THE NCE PROGRAM

THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

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

The program is managed by a Steering Committee comprised of the presidents of the three granting agencies and the Deputy Minister of Industry Canada (or their delegates). The NCE Directorate is responsible for program management and communications. The three granting agencies provide the majority of the Program Directorate's staff.





THE NCE PROGRAM



MANAGING PARTNERSHIPS

MESSAGE FROM THE MINISTER

Networks successfully manage many diverse interests as they form a consortium of researchers, companies, universities, federal and provincial governments, as well as other organizations.

MESSAGE FROM THE CHAIR

A Board of Directors is responsible for overall policy, management direction, and financial accountability of the network. It is accountable to the NCE Steering Committee.

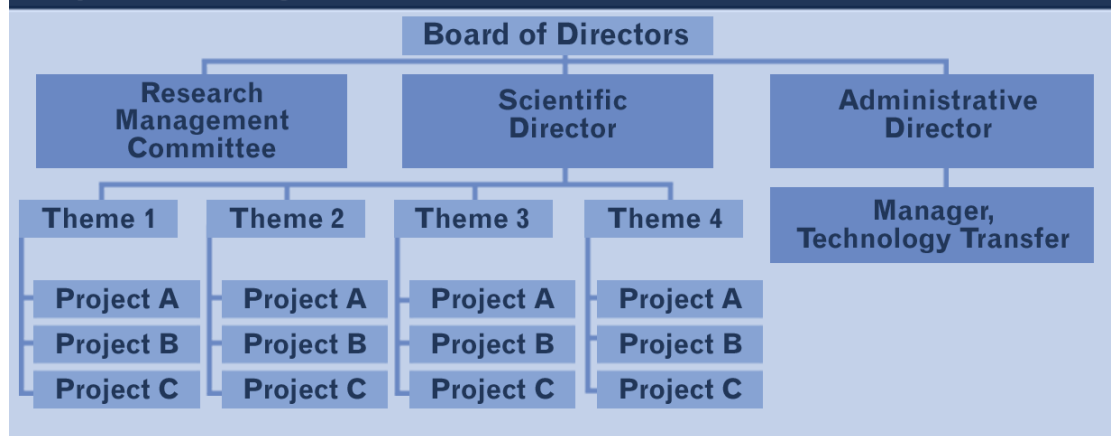
THE NCE PROGRAM

THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

The Scientific Director provides scientific leadership, promotes collaboration and often chairs the Research Management Committee, among other functions. The Network Manager directs daily business, ensuring control and accountability, and is responsible for internal and external communications. The Host Institution, normally a university, hospital or other partner provides suitable space for the network's Administrative Centre.

A typical NCE organizational chart





**THE NCE PROGRAM**



**FOCUSING ON EXCELLENCE**

**MESSAGE  
FROM THE MINISTER**

The NCEs are recognized for their clear focus on excellence in every aspect of their operations. From hiring world-class research leaders and putting forward the most innovative research strategies, to offering the best research environment and the most effective commercialization practices, the NCEs have a solid track record.

**MESSAGE FROM THE  
CHAIR**

**THE NCE PROGRAM**

**THIS YEAR'S HIGHLIGHTS**

**SUCCESS STORIES -  
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In 2002, an independent evaluation of the NCE Program was launched to comply with the Treasury Board's requirement to ensure that Canadians receive the best value for their investment in research and innovation. The evaluation assessed the success of the program as measured by the NCEs' results. It also asked questions such as:

- Does the program support internationally competitive research in areas of critical importance?
- Do the networks develop new educational and training approaches in universities and other sectors?
- How many start-up companies were created?
- How many patents were applied for and issued?
- What impact have the networks had on socio-economic policies, norms, standards, and regulations?
- How many international contracts were awarded as a result of NCE research?

The results of the evaluation were submitted to the NCE Steering Committee in June 2002.



## THIS YEAR'S HIGHLIGHTS



## DEMONSTRATING SOCIO-ECONOMIC IMPACTS

Building on previous years' track records, the NCE Program has continued to deliver high-quality results in many areas. Each year, statistics clearly show that the program meets its objectives. They also indicate that the networks are successful in engaging their members and in having an impact on our industry, economy, environment, health and quality of life.

**MESSAGE  
FROM THE MINISTER**

**MESSAGE FROM THE  
CHAIR**

**THE NCE PROGRAM**

**THIS YEAR'S HIGHLIGHTS**

**SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"**

Regional and sectoral distribution of NCE partners							
Province / Territory	University	Company/ Industry	Hospital	Federal	Provincial	Other	Total
Alberta	4	79	5	4	14	31	137
British Columbia	8	92	6	7	21	33	167
Manitoba	2	11	1	1	10	3	28
New Brunswick	3	23	1	4	6	13	50
Newfoundland and Labrador	1	19	0	2	2	5	29
Northwest Territories, Yukon Territories and Nunavut	0	1	0	1	2	5	9
Nova Scotia	5	17	2	3	5	6	38
Ontario	17	279	23	34	24	119	496
Prince Edward Island	1	8	0	1	2	2	14
Quebec	20	132	18	13	26	56	265
Saskatchewan	2	8	1	4	8	4	27
<b>TOTAL CANADIAN</b>	<b>63</b>	<b>669</b>	<b>57</b>	<b>74</b>	<b>120</b>	<b>277</b>	<b>1,260</b>
<b>TOTAL FOREIGN</b>	<b>92</b>	<b>109</b>	<b>6</b>	<b>26</b>	<b>1</b>	<b>50</b>	<b>284</b>
<b>GRAND TOTAL</b>	<b>155</b>	<b>778</b>	<b>63</b>	<b>100</b>	<b>121</b>	<b>327</b>	<b>1,544</b>



## THIS YEAR'S HIGHLIGHTS



### LEVERAGING SUPPORT

MESSAGE  
FROM THE MINISTER

MESSAGE FROM THE  
CHAIR

THE NCE PROGRAM

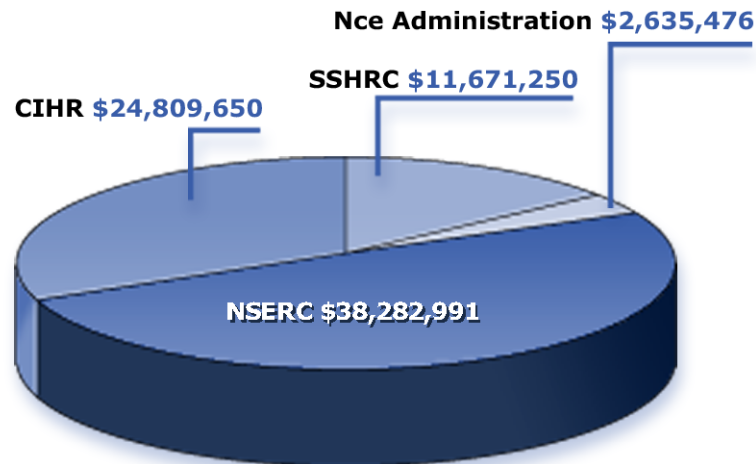
THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"

In 2001-02, the networks leveraged over \$87 million in support from partners. This amount complements the NCE Program's investment of \$77.4 million for a total of more than \$165 million to support research and training activities, as well as effective knowledge transfer and commercialization of research results.

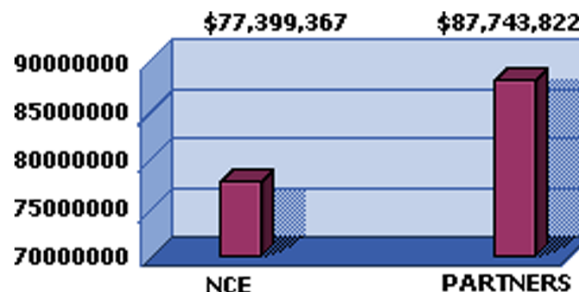
#### NCE program funding

**TOTAL \$77,399,367**



#### Leveraging support

Source	Cash	In-Kind	Total
<b>NCE</b>	<b>77,399,367</b>	<b>0</b>	<b>77,399,367</b>
<b>Partners:</b>			
University	1,990,932	5,784,712	7,775,644
Industry	16,503,431	27,942,398	44,445,829
Federal	12,304,803	4,062,294	16,367,097
Provincial	6,810,215	2,045,320	8,855,535
Other	6,837,315	3,462,402	10,299,717
<b>Partners' Total</b>	<b>44,446,696</b>	<b>43,297,126</b>	<b>87,743,822</b>
<b>GRAND TOTAL</b>	<b>121,846,063</b>	<b>43,297,126</b>	<b>165,143,189</b>





THIS YEAR'S HIGHLIGHTS



KNOWLEDGE EXCHANGE AND TECHNOLOGY

Over 7,000 highly qualified professionals — researchers in academia and industry, research associates, postdoctoral fellows, and graduate students — work in these networks, developing new ideas and turning them into marketable products and services. In 2001-02, the networks filed 87 patents, obtained close to 72 licenses, and created 7 spin-off companies. In the last 12 years, the networks have created a total of 97 spin-off companies.

MESSAGE FROM THE MINISTER

MESSAGE FROM THE CHAIR

THE NCE PROGRAM

THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

IMPACT 2001-02	
Refereed publications*:	3,249
Patents filed:	87
Patents awarded:	27
Licenses under negotiation:	32
Licenses granted:	72
Spin-off companies created:	7
* Refereed publications include refereed articles and other refereed contributions that were published, accepted for publications or in press in 2001-02	



THIS YEAR'S HIGHLIGHTS



PROVIDING HIGH-QUALITY TRAINING

One of the most visible impacts of the NCE Program is the training of highly qualified people for the new economy. Each year, close to 1,500 graduate students find high-quality jobs in industry, bringing with them the best research training available and a clear understanding of the challenges facing Canadian companies on the global market.

MESSAGE FROM THE MINISTER

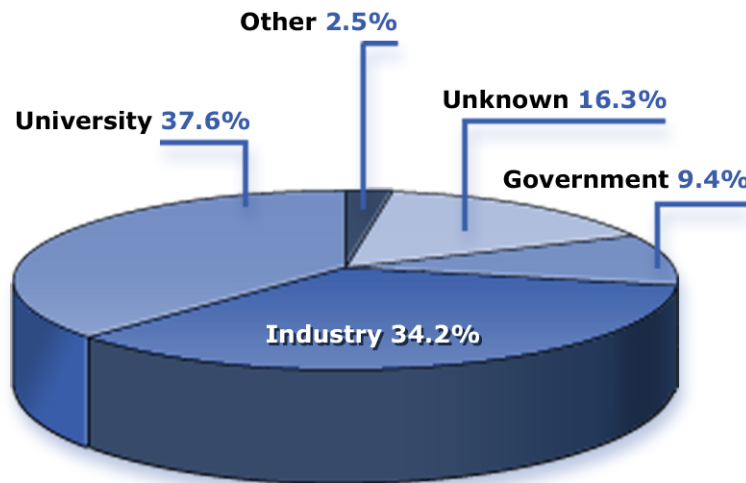
MESSAGE FROM THE CHAIR

THE NCE PROGRAM

THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

Post-network employment by sector



Many students involved in networks are also recognized in national and international competitions for the quality and innovativeness of their research. In August 2001, a team of students from the Institute for Robotics and Intelligent Systems Network won the 2001 ROBO-CUP awarded by the American Association for Artificial Intelligence. Comprised of students from the University of British Columbia and the Memorial University of Newfoundland, the team won first place for José, a "robo-waiter" with vision applications that enable computing devices to see and interact with the world.





## **THIS YEAR'S HIGHLIGHTS**



### **CHOOSING THE BEST**

To ensure that the program objectives are met, proposals for NCE funding are assessed against the program's five criteria:

- Excellence of the Research Program
- Development of Highly Qualified Personnel
- Networking and Partnerships
- Knowledge Exchange and Technology Exploitation
- Management of the Network

Networks are also evaluated on an ongoing basis during tenure of their NCE grant against the same criteria. The quality of research is considered first and, unless it is deemed excellent, the network is denied NCE funding. In other words, research excellence is a necessary condition for the initial or continued funding of an NCE. It is not the sufficient condition, because the goals of the program are also reflected in the four additional criteria.

**MESSAGE  
FROM THE MINISTER**

**MESSAGE FROM THE  
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**THE NCE PROGRAM**

**THIS YEAR'S HIGHLIGHTS**

**SUCCESS STORIES -  
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**MID-TERM REVIEW**

In 2001-02, nine networks passed a critical milestone following a rigorous review by international experts from the academic, business, and finance sectors. In October 2001, these networks were awarded \$99.5 million over three years to further their research, training, and commercialization activities in the areas of arthritis, genetics, bacterial diseases, protein engineering, robotics, microelectronics, photonics, geomatics, and mathematics.

These networks were put to the test and succeeded in meeting the program's evaluation criteria and in demonstrating how they continue to add value to their field of activity. They were assessed by experts in their own fields for their ability to:

- perform outstanding research;
- nurture and develop effective research partnerships with the public, private, and not-for-profit sectors;
- exchange knowledge and exploit technology;
- train graduate students who go on to work in industry and in other critical sectors; and
- run a national research consortium.

**Here is a list of the nine networks:**

Canadian Arthritis Network

\$10,928,000

Scientific Director:  
Tony Cruz — Mount Sinai Hospital

Chair of the Board:  
E. Sydney Jackson  
Toronto, Ontario



THIS YEAR'S HIGHLIGHTS



**MID-TERM REVIEW (CONTINUED)**

**MESSAGE  
FROM THE MINISTER**

Canadian Bacterial Diseases Network  
\$11,400,000

**MESSAGE FROM THE  
CHAIR**

Scientific Director:  
Donald Woods — University of Calgary

**THE NCE PROGRAM**

Chair of the Board:  
Kevin O'Brien-Fehr — Glaxo Wellcome  
Mississauga, Ontario

**THIS YEAR'S HIGHLIGHTS**

**SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"**

Canadian Genetic Diseases Network  
\$13,500,000

Scientific Director:  
Michael Hayden — University of British Columbia

Chair of the Board:  
Rt. Hon. Don Mazankowski — Vegreville, Alberta

Canadian Institute for Photonic Innovations  
\$9,786,000

Scientific Director:  
Michel Piché — Université Laval  
William van Wijngaarden — York University

Chair of the Board:  
Michael Steinitz — St. Francis Xavier University

Geomatics for Informed Decisions Network  
\$8,953,000

Scientific Director:  
Geoffrey Edwards — Université Laval

Chair of the Board:  
Philip A. Lapp — Philip A. Lapp Ltd.  
Ottawa, Ontario



THIS YEAR'S HIGHLIGHTS



**MID-TERM REVIEW (CONTINUED)**

**MESSAGE  
FROM THE MINISTER**

Institute for Robotics and Intelligent Systems  
\$13,125,000

**MESSAGE FROM THE  
CHAIR**

Scientific Director:  
Bernie MacIsaac — GasTOPS Ltd.  
Ottawa, Ontario

**THE NCE PROGRAM**

**THIS YEAR'S HIGHLIGHTS**

**SUCCESS STORIES -  
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Chair of the Board:  
Jim Roche — Tundra Semiconductor Corporation  
Ottawa, Ontario

Micronet  
\$6,900,000

Scientific Director:  
Andy Salama — University of Toronto

Chair of the Board:  
Claudine Simson — Nortel Networks  
Ottawa, Ontario

Mathematics of Information Technology and Complex Systems  
\$10,853,000

Scientific Director:  
Arvind Gupta — Simon Fraser University

Chair of the Board:  
Hugh Morris — Padre Resources Corporation  
Delta, British Columbia

Protein Engineering Network  
\$14,025,000

Scientific Director:  
Steve Withers — University of British Columbia

Chair of the Board:  
J. Fraser Mustard - Founder's Network  
Toronto, Ontario



## THIS YEAR'S HIGHLIGHTS



MESSAGE  
FROM THE MINISTER

MESSAGE FROM THE  
CHAIR

THE NCE PROGRAM

THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES -  
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### FUNDING RENEWAL

Every network is eligible to receive funding for two seven-year cycles. Funding for the second funding cycle is awarded following an in-depth assessment of the network's scientific track record, long-term vision, and strategies for training and commercialization. The peer-review process involved visits by international experts and a thorough evaluation of their reports by the NCE Selection Committee.

#### **NCE Selection Committee**

##### **Chair**

##### **Bill Cheliak**

Vice-President  
Business Development and Alliance  
Supratek Pharma Inc.  
Montréal, Quebec

##### **Members**

##### **James Bruce**

Senior Associate  
Global Change Strategies International, Inc.  
Ottawa, Ontario

##### **Michel Claes**

Professeur  
Département de Psychologie  
Université de Montréal  
Montréal, Québec

##### **Joseph Clark**

Chairman and CEO  
Videodiscovery Inc.  
Seattle, Washington  
U.S.A.

##### **John Grace**

Professor  
Department of Chemical Engineering  
University of British Columbia  
Vancouver, B.C.



THIS YEAR'S HIGHLIGHTS



**FUNDING RENEWAL (CONTINUED)**

**MESSAGE  
FROM THE MINISTER**

**Rosemary E. Ommer**

Director  
Calgary Institutes for Humanities  
University of Calgary  
Calgary, Alberta

**MESSAGE FROM THE  
CHAIR**

**THE NCE PROGRAM**

**David B. Shindler**

President and CEO  
Milestone Medica Corporation  
Toronto, Ontario

**THIS YEAR'S HIGHLIGHTS**

**SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"**

**Ian Smith**

Professor and Director  
Applied Computing and Mechanics Laboratory  
Institute for Structural Engineering and Mechanics  
Federal Institute of Technology  
Lausanne, Switzerland

**Jeanne M. Stellman**

Professor and Deputy Head  
Division of Health Policy and Management  
Columbia University  
New York, New York  
U.S.A.

In May 2001, two networks — Intelligent Sensing for Innovative Structures and Sustainable Forest Management — were awarded another seven years of funding as NCEs and, as a result, received additional funding of \$29.2 million over four years. Further funding for the last three years of their second cycle will be subject to a successful mid-term review.



## THIS YEAR'S HIGHLIGHTS



### FUNDING RENEWAL (CONTINUED)

MESSAGE  
FROM THE MINISTER

MESSAGE FROM THE  
CHAIR

THE NCE PROGRAM

THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"

#### HEALNET AND TELELEARNING

Following the May 2001 competition for renewal of their funding, two other networks — HealNet and Telelearning — will be wrapping up their activities as NCEs. Since 1995, these networks have made a number of noteworthy contributions to their own area of activities.

##### **HealNet**

HealNet's activities focused on helping the Canadian health system to become more efficient, effective and evidence-based. Its research activities contributed to advances in a number of areas, including:

- understanding how policy advisors use health research;
- the use of evidence in the public consultation process on health issues;
- partnerships with industry to improve diagnostic tools;
- assessment of ergonomic risk factors; and
- injury and disability prevention in the workplace.

##### **TeleLearning**

TeleLearning focused on the development and application of networked educational processes and technologies. Its contributions included:

- advances in telelearning theory, technology, and practice;
- Web-based learning environments with database sharing;
- tools to support distance teaching and learning activities;
- learning communities reaching across sectors, age groups and boundaries; and
- cost-benefit models for assessing telelearning projects.



## THIS YEAR'S HIGHLIGHTS



### MESSAGE FROM THE MINISTER

### MESSAGE FROM THE CHAIR

### THE NCE PROGRAM

### THIS YEAR'S HIGHLIGHTS

### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

## COMPETITION LAUNCHED FOR NEW NETWORKS

The NCEs are recognized for the relevance of their research. They are also recognized for their creative collaborations and innovative approaches — and their application to many areas of significance for industry and government.

This is all achieved through a national process that calls for researchers in Canadian universities and hospitals to exchange ideas, assess the relevance and significance of research programs, and talk to potential partners. Their goal is to develop innovative proposals that are relevant to the needs of the public, private, and not-for-profit sectors, and that have the potential to enhance Canada's economic growth and social development.

In January 2002, the NCE Steering Committee announced a competition to create up to three new networks — with a budget of approximately \$12 million annually to support them. To start the competition process, researchers and their partners from the private and public sectors were invited to submit letters of intent to establish new networks. The deadline to receive these letters was July 12, 2002.

To provide interested groups and consortia with the opportunity to develop proposals in areas that present the most potential for Canada, the competition for new networks was open to all sectors. As a result, letters of intent were invited from all research areas. This means that the selected networks will truly represent the best potential for Canada, as determined by those at the forefront of their discipline or industry.

The new networks are selected through a rigorous peer-review process. First, the NCE Selection Committee, which is comprised of experts of international stature with broad expertise in the areas of activities of the three granting agencies, will review the letters of intent against the NCE Program's five criteria:

- Excellence of the Research Program
- Development of Highly Qualified Personnel
- Networking and Partnerships
- Knowledge Exchange and Technology Exploitation
- Management of the Network

Then, in October 2002, selected applicants will be invited to submit full applications before the deadline of March 7, 2003.





**THIS YEAR'S HIGHLIGHTS**



**COMPETITION LAUNCHED FOR NEW NETWORKS (CONTINUED)**

Interdisciplinary Expert Review Panels then meet with representatives of applicant groups and prepare in-depth evaluation reports of each application. The NCE Selection Committee reviews the full proposals, as well as the panel reports, and makes recommendations to the NCE Steering Committee. The Steering Committee will make the funding decision for new networks in the fall of 2003.

**MESSAGE  
FROM THE MINISTER**

**MESSAGE FROM THE  
CHAIR**

**THE NCE PROGRAM**

**THIS YEAR'S HIGHLIGHTS**

**SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"**



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"



### MESSAGE FROM THE MINISTER

### MESSAGE FROM THE CHAIR

### THE NCE PROGRAM

### THIS YEAR'S HIGHLIGHTS

### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

The Networks of Centres of Excellence extend across the country and are working to turn research results into marketplace products, processes, services and better public policies. Canada's top researchers from universities, industry, and government are pooling their skills and resources to investigate areas of strategic importance to Canada — areas that are enhancing the lives of Canadians.

### HEALTH, HUMAN DEVELOPMENT AND BIOTECHNOLOGY

The eight networks in this research area have in common their focus on acquiring the knowledge that can ultimately lead to improved treatments of the most common human diseases and developmental deficits. The networks are studying arthritis, strokes, bacterial and genetic diseases, protein engineering, stem cells, vaccines, and child literacy.

### EIGHT SUCCESS STORIES

Blood test can predict progression of osteoarthritis

Developing disease-resistant super plants

Test for cancer saves children's vision

Carbohydrate blocking therapy helps cancer patients

Sonic "Hedgehog" gives stem cells a boost

Testing vaccines in real-life conditions

Study tracks stroke patients' recovery

Developing a clear vision of literacy problems among Canada's children



**SUCCESS STORIES - "FORGING INNOVATION NETWORKS"**



**INFORMATION AND COMMUNICATIONS TECHNOLOGIES**

The networks in the area of information and communications technologies are reputed for the high number of graduate students who find employment in industry following their training experience with the NCEs.

**MESSAGE  
FROM THE MINISTER**

**MESSAGE FROM THE  
CHAIR**

**THE NCE PROGRAM**

**THIS YEAR'S HIGHLIGHTS**

**SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"**

**SIX SUCCESS STORIES**

- Robotics for safer mining
- New computer program to track environment-related health conditions
- Microchip design on the cutting edge of technology
- Combining supercomputers with the most advanced laser technology
- The global race toward a broadband wireless standard
- Using math to speed air travelers through enhanced security checkpoints



**SUCCESS STORIES - "FORGING INNOVATION NETWORKS"**



**NATURAL RESOURCES AND ENVIRONMENT**

**MESSAGE  
FROM THE MINISTER**

Four networks in the areas of forestry, water quality, and aquaculture help to develop technologies and products that are critical to the sustainable growth of the natural resources and environment sector, a key driver of Canada's economy.

**MESSAGE FROM THE  
CHAIR**

**THE NCE PROGRAM**

**FOUR SUCCESS STORIES**

**THIS YEAR'S HIGHLIGHTS**

Atlantic salmon swim back to Great Lakes  
Battling bugs help maintain a healthy Canadian forest  
Small company helping to improve paper quality worldwide  
Shedding light on Walkerton's last mystery

**SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"**



**SUCCESS STORIES - "FORGING INNOVATION NETWORKS"**



**ENGINEERING AND MANUFACTURING**

The two networks in this area have a direct impact on Canada's ability to innovate and compete globally. With their focus on the automotive industry and structures, they develop new products and technologies that are exported worldwide.

**MESSAGE  
FROM THE MINISTER**

**MESSAGE FROM THE  
CHAIR**

**THE NCE PROGRAM**

**TWO SUCCESS STORIES**

**THIS YEAR'S HIGHLIGHTS**

Satellite technology could help build better, safer cars  
Students working on state-of-the-art building technologies

**SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"**



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### CANADIAN ARTHRITIS NETWORK (CAN)



### BLOOD TEST CAN PREDICT PROGRESSION OF KNEE OSTEOARTHRITIS

#### MESSAGE FROM THE MINISTER

#### MESSAGE FROM THE CHAIR

#### THE NCE PROGRAM

#### THIS YEAR'S HIGHLIGHTS

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

A recent discovery by Dr. Robin Poole, director of the Joint Diseases Laboratory at the Shriners Hospital for Children in Montreal, and researchers at McGill University will enable physicians to use a simple blood test to chart the efficacy of new medications to slow down the progression of knee osteoarthritis instead of having to wait for effects on joint damage to appear on an x-ray over a two- or three-year period.

Dr. Poole, a member of the Canadian Arthritis Network that funded his research said, "Earlier detection of disease activity modification will mean much shorter and less expensive clinical trials and will help researchers develop new drugs for patients more quickly." The test uses biomarkers — indicators present in the blood or urine that reveal what is happening in the body. In this case, the biomarkers are breakdown products formed when type II collagen, found in joint cartilage, is destroyed in arthritis.

Cartilage enables joints to move and when it breaks down the space between the bones narrows, causing great discomfort and a loss of function. A diagnosis of osteoarthritis is usually made when an x-ray of the joint shows an excessive narrowing of the joint space. Now the detection of biomarkers in the blood can provide doctors with important information about the rate of joint damage. And since there are currently no disease-modifying treatments, this new test will create considerable new opportunities to assess drugs efficacy.

This discovery is of great interest to pharmaceutical companies because it will make it easier for them to develop new therapies for osteoarthritis. The biomarkers should indicate within a few months whether a new drug is working in a clinical trial. Currently pharmaceutical companies have to spend US\$100 million on such clinical trials because osteoarthritis progresses slowly and it takes about two to three years before evidence of joint destruction can be detected on an x-ray. The x-ray measurements are not too accurate and therefore clinical trials require large numbers of patients. The shorter clinical trials will inevitably cost less and require fewer patients. This will be an incentive for companies to bring new drugs to the market.

IBEX Technologies Inc. of Montreal has licensed the technology so that it can be accessed more quickly by pharmaceutical companies that want to develop or test the efficacy of a new drug.

Dr. Poole is the scientific director of the Canadian Arthritis Network, one of the 20 federal Networks of Centres of Excellence. CAN is dedicated to creating a world free of arthritis through integrated, trans-disciplinary research and development.

[www.arthritisnetwork.ca](http://www.arthritisnetwork.ca)



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### CANADIAN BACTERIAL DISEASES NETWORK (CBDN)



### DEVELOPING DISEASE-RESISTANT SUPER PLANTS

#### MESSAGE FROM THE MINISTER

#### MESSAGE FROM THE CHAIR

#### THE NCE PROGRAM

#### THIS YEAR'S HIGHLIGHTS

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

#### Spin-Off Company: SynGene Biotech Inc.

Researchers have long waited for the day when plants would be able to repel disease without the use of harmful pesticides; and fruits and vegetables could be stored and kept fresh for over a year. Now, thanks to technology being produced by SynGene Biotech Inc., that day has arrived.

SynGene Biotech Inc. is developing a technology that involves a series of small anti-microbial peptides called "cationic peptides." These peptides have a powerful killing effect and encounter virtually no resistance. What makes them so attractive? They can be introduced into plant cells to make the plants resistant to bacterial, fungal, and viral diseases in the field. And that could go a long way in helping plants to repel disease and stay fresh — naturally.

SynGene Biotech Inc. was started by Dr. William Kay, a molecular biologist, in collaboration with the University of Victoria, Innovation and Development Corporation. He was later joined by Dr. Santosh Misra, a plant molecular biologist. Both doctors have part of their work funded by the Canadian Bacterial Diseases Network (CBDN), one of Canada's 20 federal Networks of Centres of Excellence.

Dr. Kay says the work that SynGene is doing is a direct response to the rising use of pesticides by farmers to keep diseases away from plants in their fields, and the resistance to fungicides that some organisms are developing. SynGene's goal is to reduce the number of chemical sprays and produce a healthier, longer-lasting, and more economically viable product.

Initial experiments with these peptides were done on three different species of tobacco plant. Early on, the doctors found they had generated plants that were resistant to various pathogens such as fungus and bacteria. Once they had confirmed the genes were stable when integrated into the genetic material and the plants were highly resistant, Drs. Kay and Misra decided to move on to a more food-relevant plant: potatoes.

During trials with peptides, the potatoes showed resistance to the most devastating fungal diseases, and at the same time, to a wide range of bacterial disease that cause loss due to rot during storage. And to test out the "freshness" angle, harvested potatoes were stored under cool conditions (four degrees Celsius) and after 26 months the control group potatoes were black, while SynGene's potatoes remained pristine.

Armed with this success, the doctors saw there was a huge commercial spin-off that was not limited to food sources such as fruit, cocoa, potatoes, maize, wheat and rice. Other applications could include tobacco, common garden bulbs, rubber, and flowers.

Dr. Misra says the next phase is to test the plants in the field. In collaboration with the United States Department of Agriculture, they'll be planting the potatoes in fields and testing the efficacy of peptide protection. She says they also have platform technology to produce disease-resistant plants and potentially peptides to be used in pharmaceuticals for resistant strains of bacteria not cured by antibiotics. She even imagines topical solutions for the skin, and maybe even cancer and AIDS treatment in the future. She calls it the "second wave of antibiotics."

"We see our company as being in the right place at the right time, with great potential and opportunity," says Dr. Misra. "We are looking forward to being a great Canadian success story."



SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

CANADIAN GENETIC DISEASES NETWORK (CGDN)



TEST FOR CANCER  
SAVES CHILDREN'S VISION

MESSAGE  
FROM THE MINISTER

MESSAGE FROM THE  
CHAIR

THE NCE PROGRAM

THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"

**Spin-Off Company: Solutions by Sequence**

A simple blood test developed by researchers at the Canadian Genetics Disease Network (CGDN) can help detect a rare cancer of the retina that occurs in infants.

The cancer — retinoblastoma — is caused by mutations in the RB gene and has the potential of being inherited in 40 per cent of all families — with an actual inheritance rate of about 10 per cent. For infants and children at risk, early detection and treatment of the cancer can save their vision and their lives.

Molecular testing of blood relatives can determine which family members are at risk for retinoblastoma. Children who do not carry the RB mutation — otherwise found in one member of the family — are not at risk. However, children who carry the RB gene mutation are watched for tumours and treated early.

The blood test, which tests for RB mutations, is now available to patients in Canada and around the world through a spin-off company — Solutions by Sequence — created by CGDN researcher Dr. Brenda Gallie and business partner Kirk Vanderzande.

"We know the gene very well; we know the disease very well. We understand how the protein works and, therefore, have found types of mutations that routine genetic labs cannot look for," says Dr. Gallie.

By testing for retinoblastoma, Solutions by Sequence has been able to use the same principles to develop the technology to test for other difficult gene mutations. Difficult genes are "big genes" where mutations are found all over the place, and every different kind of mutation disrupts the gene — as in the case of retinoblastoma. With these genes, the scientific challenge lies in finding all of the different mutations, unlike with other diseases such as cystic fibrosis, where there is predominantly only one common mutation.

One of Solutions by Sequence's goals is to optimize its test sensitivity so that it can more reliably detect a mutation in diseases where detection would have a benefit to the health of the family. Another is to reduce the turnaround time between testing and issuing a report to the medical team. The company is now able to identify 90 per cent of RB mutations, and the entire test procedure takes an average of 3.7 weeks.

Solutions by Sequence has filed several patent applications and is applying to license other genes. The new company was established with the support of the strategic fund of the CGDN, one of Canada's 20 federal Networks of Centres of Excellence. The fund is designed to provide early-stage support for projects with commercial potential. The University Health Network of Toronto is also an equity partner in the company.

[www.cgdn.generes.ca](http://www.cgdn.generes.ca)





## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### PROTEIN ENGINEERING NETWORK OF CENTRES OF EXCELLENCE (PENCE)



### CARBOHYDRATE BLOCKING THERAPY HELPS CANCER PATIENTS

#### MESSAGE FROM THE MINISTER

#### MESSAGE FROM THE CHAIR

#### THE NCE PROGRAM

#### THIS YEAR'S HIGHLIGHTS

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

#### Spin-Off Company: **GLYCODesign Inc.**

A Canadian biopharmaceutical company is working on a number of innovative new products — including one that slows down the growth of cancerous tumours and keeps them from spreading.

GLYCODesign Inc. was founded in 1993 by Dr. Jeremy Carver, a world leader in glycobiology, which is the study of carbohydrate-containing molecules and their function in the body. The company, which became publicly traded in 2000 and now employs almost 100 people, is a successful spin-off of the Protein Engineering Network of Centres of Excellence (PENCE), where some of the technology was developed.

Glycobiology is an area of science that has been growing rapidly during the last 30 years, says Dr. Carver who was also involved in the creation of PENCE. It has much to do with the growing recognition that cells synthesize very specific carbohydrate structures on their external surfaces. These structures are how cells differentiate from each other.

"This area of glycobiology offers an extraordinarily rich opportunity for developing therapeutics. It's been relatively under-exploited to date and we think there's potential for a huge impact," says Dr. Carver.

Many tumours synthesize different carbohydrates than normal cells and lose their contact with neighbouring cells, growing elsewhere as secondary tumours. Carbohydrate structures become altered in some disease processes, and can speed the progression of the illness. The company's lead anti-cancer compound, GD0039, blocks the production of specific carbohydrates that coat the outside of cancer cells, and restores some degree of growth control. In animal models, tumour growth has been slowed by the compound and the spread has been blocked.

The anti-cancer product is in Phase II clinical trials and is targeted at treating metastatic renal cancer, which is resistant to chemotherapy. The compound may be used in conjunction with chemotherapy for other cancers, which could allow smaller toxic doses than usual. The company expects to have this treatment on the market in 2005.

GLYCODesign is also developing a number of other products that have the potential to improve the health of countless numbers of people. Its program in cardiovascular disease has potential applications in the prevention and treatment of deep vein thrombosis, and the prevention of pulmonary embolism. The company also has an anti-inflammatory program, currently in the discovery phase with Seikagaku Corporation of Japan, to develop a drug that will treat chronic inflammatory diseases.

Also, in collaboration with the National Research Council and the Institute for Biological Sciences, GLYCODesign is conducting research to identify and validate molecular targets that play an important role in certain infectious diseases, such as the bacterium that causes duodenal ulcers and is believed to cause gastric cancer.

"Carbohydrates are a part of just about every aspect of biology and I'm sure there will be lots of other opportunities that will emerge for treatment," says Dr. Carver.

[www.pence.ualberta.ca](http://www.pence.ualberta.ca)



SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

STEM CELL NETWORK (SCN)



SONIC "HEDGEHOG" GIVES  
STEM CELLS A BOOST

MESSAGE  
FROM THE MINISTER

Bone marrow transplants help save countless lives every year, but for donors the standard procedure can be painful: A syringe with a hollow needle has to be inserted into the hipbone to extract the marrow.

MESSAGE FROM THE  
CHAIR

But, once transfused, stem cells in that donor marrow can produce new blood cells to replace those damaged by chemotherapy or radiation.

THE NCE PROGRAM

Now, a team led by a renowned Canadian stem cell biologist has discovered that a protein can be used to multiply a few blood stem cells into potentially millions — a finding that could make the life-giving procedure easier on donors.

THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"

In the future, the molecule could be used to increase the number of stem cells collected from a cancer patient's own blood before undergoing treatment. The cells could then be transplanted back into the patient to repair his or her damaged blood-forming systems.

The protein is called Sonic Hedgehog. What has researchers the world over excited is the spiky molecule's ability to manipulate blood stem cells into reproducing over and over again, without ever losing their "stemness" — that is, their ability to develop into all other blood cells.

"Unlike what's classically used clinically, our results suggest that these molecules play a far more substantial role in increasing stem cell numbers," says Dr. Mick Bhatia, principal scientist at the Robarts Research Institute in London, Ontario, and senior author of a study on the finding published last year in the prestigious journal Nature Immunology.

Until now, researchers trying different combinations of growth factors to make stem cells grow all come up against the same wall: not only do the stem cells proliferate, they differentiate, and therefore lose their stem cell properties. That means that their progeny or "daughter cells" are no longer capable of making different kinds of cells, or making more of themselves. Instead, they have grown into a specific cell with a specific function.

"The problem is when you culture human stem cells, the cells lose their stem cell properties, resulting in an overall loss of stem cells. We believe the conditions used to culture these stem cells alter stem cell properties, and differentiate the cells," says Dr. Bhatia, a member of the Stem Cell Network, a federal Network of Centres of Excellence based at the University of Ottawa. Instead of simply "tweaking" the concentration and combinations of known growth factors classically used, Dr. Bhatia's team is using a whole new set of proteins normally found in higher amounts during early human blood development.

"We know where hematopoietic stem cells came from, and we all have more than one. So there must have been a point during our development, probably in utero, when there must have been a rich source of factors to expand the stock of this pool of cells. This expansion is exactly what we hope to mimic in our culture systems using adult stem cells.

Dr. Bhatia is also looking at whether Sonic Hedgehog proteins could be used to grow neural stem cells, research that could one day lead to stem-cell based therapies for Parkinson's and other neural degenerative diseases.

[www.stemcellnetwork.ca](http://www.stemcellnetwork.ca)



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### CANADIAN NETWORK FOR VACCINES AND IMMUNOTHERAPEUTICS (CANVAC)



### TESTING VACCINES IN REAL-LIFE CONDITIONS

#### MESSAGE FROM THE MINISTER

HIV and hepatitis C are chronic, progressive diseases for which there are currently no effective vaccines. In Canada, it is estimated some 54,000 people are infected with HIV, another 275,000 with the hepatitis C virus. The actual number is likely far higher.

#### MESSAGE FROM THE CHAIR

Finding ways to improve the reliability of clinical studies into new vaccines is a major objective of the Canadian Network for Vaccines and Immunotherapeutics (CANVAC). A research team led by Dr. Julie Bruneau, an addiction specialist at the University of Montreal, is studying the processes and factors related to HIV and HCV prevention, along with vaccine development studies among injection drug users. The Montreal team works in close association with Dr. Martin Schechter, an epidemiologist at the University of British Columbia. Basing their research program in Montreal and Vancouver is no random choice, for both cities house the largest number of injection drug users and primary test subjects.

#### THE NCE PROGRAM

#### THIS YEAR'S HIGHLIGHTS

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

"The consequences of the cocaine epidemic that plagues Montreal are devastating, and new HIV infections continue to occur at a high pace, despite innovative and important harm reduction efforts," said Dr. Bruneau. "Vancouver has the dubious distinction of being home to the highest concentration of HIV infected injection drug users in the developed world, with nearly 20% of them carrying the virus" added Dr. Schechter.

The team's goal is to create new research tools to speed up the development of future vaccines. One advance resulting from their work is the development of infection risk scores based on attributes such as drug-related behaviours and social network. These scores help ensure the accuracy of clinical trials by providing researchers with a means to achieve an equal balance of high-risk subjects in each of the control and vaccine groups. Infection risk scores are used to establish their targeted population, to calculate the size of the sample to be taken and to determine the composition of each group.

Another innovation realised within this CANVAC project pertains to better evaluate quality of life outcome measures. The IDUQOL, that is the Injection Drug User Quality of Life index. A promising tool with unique features, the IDUQOL can not only be used to assess whether a particular injection drug user is a suitable candidate for inclusion in a trial, but also measure changes in the quality of life of those participating in the clinical trial.

In an ethnographic component of their work, the Montreal and Vancouver teams at CANVAC look at the social network of users, whether or not they share needles and why they engage in such high-risk behaviour. So far, they've made some surprising observations. Incredibly, some injection-drug users risk contracting HIV and hepatitis C because many view sharing a needle as socially acceptable conduct. In their culture, it is sometimes considered a polite or friendly gesture.

"Understanding the social and ethnographic environment and behaviours of injection drug users is as critical to the development of effective vaccines as molecular and virology studies," said Dr. Bruneau. "It may also help develop public health policies that are better targeted to the needs of people who, unfortunately, have very little quality of life."



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### CANADIAN STROKE NETWORK (CSN)



### STUDY TRACKS STROKE PATIENTS' RECOVERY

#### MESSAGE FROM THE MINISTER

#### MESSAGE FROM THE CHAIR

#### THE NCE PROGRAM

#### THIS YEAR'S HIGHLIGHTS

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

A study of the chain of events from the onset of symptoms to hospital admission and treatment could help prevent irreversible brain damage in a higher number of patients, and improve stroke care.

The world's most ambitious study ever of stroke patients is providing an early snapshot of stroke and stroke care in Canada. In its initial phase of operation between July 2001 and February 2002, over 4,000 stroke patients enrolled in the Registry of the Canadian Stroke Network — more than half the 6,000 patients that organizers had hoped to have signed on in the first year. Twenty-one participating hospitals are enrolling patients and collecting data. The CSN is one of Canada's 20 federal Networks of Centres of Excellence.

Preliminary findings were released in the spring issue of the Canadian Stroke Network magazine.

"Things are really moving along nicely," says CSN investigator Dr. Frank Silver, a University of Toronto professor of neurology who is overseeing the project with Dr. Moira Kapral, also of the University of Toronto.

A preliminary analysis of patients for whom researchers have complete data reveals:

- 22 per cent of strokes were evident when the patient woke up; the stroke was recognized in one in five patients on awakening;
- 52 per cent of stroke victims were male;
- hemorrhagic strokes, which occur when a blood vessel in or around the brain ruptures, accounted for about 24 per cent of all strokes, while the remainder were ischemic strokes (caused by a blood clot in an artery in the brain);
- about 40 per cent of patients arrived at hospital by ambulance;
- 25 per cent of patients arrived at the emergency room within two hours of the onset of stroke symptoms;
- 43 per cent of patients arrived within five hours of their stroke.

"That's bad, because we want patients to get to hospital a lot faster than that," Dr. Silver says. Treatment with the clot-busting drug t-PA can dramatically lower the risk of a patient being left with irreversible brain damage following an ischemic stroke. But in order to be safe, it must be administered within three hours of the onset of a stroke.

In the preliminary analysis, only seven per cent of ischemic stroke patients received t-PA. Dr. Silver said that number was slightly better than what researchers expected they would find, given that earlier studies have revealed that only about three to five per cent of stroke patients receive t-PA, but he still said it should be much higher.

"We'd like to see the number closer to 10 or 15 per cent, so we've got our work cut out for us," Dr. Silver says.

The registry is unprecedented in its scope. Previous registries were much smaller and usually involved only one or two hospitals. The Canadian registry, by comparison, will involve up to 24 hospitals across the country, including large tertiary-care teaching facilities and community hospitals. Three northern Ontario hospitals will also participate through the Telestroke project.

The information collected will include how long it took patients to reach hospital after a stroke; how quickly they were investigated; how soon they were seen by rehabilitation specialists; and whether patients who received different kinds of care had better outcomes.

The data collected is completely anonymous, so there is no breach of privacy to patients. It will allow investigators to identify variations in how stroke patients are managed between provinces — and between hospitals — and feed confidential information back to hospitals and health ministries.

"We'll be able to show them graphically, and with statistics, their outcomes as compared to five similar hospitals in the region," Dr. Silver says. "It's a very powerful feedback loop to improve care."

[www.canadianstrokenetwork.ca](http://www.canadianstrokenetwork.ca)



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### CANADIAN LANGUAGE AND LITERACY RESEARCH NETWORK (CLLRNET)



#### DEVELOPING A CLEAR VISION OF LITERACY PROBLEMS AMONG CANADA'S CHILDREN

#### MESSAGE FROM THE MINISTER

#### MESSAGE FROM THE CHAIR

#### THE NCE PROGRAM

#### THIS YEAR'S HIGHLIGHTS

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

Recent data from Statistics Canada indicate that more than 20 per cent of Canadian high school graduates lack the literacy skills required for entry-level jobs, and experience difficulty reading even simple texts for comprehension. Another 25 per cent of Canadians can read only simple printed material.

Faced with academic failure, many students drop out of school. The result? Poor psycho-social development, reduced self esteem, and a diminished sense of well-being that are directly linked to reduced opportunities to succeed in life.

Although a number of well-known factors can affect a person's ability to learn how to read and write, some problems are fundamental. A new project being carried out by CLLRNet researchers, one of Canada's 20 Networks of Centres of Excellence, is highlighting the importance of vision screening of pre-school children to identify children at risk. In fact, researchers are hoping that early detection of children with poor eyesight could avoid more serious literacy problems later in life.

Canadian Language and Literacy Research Network researcher Dr. William Bobier is working on the issue with the Oxford County Board of Health in rural Ontario. Dr. Bobier, who is the Director of the School of Optometry at the University of Waterloo, believes it is critical that choices about the necessity for vision screening be based on research. In the current climate of fiscal conservatism, and in the absence of evidence, government may be tempted to withdraw vision screening on the basis that it is not effective.

"We want to move from subjective to objective testing and prove conclusively the return on our investment," says Dr. Bobier. "We need to know, as opposed to guessing, so we can build the appropriate links."

The problem is not with the idea of vision screening but in part with the methods. One of the most difficult problems in pre-school screening is the identification of hyperopia or farsightedness. Unlike other refractive errors (myopia or astigmatism), hyperopia can be overcome by increasing ocular focusing. Clinical hyperopia, which is the predominant refractive error in pre-school children, is manifested with eye drops that relax the eye's focus. Since these cannot be administered in a screening situation, researchers are looking into strategies that will allow instruments to better reveal a child's hyperopia.

Studies show that the prevalence of vision problems is reduced when early vision screening programs are in place. A story Dr. Bobier tells about a four-year-old child who believed tree leaves were fuzzy round circles paints a clear picture. Children in the early stages of development don't know they have a vision problem because imperfect eyesight seems normal. Therefore, their parents don't know they have a problem. The children are able to adjust to farsightedness intermittently through focusing.

"For example, it is well established that if children sustain inequality in their eyes as they develop, and it goes undetected or untreated, it leads to lazy eye. Early detection can impact this evolution and corrective steps can be taken."

In essence, the research impacts two issues. It will prove the effectiveness of vision screening, and will afford the opportunity to determine the impact of the developing visual system on emerging language and literacy skills.

"We can optimize vision screening methodology for pre-school children. We can add substance to health care policy in the same context," says Dr. Bobier. "And we can help four-year-old kids see the letters of the alphabet on a blackboard as clearly as they see the pointy leaves on trees."

[www.cllrnet.ca](http://www.cllrnet.ca)



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### INSTITUTE FOR ROBOTIC AND INTELLIGENT SYSTEMS (IRIS)



### ROBOTICS FOR SAFER MINING

#### MESSAGE FROM THE MINISTER

#### MESSAGE FROM THE CHAIR

#### THE NCE PROGRAM

#### THIS YEAR'S HIGHLIGHTS

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

#### Spin-Off Company: Intrignia Solutions Inc.

The image of workers descending deep into underground mines to toil away to bring up precious natural resources may soon be a thing of the past thanks to a new technology being developed by a Canadian company.

Established two years ago as a spin-off company from the Institute for Robotics and Intelligent Systems (IRIS), Intrignia Solutions Inc. is currently developing a software for a telerobotic management system (TMS) that could eventually replace human miners with robotic ones. Although the technology is still in development, Jamie King, Intrignia's president, says the concept of "plug and play" robotics is a big selling point for companies concerned with the safety and economic issues surrounding deep-earth mining.

How does TMS work? In essence, the system will be designed so that any underground mining vehicles or "robots" from any manufacturer that is enabled by TMS can join a network of vehicles with very little integration effort required. It's the same technology currently used when networking printers. As soon as a machine is turned on, it will connect to the system and a mission control operator will be able to assign it tasks remotely.

Lost productivity, safety concerns, cost controls, and gaps in existing technologies are all issues that Intrignia Solutions Inc. hopes to tackle with the introduction of its fully automated underground mining system, or Intelligent Central Control System (ICCS). "One obvious problem is a safety problem, an underground mine is very dangerous," says King.

The goal is to enable underground mining operations to advance further. King says many mining companies are automating vehicles so that people will no longer have to risk their lives by descending into mines. "Ultimately, I think the goal is to be able to run a mine remotely, from some centralized location. Maybe even a big city somewhere. You'd keep limited resources at the site just for maintenance and to make sure everything is running," he says.

In addition, robotics in mines makes sense from an economic standpoint. King says safety and logistic limitations make certain resources difficult — and expensive — to mine because the mine is either too deep or its location too remote. Part of the expense comes from adhering to government occupational health and safety regulations that require mine shafts to be 1.5 metres wider than the largest vehicle, to prevent workers from becoming trapped. As well, escape tunnels and ventilation systems must be installed for workers in order to limit exposure to diesel fumes. These factors, says King, make it very costly to put people underground.

King started Intrignia Solutions as an extension of the work he was doing to co-ordinate series of robots specifically geared to underground mining. He began his graduate work at IRIS — one of Canada's 20 federal Networks of Centres of Excellence — where he received the training necessary to make an impact in the robotics world.

Although robotics in mining is Intrignia's specialty, the foundation technologies for the ICCS can be applied to a number of different issues. "We hope to transfer our technology to other sectors. For example, the handling of wares, oil and gas, and other industries where human safety and cost are issues," says King.



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### GEOMATICS FOR INFORMED DECISIONS (GEOIDE)



### NEW COMPUTER PROGRAM TO TRACK ENVIRONMENT-RELATED HEALTH CONDITIONS

#### MESSAGE FROM THE MINISTER

New software is giving professionals in the environmental health field an important tool to help in decision making and improve treatment practices.

#### MESSAGE FROM THE CHAIR

Developed by a team of researchers from the Geomatics for Informed Decisions Network, one of Canada's 20 Networks of Centres of Excellence, the user-friendly software makes environment-related health data accessible via an interactive map interface.

#### THE NCE PROGRAM

The software uses statistical data extrapolated from various combinations of regional and temporal indicators to represent the distribution patterns of diseases such as cancer or contagious diseases. It also allows environmental tables to be created for the purpose of tracking the evolution of greenhouse gases or the dispersal patterns of pollutants in the air, water or soil.

#### THIS YEAR'S HIGHLIGHTS

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

The tool facilitates monitoring by providing access to high-quality data and even allows new research hypotheses to be formulated. "It's a rapidly expanding field," says Yvan Bédard, director of the Centre de recherche en géomatique at Université Laval. "The software allows us to eliminate the complexity inherent in these types of analyses and provides easy access to data that are normally not available in a single environment."

Professionals in the field of environmental health are consequently able to answer questions such as: What number of men have died of cancer of the respiratory system for a given year or region? For the following year? For the neighbouring region? For all regions? What are the concentrations of carcinogens in such or such a region?

Developed on the basis of data available in the Quebec health region, this general application software can also be used for research in other Canadian regions or even abroad. A partnership agreement was signed with a company in Montreal — Les Conseillers Khéops Technologies — to commercialize the software on the Canadian and American markets. As well, the Quebec Ministry of Health and Social Services, which collaborated in the research project, plans to implement the software throughout the province over the next year.

"The support we received from the Networks of Centres of Excellence Program has allowed us not only to support graduate students but also to recruit established researchers and to collaborate with specialists from the ministry and from the Institut national de la santé publique, says Yvan Bédard. "It's what has allowed us to go a lot farther."

[www.geoide.ulaval.ca](http://www.geoide.ulaval.ca)



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### MICRONET



### MICROCHIP DESIGN COMPANY ON THE CUTTING EDGE OF TECHNOLOGY

MESSAGE  
FROM THE MINISTER

MESSAGE FROM THE  
CHAIR

THE NCE PROGRAM

THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"

#### Spin-Off Company: Snowbush

A company named after a tropical plant found only in the South Pacific is developing some of the fastest analog-to-digital converters ever designed.

Started in 1998 by Ken Martin and David Johns, two professors of electrical engineering at the University of Toronto who are experts in mixed-signal integrated circuit design, Snowbush has provided design services to a variety of semiconductor companies. The companies range from large, established leaders to promising start-ups.

Snowbush — a spin-off of Micronet, one of Canada's 20 federal Networks of Centres of Excellence — is responsible for the hardware-design part of microchip design services known as transistor-level design. Snowbush's specialty lies within microchip design: analog and mixed-signal integrated circuit (IC) design. The technology is used in a number of everyday products, such as cellular phones, digital projectors, DVD players, and Ethernet connections.

Snowbush operates as a "contract research and development house." If larger semiconductor companies don't have the expertise or personnel available to do a project, they'll go to Snowbush and outsource their research and development in the area of chip design.

One of their original goals was to offer graduating students cutting-edge analog and mixed-signal design work in the Toronto area. Many of these students have been trained with the help of Micronet, which Johns says has prepared them for careers elsewhere. "When people go down to the States, it's not just for the money. They also want to work on very leading-edge technology work," says Johns, now the company's vice-president of technology.

The company already has a list of accomplishments and innovations to its credit. Snowbush has produced a chip for flat-panel displays that helps to replace a standard computer monitor with an LCD flat-panel monitor, which involves an analog-to-digital converter. A project that Johns says was very successful. Currently, they are working on high-speed data communications for next-generation disk drives — essentially a chip that helps to connect a computer's motherboard to the disk drive. Johns says Snowbush is also working with one of the world's leading semiconductor companies on one of the fastest analog-to-digital converters that's ever been designed.

[www.micronetrd.ca](http://www.micronetrd.ca)





## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### CANADIAN INSTITUTE FOR PHOTONIC INNOVATIONS (CIPI)



### COMBINING SUPERCOMPUTERS WITH THE MOST ADVANCED LASER TECHNOLOGY

#### MESSAGE FROM THE MINISTER

#### MESSAGE FROM THE CHAIR

#### THE NCE PROGRAM

#### THIS YEAR'S HIGHLIGHTS

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

World-class researchers and scientific breakthroughs at the Canadian Institute for Photonic Innovations, one of Canada's 20 federal Networks of Centres of Excellence, have helped to attract over \$1 million in sophisticated equipment to develop one of the country's most advanced supercomputing facilities.

In November 2001, IBM Canada donated 30 workstations and computing nodes for installation at the Theoretical Chemistry Laboratory at the Université de Sherbrooke. The new equipment will enable a research team, led by Dr. André Bandrauk, a Canada Research Chairholder in Computational Chemistry and Photonics, to further the work being done on simulating the dynamics of the interaction between intense laser fields and atomic or molecular systems. The equipment will increase the speed and power of the computer system used in Dr. Bandrauk's laboratory.

A world-leading expert in the area of high-performance computing, Dr. Bandrauk is recognized for a recent research breakthrough in collaboration with another network team led by Dr. Paul B. Corkum of the National Research Council's Steacie Institute in Ottawa. The two researchers are credited for combining the power of super computing and the latest laser developments to "control and manipulate" matter with lasers at the molecular level, both spatially and temporally. The research could lead to advances in materials technology, biophotonics and high-bandwidth telecommunications by using ultra-short lasers to image molecular structure and its evolution on a very short time scale.

The measurement of nuclear motion in molecules on an infinitesimal time scale was the result of highly sophisticated simulations by the Bandrauk group, and detailed measurements with current advanced laser technology by Corkum's group. "This revolutionizes the way we do research," said Dr. Bandrauk. "By using supercomputers and the most advanced laser technology, we can do computer simulations that open brand new research directions."

The IBM equipment will also be available to other network investigators involved in CIPI's research projects. IBM Canada joins over 40 affiliate members — all of them companies and research organizations working in the area of photonics — that support CIPI's projects through cash or in-kind donations.

[www.cipi.ulaval.ca](http://www.cipi.ulaval.ca)



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### CANADIAN INSTITUTE FOR TELECOMMUNICATIONS RESEARCH (CITR)



### THE GLOBAL RACE TOWARDS A BROADBAND WIRELESS STANDARD

#### MESSAGE FROM THE MINISTER

#### MESSAGE FROM THE CHAIR

#### THE NCE PROGRAM

#### THIS YEAR'S HIGHLIGHTS

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

A CITR researcher's work has been pivotal in altering the direction of international standards being established for fixed broadband wireless technology, an area with huge commercial potential.

It is expected there will be big markets for providing broadband services such as multimedia and high-speed data communications to homes and offices via the airwaves. An international body, a working group of the Institute of Electrical and Electronics Engineers — dubbed IEEE 802.16 — is racing to establish a global standard for the enabling technologies. The group's deliberations took a dramatic turn last year, in light of research by David Falconer of Carleton University.

"The development of international standards is critical to ensure that Canadian companies manufacturing wireless access equipment and systems can develop, design, and sell their products to a much larger market," explains Dr. Falconer. "In a proprietary environment, they would be faced with fragmented, and even more competitive, markets."

Initially, a single technology, orthogonal frequency division multiplexing (OFDM), monopolized consideration in the standards body. However, about two years ago a group of companies emerged that wanted to explore a second technological possibility, the use of well-known single-carrier systems.

Harris Canada — a CITR industrial affiliate — was familiar with the Network of Centres of Excellence's extensive research into broadband wireless communications and drew on the expertise of the investigator.

Professor Falconer did research and simulations to compare OFDM and single-carrier technologies (with frequency domain equalization). He showed that single-carrier systems are equal to OFDM in performance and most other attributes. But there is one big difference. Single-carrier systems require less expensive power amplifiers, which is important since every wireless terminal contains an amplifier and it is among the costliest components.

Professor Falconer's research drew the attention of one of the world's foremost high-tech commentators, George Gilder. In his newsletter in March 2000, Mr. Gilder cited the CITR researcher's work as a caution against "the sometimes spectacular claims" of OFDM backers.

The IEEE 802.16 group was impressed, too. It has endorsed both OFDM and single-carrier technologies in a draft standard that is now in the last sponsor ballot stage before finalization, which is expected in late 2002 or early 2003.

In another North American first, Carleton's CITR-affiliated Broadband Communications and Wireless Systems research team, directed by Dr. Falconer, has joined an international consortium of companies, research organizations, and universities — the Wireless World Research Forum — to discuss and lay the groundwork for wireless systems that will dramatically enhance existing multimedia and videoconferencing applications.

"The fourth generation will make these systems available anywhere at anytime," explains Dr. Falconer. "And we want to make sure Canadian companies have access to the knowledge and technologies to take advantage of their tremendous potential."

[www.citr.ece.mcgill.ca](http://www.citr.ece.mcgill.ca)



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### MATHEMATICS OF INFORMATION TECHNOLOGY AND COMPLEX SYSTEMS (MITACS)



#### USING MATH TO SPEED AIR TRAVELERS THROUGH ENHANCED SECURITY CHECKPOINTS

##### MESSAGE FROM THE MINISTER

In response to the events of September 11, airports around the world have implemented new and tighter security restrictions for the safety of passengers and workers.

##### MESSAGE FROM THE CHAIR

Before passengers are allowed to board their flights, each has to pass through metal detectors and have all hand-carried items X-rayed. Security personnel inspect all electronic and battery-operated items, and have passengers turn on all laptops and PDAs (personal digital assistants) before boarding the planes. The predictable result has been longer queues and waiting times for passengers.

##### THE NCE PROGRAM

##### THIS YEAR'S HIGHLIGHTS

##### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

In its search for ways to speed up pre-boarding screening, while maintaining high levels of security, the Vancouver Airport Authority has turned to the experts at MITACS — one of Canada's 20 Networks of Centres of Excellence — and Dr. Martin Puterman, Professor of Operations and Logistics and Director for the Centre of Operations Excellence at UBC.

"What we're doing is using math to help shorten lines without reducing security," says Dr. Puterman.

The network put together teams of students and faculty and sent them to the airport to observe passengers as they moved through security clearance lines. They carefully timed how long each step in the process took, recording data that later revealed bottlenecks in the system. Of particular note, they found business travelers took far longer to get through lines, because they had to turn on their laptops and cell phones and often had to be re-screened.

After months of study, the team was ready to produce mathematical models to create a simulation of the airport security procedures.

The study resulted in a computer simulation that follows the path passengers take through the screening system at one gate, and records the time it takes for them to get through the system. This allows the network project team to identify the areas that cause delays, and allows them to suggest improvements to the system. The simulation also enables them to predict the optimal number of staff required at each stage of the screening process.

In less than a year, Dr. Puterman and his team have developed a system that is already earning them high praise from their industrial partners. "The team has done an excellent job of putting together a simulation model of the pre-board screening process at Vancouver International Airport," says Paul Levy, Director of Security and Emergency Planning at the Vancouver International Airport Authority. "This has a great deal of benefit to the airport now and in the future. It's something that will be around for many years."

[www.mitacs.math.ca](http://www.mitacs.math.ca)



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### NETWORK IN AQUACULTURE (AQUANET)



#### ATLANTIC SALMON SWIM BACK TO GREAT LAKES

#### MESSAGE FROM THE MINISTER

Once abundant in Ontario, Atlantic salmon disappeared from our lakes at the end of the 19th century due to over fishing and habitat loss. Since then, Pacific salmon species like chinook and coho have been used to stock Ontario lakes for sports fishing.

#### MESSAGE FROM THE CHAIR

But despite efforts to re-introduce Atlantic salmon to its natural Ontario habitat, its Pacific cousin may actually be preventing the stock from recovering. University of Western Ontario zoology professor and AquaNet researcher, Dr. Robert Scott, is trying to determine the effect that these Pacific salmon have had on attempts to restore the native Atlantic salmon to Lake Ontario.

#### THE NCE PROGRAM

#### THIS YEAR'S HIGHLIGHTS

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

What have the researchers with the Network of Centres of Excellence learned so far? Preliminary results indicate that the Pacific chinook set up social hierarchies, showing little regard for the Atlantic salmon. In fact, the Pacific salmon physically and aggressively displace the Atlantic salmon whenever they're in the way. As a result, the Atlantic fish have to find a new area, setting off a chain reaction of aggression.

"There have been many attempts to restore Atlantic salmon, and all have been met with little to no success," says Dr. Scott. But there's no indication that the researchers have given up on finding a solution. They are already looking at behavioural interactions between the two fish types, and have recently begun examining spawning habitat characteristics and juvenile foraging behaviour.

Dr. Scott and his team first began the project in the fall of 2000 by examining the interactions between the Atlantic and Pacific salmon on spawning grounds in a creek that flows into Lake Ontario near Oshawa. The creek was divided into sections, with Atlantic salmon in all of the sections and Pacific chinook salmon in only half. Their goal was to observe how the Atlantic salmon behaved both alone and with Pacific salmon around.

When the Atlantic salmon were alone, says Dr. Scott, they were much more relaxed. That's because the Atlantics normally set up their own hierarchy. In the presence of Pacific juveniles, however, this hierarchy is disrupted and juvenile Atlantics spend more time being aggressive toward one another rather than feeding. The fish tended to follow a cycle of fighting and settling down.

In the spring of 2001, the researchers began examining juvenile foraging behaviour. Since Pacific salmonids are all stocked as juveniles, they compete for the same food as the Atlantic juveniles. If the Pacific juveniles show the same aggressiveness as the adults and manage to deprive the Atlantic juveniles of food, Dr. Scott says the Atlantic fish would have no chance of survival and this could explain why the restoration efforts are failing.

Ultimately, the researchers hope to create a sophisticated model that can be used to make predictions about whether a river can support Atlantic salmon. "We need to know two things about the fish interactions: first, what are the potential outcomes when an Atlantic salmon meets a Pacific salmonid? And second, how common is each outcome?" states Dr. Scott. "When we have all the answers, we'll be able to develop the model."

[www.aquanet.ca](http://www.aquanet.ca)



SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

SUSTAINABLE FOREST MANAGEMENT NETWORK (SFM)



**BATTLING BUGS  
HELP MAINTAIN  
A HEALTHY CANADIAN FOREST**

**MESSAGE  
FROM THE MINISTER**

Logging and forest management practices could have a direct impact on devastating forest tent caterpillar outbreaks in the boreal forest.

**MESSAGE FROM THE  
CHAIR**

Dr. Jens Roland, an insect population ecologist at the University of Alberta and a researcher with the Sustainable Forest Management Network, one of Canada's 20 federal Networks of centres of Excellence, has discovered a correlation between forest tent caterpillar infestations and the amount of forest left standing after an area has been harvested. The caterpillars are a principal defoliating insect of trembling aspen in the boreal forest across the country.

**THE NCE PROGRAM**

**THIS YEAR'S HIGHLIGHTS**

Dr. Roland's work suggests that a forest tent caterpillar outbreak and the rate of collapse is a critical indicator of the overall health of Canada's aspen boreal forest. His work also provides various new options for forest managers who would like to minimize the effects of the caterpillar outbreaks, which normally have 10-to-12-year cycles.

**SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"**

"During a major outbreak, forest tent caterpillars can completely defoliate an aspen forest and virtually stop its growth," says Dr. Roland. "But while we can't stop a tent caterpillar infestation, we don't want to do anything to prolong it either, such as rendering its natural enemies ineffective through the effects of altered forest structure."

The research has focused on four species of parasitic flies that are the main enemy of these caterpillars, as well as various viral diseases that also kill forest tent caterpillars. The research also showed that larger forest stands provide the environment needed for the tent caterpillar enemies to reduce the duration of outbreaks.

"We were aware that forest cover has an impact on the search behaviour of these flies as they attempt to find their prey, and on the rate at which viruses spread," explains Dr. Roland. "We may want to avoid having lots of small forest stands left behind. We need to log in a way that leaves areas large and contiguous so the normal processes can function."

And because the disease and parasites are so tightly linked with the tent caterpillar (their main source of food), they enter a cyclic pattern — where the tent caterpillars increase, then a year or so later the parasites and disease start to increase. "We think that fragmentation of forest stands in some way decouples the tent caterpillar from its natural enemies. Their natural enemies are less able to respond numerically to the forest tent caterpillar outbreak, and then there's a longer lag and the outbreak lasts longer in those fragmented stands."

Roland and his team of researchers sampled 127 sites covering an area of 400 square kilometres near Ministik Hills, Alberta. They studied aspen stands ranging in size from as small as .28 hectares to 289 hectares. "What we determined," said Roland, "is that for the parasites and the viruses to be most effective, the size of the forest stand should be a minimum of about 100 hectares. Smaller forest stands serve as a caterpillar refuge because of less effective natural enemies — helping to extend the length of the infestation by several years."

[www.ualberta.ca/sfm](http://www.ualberta.ca/sfm)



SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

MECHANICAL WOOD-PULPS NETWORK (MWPN)



SMALL COMPANY HELPING  
TO IMPROVE PAPER QUALITY  
WORLDWIDE

MESSAGE  
FROM THE MINISTER

MESSAGE FROM THE  
CHAIR

THE NCE PROGRAM

THIS YEAR'S HIGHLIGHTS

SUCCESS STORIES -  
"FORGING INNOVATION  
NETWORKS"

Demonstrating that it has the expertise to compete with the very best from around the world, a company in Hawkesbury, Ontario, leads in the global paper market with an innovative technology that is helping paper mills detect flaws earlier in the papermaking process.

First started in 1992, OpTest is a high-tech manufacturing company based in optics and image analysis that has turned into a Canadian success story. It regularly does business in 34 countries all around the world, with customers ranging from pulp and paper mills to research and development centres in pulp, paper, and allied industries. OpTest also has a close affiliation with the Pulp and Paper Research Institute of Canada (Paprican), and through it, the Mechanical Wood-Pulps Network, one of Canada's 20 federal Networks of Centres of Excellence.

Roland Trepanier, OpTest's president, says the company's goal is to develop and commercialize useful technology that paper mills can introduce as early as possible in the papermaking process. If they can make changes and adjustments early in the process, before it's too late, they can get quality results more frequently. The benefits? Less wasted paper that doesn't meet the standards specified in the buyer's original order. And paper wouldn't have to be downgraded and shipped to another buyer at a loss because of inferior quality.

The product that OpTest is best known for is the Fibre Quality Analyzer (FQA), for which it shared the 1998 University-Industry Synergy Award for R&D Partnership with Paprican and the University of British Columbia. The FQA went to market in 1995-96 and has sold nearly 100 units since. Trepanier says that an unexpected and important benefit of OpTest's relationship with the NCE is that it has raised the company's profile within Canada, helping it to find new opportunities to transfer technology from the lab to industry.

Trepanier says the FQA is an important product for OpTest, allowing it to break into new markets, and giving it access to export markets for its other products. In fact, OpTest exports about 75 per cent of its products, with half of that product going to the United States and half overseas. It develops and markets its products around the world and sells to other companies that deal in the paper industry and measure quality attributes.

And the company is expanding its product lines. January 2002 marked the launch of the new and improved High Resolution FQA, which Trepanier says measures greater sensitivity and resolution. OpTest's newest commercial product is the Paper Perfect Formation Analyzer, which monitors the uniformity of paper formation. Trepanier says that they are also working on a number of in-house projects that are moving their technology from the lab to the floor. This could end up benefiting the paper mills, allowing them to continuously make on-line or process measurements, and to potentially save money.

"All the new things we've been working on have been trying to push that barrier closer to the forest," concludes Trepanier.

[www.wood-pulps.org](http://www.wood-pulps.org)



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### CANADIAN WATER NETWORK (CWN)



### SHEDDING LIGHT ON WALKERTON'S LAST MYSTERY

#### MESSAGE FROM THE MINISTER

#### MESSAGE FROM THE CHAIR

#### THE NCE PROGRAM

#### THIS YEAR'S HIGHLIGHTS

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

Canadians in communities all across the country are concerned about the safety of the water they drink.

During the two years after the tragedy in Walkerton, Ontario, judicial inquiry officials turned to researchers to understand how contaminants seeped into the public waterworks, killing seven and making 2,300 others sick. Their goal was to understand how hazardous bacterial contaminants originating in cattle manure in a field ended up threatening the entire farming community.

Results of the judicial enquiry pointed to heavy rains in early May of that year that contributed to the spread of *E. coli* O157:H7 and *Campylobacter jejuni*. But how the actual contamination process happened is still a mystery.

"The fact is, we don't understand the pathway," said Dr. Robert Gillham, a University of Waterloo professor and scientific director of the Canadian Water Network.

Dr. Gillham, along with Waterloo colleagues Peter Huck, Dr. Steve Rhudey, Dr. Judith Isaac-Renton — all CWN researchers — and University of Guelph professor Michael Goss, provided expert testimony and assistance to the inquiry during its hearings in Walkerton.

Three possible pathways were identified during the course of the investigation. Contaminated water could have seeped through the soil around the farm on its way underground to Well 5. It could have flowed overland and inundated the area around the well before being drawn in through neighbouring springs. Or it could have been directly channeled to the fractured bedrock and into the well through a direct breach in the soil above the bedrock.

While a hydrogeological report prepared for the inquiry by consulting engineers suggested that either overland or underground flow could be to blame, most experts, including Dr. Gillham, discounted the overland theory. "You can almost think of it as running through a pipe," said Dr. Gillham. "It would take as long as a year for bacteria to seep through the soil before reaching the bedrock, meaning that it would likely die off before reaching Well 5."

But a definitive conduit was never found, and the technical uncertainties remain.

Although groundwater experts admit there are some questions that will likely never be fully answered, researchers at the Canadian Water Network are studying the impact of declining water levels in central Canada, and outbreaks of emerging pathogens in Canada's water supply. Their research is also supporting the development of public policies that have a direct impact on the safety of Canada's drinking water and the sustainability of Canada's water resources.

[www.cwn-rce.net](http://www.cwn-rce.net)



## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### AUTOMOBILE OF THE 21ST CENTURY (AUTO21)



### SATELLITE TECHNOLOGY COULD HELP BUILD BETTER, SAFER CARS

#### MESSAGE FROM THE MINISTER

Navigational satellites orbiting 20,000 kilometres above the Earth have the potential to revolutionize the automotive industry and help build "smart" cars for the 21st century.

#### MESSAGE FROM THE CHAIR

Dr. Elizabeth Cannon, a University of Calgary geomatics engineering professor and a researcher with the AUTO21 network — one of Canada's 20 federal Networks of Centres of Excellence — has seen the potential that these satellites hold for developing innovative applications for the automotive industry.

#### THE NCE PROGRAM

#### THIS YEAR'S HIGHLIGHTS

Dr. Cannon says she is excited about capitalizing on the unparalleled ability of these satellites to help us locate and position ourselves here on Earth-from space. "GPS totally captured my imagination. I thought, if I can get involved with this, I don't know how it will impact society, but I knew it was going to in major ways."

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

In 2001, Dr. Cannon was the first female recipient of the Johannes Kepler Award, the world's most prestigious satellite navigation prize. She considers her contribution to the AUTO21 research program as a natural extension of her award-winning research in satellite navigation. "We already have systems in cars, particularly in Japan, that allow you to navigate between points A and B," explains Dr. Cannon. "They work reasonably well. Now we're at the point of asking, "What else can we do?"

One answer may turn out to be autonomous hands-free driving using an automatic pilot. "If I had a database of the locations of various stores and services, I could program my system to navigate my way there," says Cannon. A vehicle equipped with a wireless Internet connection could provide the driver with anything from real-time traffic information, to what the latest specials are in various stores. The driver could then make decisions based on the data.

"One of the real challenges is that GPS is a line-of-sight system," she says. "This makes it difficult to use in urban areas. So the question is how can we mitigate its limitations by integrating it with other systems?" Working with the DaimlerChrysler Corporation, Dr. Cannon is exploring ways of combining GPS with existing, commercially available, inertial navigation systems — sensors inside a vehicle that record its rate of acceleration and direction. Her work is focused on developing algorithms and error modeling that will provide the best mathematical ways for merging the two different types of information provided by GPS and inertial systems.

Applications of this work include the development of "collaborative" driving systems that can instantly calculate the distance between cars on a clogged freeway. "We want to develop a car-based system that would allow it to continuously position the vehicle to centimetre-level accuracy in real-time," says Dr. Cannon.

While this highly precise positioning is probably more than what's needed for getting to the corner store, it's the kind of ability that opens up whole new realms of possibilities for the driving experience of the future.

[www.auto21.ca](http://www.auto21.ca)





## SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

### INTELLIGENT SENSING FOR INNOVATIVE STRUCTURES (ISIS)



### STUDENTS WORKING ON-STATE-OF-THE-ART BUILDING TECHNOLOGIES

#### MESSAGE FROM THE MINISTER

A student competition for the design of a pedestrian bridge has given participants the chance to demonstrate the potential applications of the new generation of structural technologies.

#### MESSAGE FROM THE CHAIR

Organized by the Intelligent Sensing for Innovative Structures network, the goal of the competition was to design a 6-metre long covered pedestrian bridge, which is to lead to the new entrance of the Faculty of Engineering of the Université Sherbrooke.

#### THE NCE PROGRAM

One benefit of the competition was to give students and student members of ISIS Network the chance to participate in the design of a structure that makes use of composite materials and that offers the possibility of integrating new fibre optic sensing technologies.

#### THIS YEAR'S HIGHLIGHTS

#### SUCCESS STORIES - "FORGING INNOVATION NETWORKS"

The composite materials for the structures and the fibre optic sensing technology are in fact the two principal axes of the ISIS network, one of Canada's 20 federal Networks of Centres of Excellence. The winning team — from Queen's University — was invited to participate in the final design project in collaboration with the engineering firm hired to carry out the project.

"It's a project that involves a significant transfer of experience," says Pierre Labossière, professor in the Department of Civil Engineering at the Université Sherbrooke. "The field of civil engineering is quite conservative, and the project allows us to show under real conditions the potential of applying new technologies and using new products developed by network researchers."

The aim of research in the field of civil engineering is to constantly improve commercially available products and technologies.

"The project creates an interesting synergy between network and industry researchers by allowing them to evaluate the performance of composite materials and fibre optic sensors incorporated into the structures — two types of product developed and commercialized by the network's industrial partners," adds Dr. Labossière.

The new pedestrian bridge, built during the summer of 2002, will be equipped with a camera and fibre optic sensors capable of measuring the stresses on its various structural elements. An accelerometer integrated into the bridge floor will also measure the dynamic behaviour of the structure. This instrumentation will allow designers to display in real time the behaviour of the working structure. The data gathered about the bridge will eventually be posted on the Web so that it can be used in future research projects.

"This is not only an important pilot project in the field of civil engineering and for network technologies, but it is an important learning tool for undergraduate students who are being exposed to structural design," concluded Dr. Labossière.

[www.isiscanada.com](http://www.isiscanada.com)