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# POWERFUL PARTNERSHIPS

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# Networks of Centres of Excellence of Canada

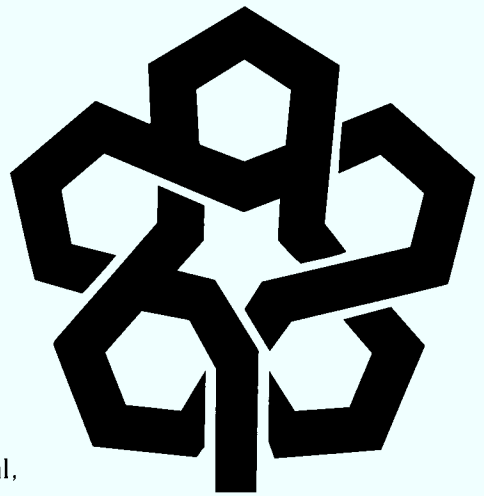
## A NEW APPROACH

The Networks of Centres of Excellence (NCE) program is an intensive national R&D team effort aimed at enhancing Canada's industrial competitiveness and social well-being in a new global economy.

This \$240 million program is a unique initiative by the Government of Canada that draws together many of the country's top researchers from universities, industry, and government to work in partnership on research challenges and opportunities that are vital to Canada's future prosperity and quality of life.

Each of the fifteen NCEs is a nationwide network pursuing leading-edge research in an area of strategic importance to Canada, and working with industry to create commercial opportunities out of the results. Their aim is to generate a synergism of excellence and collaboration in research, to provide internationally-competitive environments for young Canadian researchers, and to accelerate the diffusion of knowledge and the transfer of new technology to the private sector.

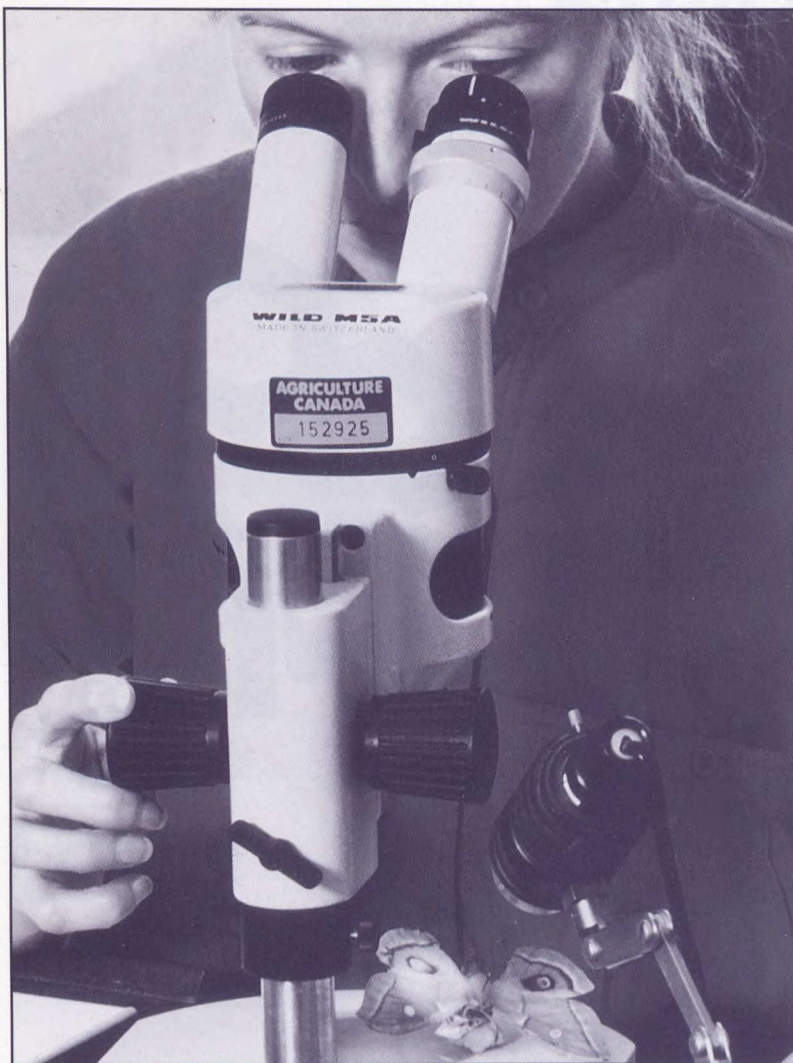
The launching of the NCEs in 1990 marked the beginning of a new era of collaborative research and technology development for Canada. Over five hundred and fifty of Canada's leading researchers in the natural, medical, and social sciences, as well as in the humanities and engineering are involved in the program.



*The NCE program is  
an intensive national  
R&D team effort.*

## A POSITIVE DIFFERENCE

A recent United Nations survey concluded that, of all member states, Canada is among the best in which to live. Our ability to maintain and improve this nation's standard of living depends on investing in targeted areas of R&D in science, engineering and the humanities. It is through this investment that our nation can generate the expertise and new products and wealth we need to achieve international competitiveness, sustainable development and a better quality of life.



Each Network is pursuing leading-edge research of strategic importance to Canada.

The Government of Canada announced the NCE program in 1988 as a major component of the federal strategy for science and technology — InnovAction. An invitation was issued to Canadian universities, industry, and government research centres to integrate their existing centres of research expertise across the country

into effective national networks — Networks of Centres of Excellence.

Following a rigorous peer review involving teams of international experts, fifteen NCEs were chosen out of 158 applications, to meet specific objectives:

- ◆ to stimulate leading-edge fundamental and long-term applied research of importance to Canada;
- ◆ to train and retain world-class scientists and engineers in fields that are critical to Canada's industrial competitiveness and quality of life;
- ◆ to integrate excellent Canadian research and technology development efforts into national networks with the participation and partnership of universities, the private sector, the federal government and the provinces;
- ◆ to develop strong university-industry partnerships to accelerate the diffusion of advanced knowledge to industry.



# The Network Strategy

## MEETING CANADA'S CHALLENGES

As a nation, Canada faces special challenges. Our population is spread across an enormous landmass. We embrace five time zones, three oceans and a multitude of climates and geographies. Moreover, Canada is a trading nation. Our small population dictates that we must compete for larger markets abroad. This means our products must be competitive internationally in quality, price and performance.

The NCEs are tackling these challenges by exploiting research excellence in labs in all parts of the country, and by forming collaborative partnerships with industry to turn quality research results into quality goods and services.

The emphasis on networking and partnerships gives the nation's top researchers the opportunity to share ideas and develop new cooperative approaches to problems. It helps increase the academic community's awareness of industry's needs and encourages both sectors to join forces to enhance Canadian excellence and competitiveness.

**To implement this innovative plan, Canada's three granting councils — the Natural Sciences and Engineering Research Council (NSERC), the Medical Research Council (MRC), and the Social Sciences and Humanities Research Council (SSHRC) — and the federal department of Industry, Science and Technology Canada, have linked efforts to support and oversee the NCE initiative. The councils have strived for years to establish a strong national base of research excellence; the NCE mission is closely tied to their endeavours to promote multi-disciplinary research and fund partnerships among academic, industrial and government sectors.**

## BUILDING ON STRENGTHS

Research in science and engineering has helped Canada to exploit and manage this country's natural endowment, and to develop new goods and services for the benefit of all Canadians as well as the rest of the world. Research in the social sciences and humanities has helped to shape our social and cultural institutions. But as the pace of international competition quickens, so does Canada's need to identify new opportunities and to invest in the research that enables us to develop sophisticated new goods and services.



*Business and research  
communities establish  
priorities together.*

Fostering strength through teamwork is the winning strategy of the Networks. Existing centres of research are linked together from coast to coast to forge a whole that is larger than the sum of its parts. In each NCE, teams of research

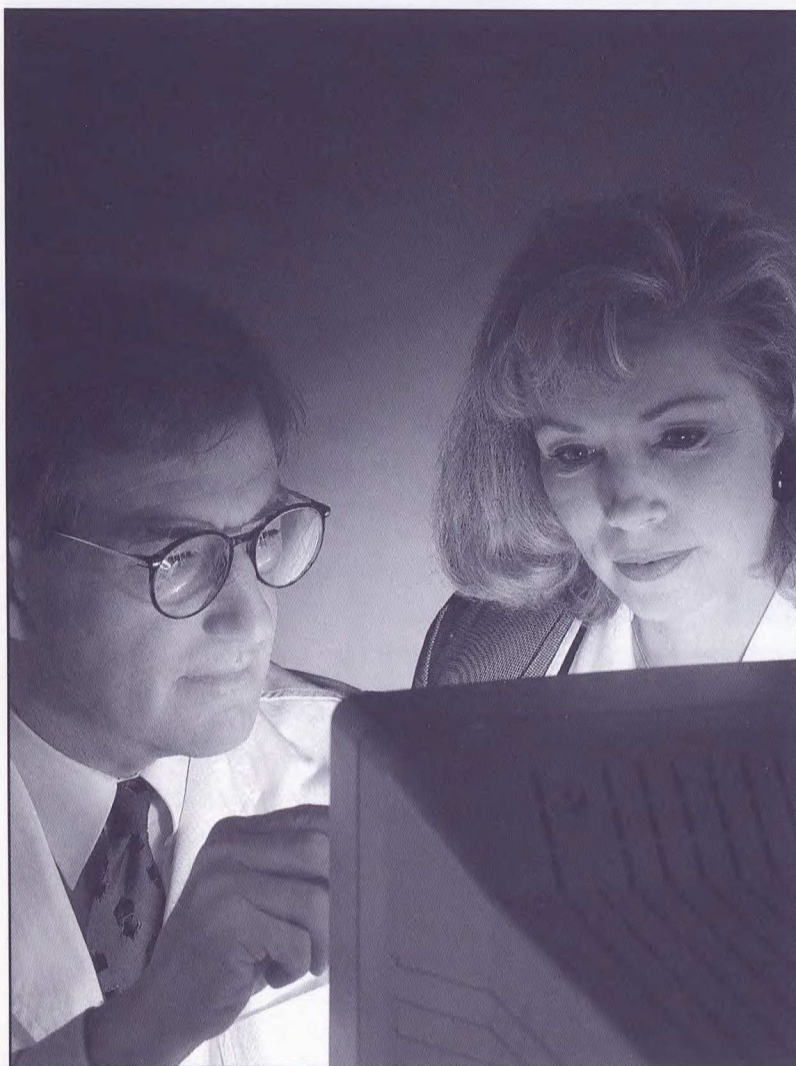
specialists combine their complementary skills and talents to work together on common goals.

Training of highly qualified scientists and engineers to provide the next generation of research specialists for Canadian business, university and government laboratories is an important priority for the Networks.

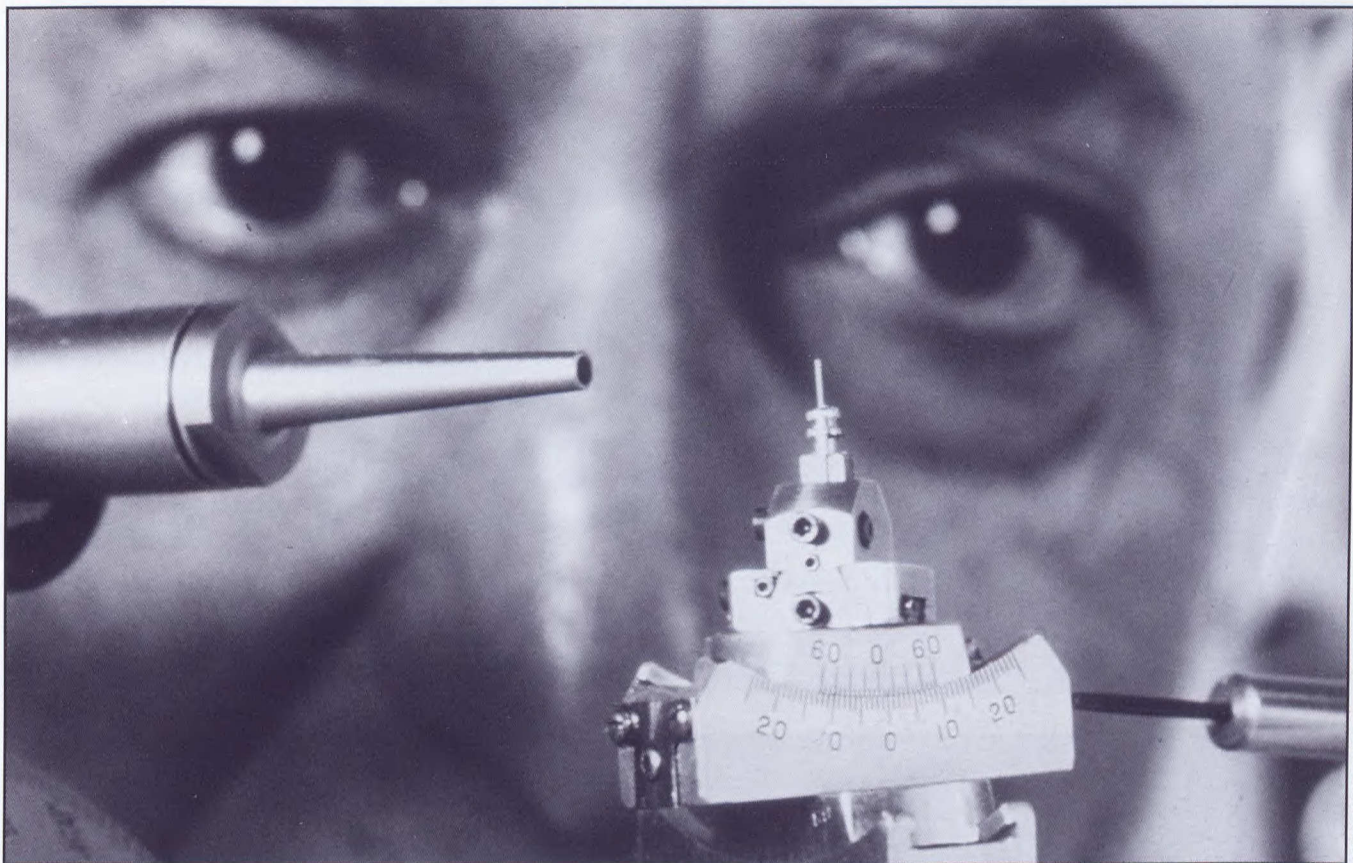
### **A SPECIAL PLACE FOR INDUSTRY**

The NCE program combines research and business. It challenges researchers to break down barriers between disciplines, ideas, institutions and sectors to help build a critical mass of expertise in vital and promising areas of research. It also provides the opportunity for industry to gain immediate access to this valuable expertise and research, and to decide on research priorities together with Canada's top university researchers. Representatives from both the private and public sectors on each NCE Board of Directors provide direction and support to ensure that the Network achieves its objectives.

The Networks are continuously striving to respond to industry's challenges and to extend existing university-industry interactions. Ultimately, the NCEs' success in accelerating the creation, diffusion and







COURTESY OF NATIONAL RESEARCH COUNCIL CANADA

application of advanced knowledge and new technologies will depend upon effective collaboration between universities and private enterprise.

**NCEs offer industry:**

- ◆ immediate access to leading-edge research
- ◆ access to intellectual property
- ◆ direct involvement in research essential to industrial competitiveness

- ◆ access to world-class expertise
- ◆ advanced research facilities and equipment
- ◆ opportunities for recruitment of highly qualified personnel
- ◆ access to national research networks and major international centres
- ◆ opportunities to influence research direction and priorities.

*NCEs offer industry  
immediate access to  
leading-edge research.*

# Targeted Research That Benefits Canadians

The 15 NCEs are conducting pre-competitive research in nine major areas: space, robotics and intelligent computer systems, telecommunications and microelectronics, medical research and health care, human genetic diseases, human aging, natural resources, biotechnology, and advanced industrial materials and processes.

*Network scientists are building on Canada's successes in space and atmospheric investigations.*

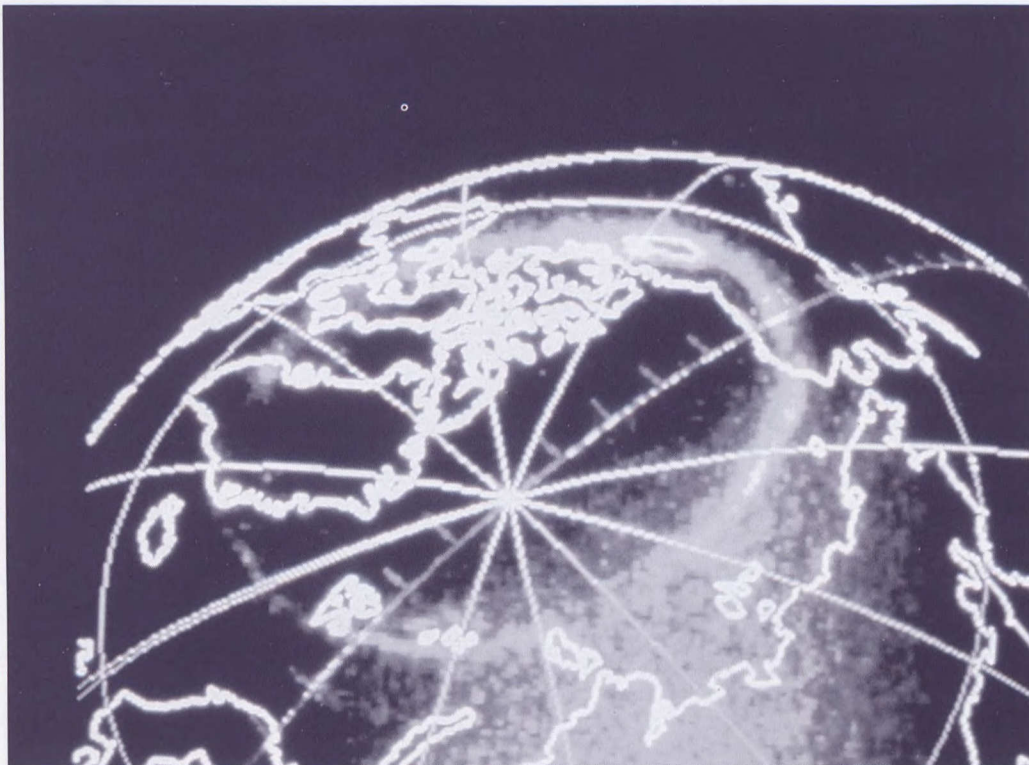
## CANADA IN SPACE

Canadian space scientists have acquired a strong international reputation for

excellence in the field of space research. From the Alouette satellite program of the sixties to participation in present-day multinational space ventures such as the NASA UARS spacecraft, Canada can claim a string of brilliant successes in space and atmospheric investigations.

▶ The Canadian Network for Space Research is undertaking an ambitious program whose goals include seeking a better understanding of how the plasma of the space environment affects satellites and causes spacecraft to deteriorate.

The Network is also using remote sensing techniques to monitor the high atmospheric processes that play a key role in global climatic change and ozone depletion. Expected industrial benefits will include the development of innovative technologies for space vehicles, space instruments and ground-based support.



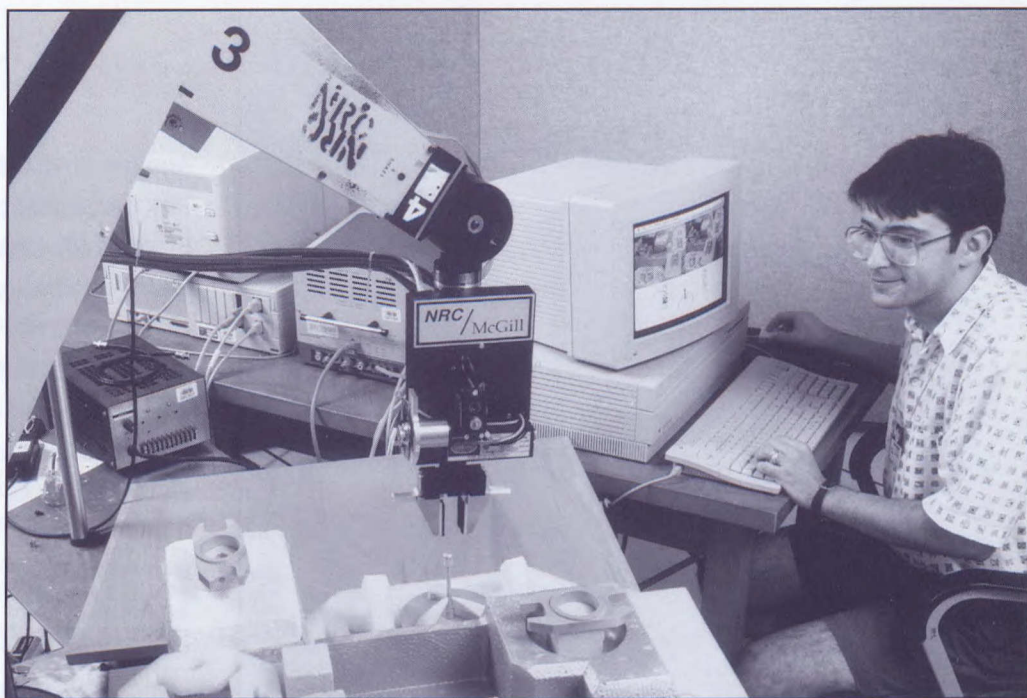
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## ROBOTICS AND "INTELLIGENT" SYSTEMS

The explosion of knowledge in computer technology and its economic impact on a global scale is an important example of how consumer goods arising from the innovative research of scientists and engineers can generate prosperity for a trading nation. The use and development of "intelligent" systems of all kinds will play a major role in keeping Canadian industry competitive.

▶ The Institute for Robotics and Intelligent Systems (IRIS) is focusing research on three key related areas involving advanced high-performance robotics and expert systems: computational perception, knowledge-based systems, and intelligent robotic devices. These are the essential elements of a computer system's ability to perceive, to reason, to plan, and finally, to act. Specific niches for Canada include research on robotic devices for use in difficult and hazardous environments.



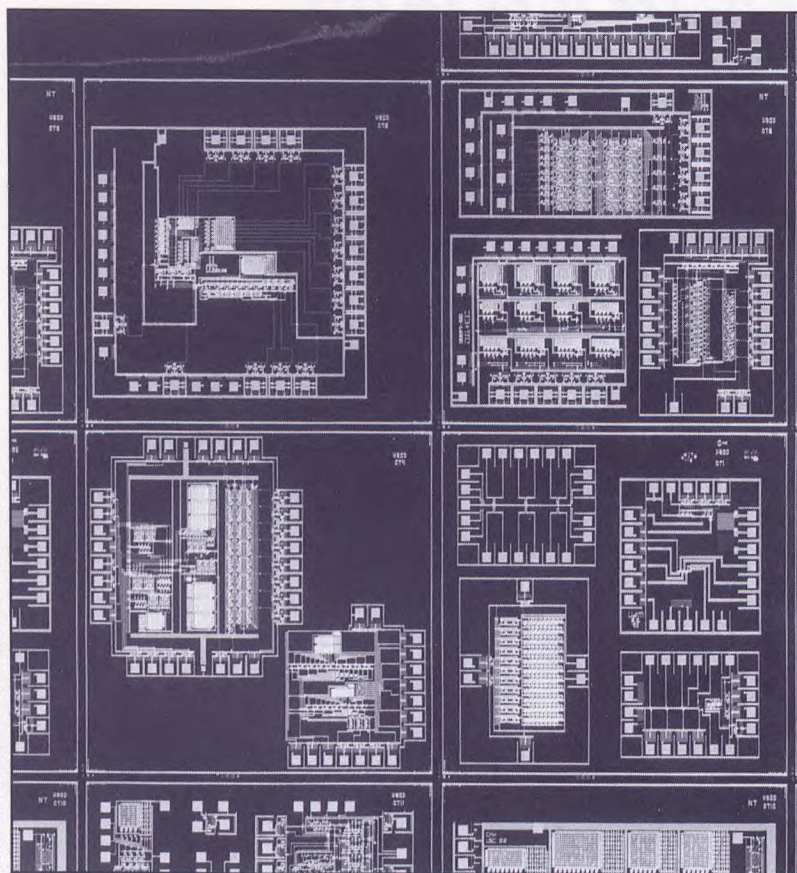
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## TELECOMMUNICATIONS AND MICROELECTRONICS

Two NCEs are exploring advanced technologies in two separate, but related, fields that are vital to the future of Canadian industry: telecommunications, which Canadians have built into a world-class industry; and microelectronics. The Canadian Institute for Telecommunications Research (CITR) is aiming its research at an exciting 'Network of the Future,' which promises users instant and transparent access to any type of telecommunications service — including voice, image, data and multi-media services. CITR's highly coordinated effort is aimed at maintaining and boosting Canada's world leadership in telecommunications services and manufacturing.

*NCE research in  
robotics contributes  
to keeping Canadian  
industry competitive.*





Another Network — Micronet (Microelectronic Devices, Circuits and Systems for Ultra Large Scale Integration 'ULSI') is developing the next generation of microelectronic systems, which will have important applications in the communications and computer industry. Part of the technological challenge includes squeezing more than ten million functioning electronic components onto a microchip layer smaller than a fingernail and thinner than soap film, technically referred to as ultra large scale integration.

▶ Micronet's leading-edge research includes designing complex miniaturized integrated devices, circuits and systems on a microchip, and using semiconductor technologies with minimum component dimensions of less than one micrometer. The technology is expected to become the mainstay of the next generation of communications and computer systems.

## MEDICAL ADVANCES AND HEALTH CARE

Three NCEs, each drawing together leading Canadian researchers, are working to accelerate advancements in critical areas of medical research and health care, including neural repair, respiratory problems, and bacterial diseases.

▶ NCE research has important applications in the communications and computer industry.

▶ CITR's development of the 'Network of the Future' involves two important concepts that are stimulating the creation of new telecommunications products and services: bandwidth-on-demand and enhanced personal communications. Bandwidth-on-demand refers to the ability of a network to handle any communications request instantly, including high-speed data, image and video services. Enhanced personal communications refers to the capability of users having instant access to a variety of telecommunications services at any fixed or moving location.

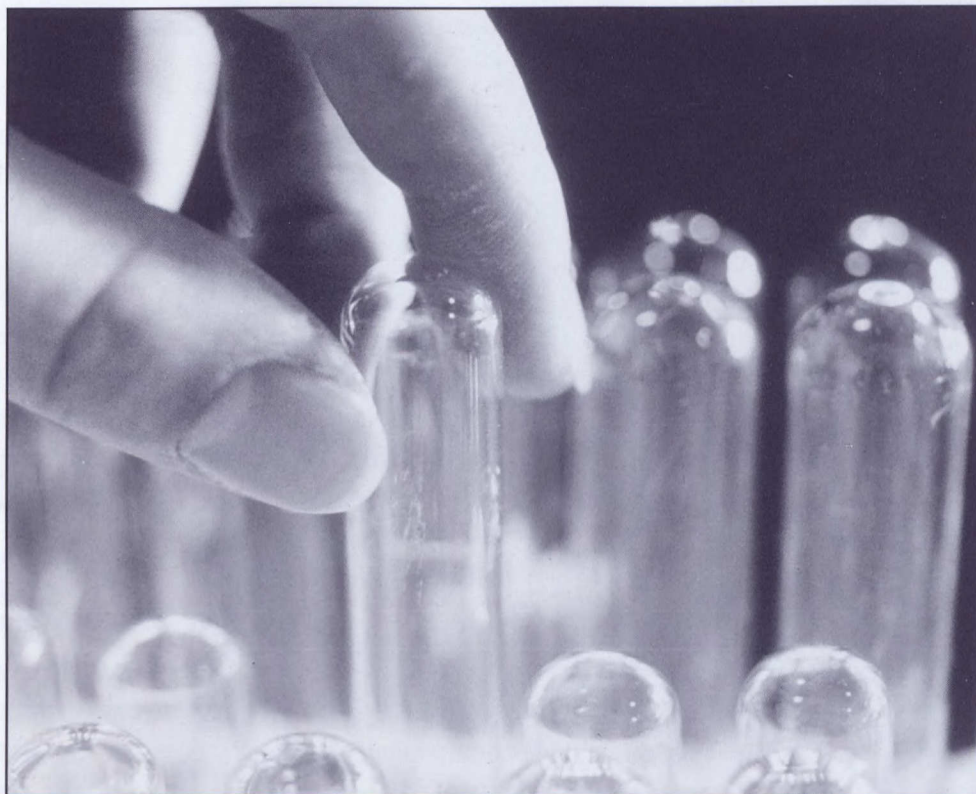


Each NCE is using and developing new research technologies to gain a better understanding of one of these disorders, which exacts untold human suffering and losses in the workforce. While researching the underlying causes of the disorders, each NCE is also focusing on improved treatment and patient care, which can reduce health care costs and open commercial opportunities for Canada.

▶ The N.R. Network (neural regeneration and recovery) is striving to understand better how the central nervous system works and what is required to restore function after eye, brain or spinal cord damage. The research carried out by investigators in this Network has important implications for the management and treatment of neurological trauma, stroke and crippling diseases such as Alzheimer's and Parkinson's.

▶ The Respiratory Health Network is developing innovative solutions for the treatment and prevention of breathing problems caused by diseases or environmental factors. The Network's diverse research projects are grouped within five main themes: lung structure and function, disease diagnosis, pharmacologic therapy, air quality in homes and buildings, and patient rehabilitation. Products range from kits for rapid diagnosis of viral lung infections, to improved heating, ventilation and air conditioning systems.

*Network collaboration  
is accelerating  
research in critical  
areas of medicine and  
health care.*



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*Advanced research  
enhances the quality of  
life of Canadians.*

▶ The Canadian Bacterial Diseases Network (CBDN) is investigating key aspects of bacterial infections through a focused study of bacterial attack and host response in humans, animals, and plants. CBDN research presents both a major challenge and a commercial opportunity. The Network is addressing the pressing demand for new vaccines, antibiotics and diagnostic kits. Researchers are also investigating bacterial kidney disease in fish, and shipping fever in cattle, which cost Canada millions of dollars annually.

### **HUMAN GENETIC DISEASES**

Contributions by Canadian scientists to the detection and understanding of genetic diseases have brought this country

international acclaim. The Canadian Genetic Diseases Network brings together many of these world-class researchers and industrial partners to focus on devastating and common genetically transmitted diseases. Through this cooperative venture, the Network is providing new insights into the causes and treatment of disease, as well as exciting new technology development opportunities.

▶ The Canadian Genetic Diseases Network's projects involve investigating genetic predisposition to diseases such as cancer and heart disease, and identifying the specific genetic abnormalities that cause diseases such as cystic fibrosis, muscular dystrophy, and Huntington's disease. The Network's activities will have a significant impact on disease detection and therapies as well as new technology for the Canadian health care industry.

### **THE CHALLENGES OF GROWING OLDER**

By the year 2030 it is predicted that one Canadian in four will be over the age of 65. The goal of CARNET: The Canadian Aging Research Network is to investigate



conditions that can help Canadians maintain and enhance their productivity and independence in their later years. Extended benefits include mitigating health and social care costs, and maintaining Canada's internationally competitive stronghold with the support of a healthy and active aging population. Ultimately, this Network is addressing improvements in Canadians' quality of life, including home and workplace environments.

▶ CARNET's research involves: private-sector partners working closely with researchers to investigate new health care products and community-based services for seniors; the impact that care-giving for the elderly has on occupations and performance; ways of developing innovative work environments to enhance productivity; and research on the general relevance of age for work.

## NATURAL RESOURCES

The careful management of Canada's rich endowment of natural resources is critical to help our resource-based industries stay competitive and thrive in an age of sustainable development. Two NCEs are responding directly to this challenge. The Mechanical and Chemimechanical Pulps Network is investigating improvements to

mechanical pulping processes that could give the Canadian pulp and paper industry a competitive edge by producing superior grade papers that will not yellow.

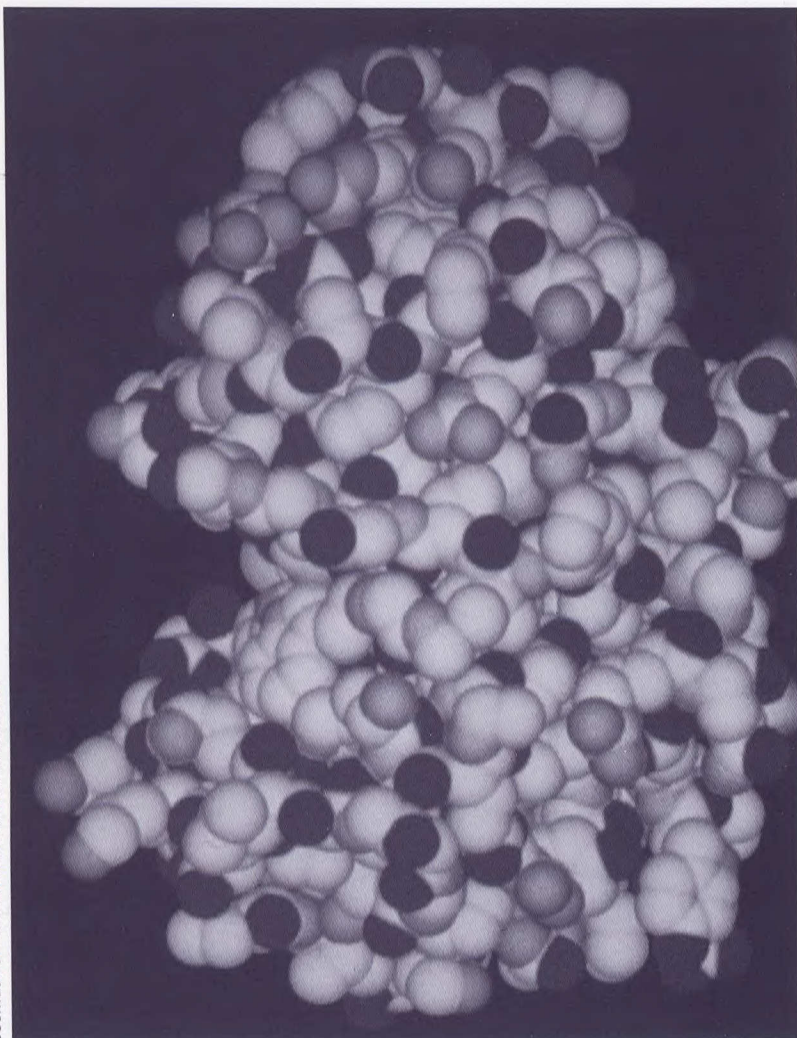
▶ Expected benefits of this Network's research include improving Canadian mechanical pulping processing technology — success in eliminating the problem of yellowing offers new commercial opportunities to produce quality grade paper out of less expensive grades of pulp. Mechanical pulping has the additional

*Responding to the  
challenge of managing  
Canada's rich  
natural resources.*



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*Biotechnology holds  
far-reaching benefits  
to human and  
environmental health.*

attraction of being less wasteful of trees, and mills that use the process have lower start-up costs. Further spinoffs include improved technology for better effluent control, and more efficient recycling of used newsprint.

The Ocean Production Enhancement Network (OPEN) is evaluating the survival, growth, reproduction and distribution of fish and shellfish to improve understand-

ing of fisheries. Research discoveries will help Canada enhance its ability to manage more effectively one of this country's major commercial natural resources.

▶ OPEN's research will provide improved data of fish populations and migrations, which will contribute greatly to the economic health of Canada's fisheries. This Network is also developing new techniques in molecular genetics and advanced instrumentation for physical oceanography, offering additional commercial opportunities.

## BIOTECHNOLOGY

New techniques in biotechnology are enabling two NCEs to undertake sophisticated research that holds far-reaching benefits to human and environmental health, and will lead to improved agricultural and industrial products. The Protein Engineering Network of Centres of Excellence (PENCE) is using these techniques to understand and improve enzymes and other proteins, leading to new ways of treating cancer and infectious diseases. The Network is also carrying out fundamental studies on protein design to advance understanding of how proteins function. Improved proteins can be used in a variety of industrial products and can be of enormous benefit in simplifying several commercial processes.



PENCE's research projects include:

- ▶ investigating cellular growth factors and receptors which can lead to improved and new pharmaceuticals for the treatment of infectious diseases; developing inhibitors directed against enzymes associated with diseases; developing specialized enzymes as new tools in the fine chemical industry and in major industries such as the production of pulp and paper.

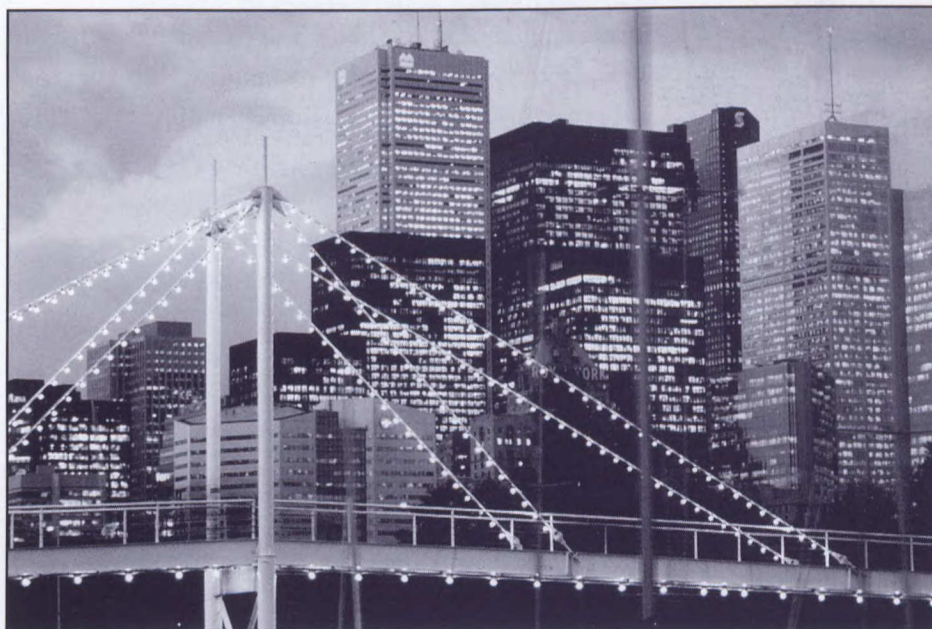
Another Network — Insect Biotech Canada (IBC) — is focusing on developing new, environmentally acceptable methods of pest control through biotechnology, offering important solutions to large annual losses of agricultural crops and forest products due to insect pests.

▶ IBC's research involves exploring ways of altering naturally occurring viruses to make them more effective and selective in their attack on insects. This NCE can make a major contribution to meeting a growing international market demand for insect pest management strategies that are not harmful to the environment.

## ADVANCED MATERIALS AND PROCESSES

The world of materials, from large concrete structures, to complex instrumentation used by industry and science, plays a central role in the economic development of industrialized countries. Two NCEs are exploring important technological advances and new thrusts in this area. Members of the Network of Centres of Excellence on High-performance Concrete are at the leading edge of technology needed to research and develop high-performance concrete, which ranks among other high-tech composite materials.

*Materials research  
offers important  
industrial benefits.*



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▶ The High-performance Concrete Network is developing a new generation of building materials that have the potential to revolutionize modern construction. Benefits include stronger, more durable concrete for roads, offshore platforms, hydro-electric power stations, and toxic-waste storage. This Network is also making major contributions to the development of codes, designs, testing methods, and applications.

The Network of Centres of Excellence in Molecular and Interfacial Dynamics (CEMAID) brings together Canada's leading physical chemists and chemical physicists to focus on the behaviour of atoms and molecules at surfaces. The aim is to gain a better understanding of advanced material processes and properties, and to help develop the computer software, light and particle sources, and analytical instruments such as spectrometers, on which most modern scientific research laboratories and high technology industries depend.

▶ CEMAID's long-term research goals and projects include gaining understanding in molecular and "interfacial" dynamics, an exciting new field that looks at the properties of surfaces. Expected benefits are the fabrication of improved new materials. In addition, this Network is conducting research on reaction dynamics, which is critical to understanding such important processes as ozone depletion, combustion and atmospheric pollution. The Network's research will contribute to the development of advanced industrial technologies such as the fabrication of integrated circuits.

# NCEs Are Your Business

The NCE program represents Canadians' determination to invest in scientific, technological and human research, assuring continued prosperity in the years and decades ahead.

If you want to know more about the Networks of Centres of Excellence program, you can phone or write to:

## **The Networks of Centres of Excellence Program**

200 Kent Street  
Ottawa, Ontario  
K1A 1H5  
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Fax: (613) 992-7356

## **THE NETWORKS ARE:**

### **Canadian Network for Space Research (CNSR)**

University of Calgary  
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Calgary, Alberta T2N 1N4  
Phone: (403) 220-8418  
Fax: (403) 289-3331

### **Institute for Robotics and Intelligent Systems (IRIS)**

PRECARN Associates Inc.  
30 Colonnade Road, Suite 300  
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Phone: (613) 727-9576  
Fax: (613) 727-5672

### **Canadian Institute for Telecommunications Research (CITR)**

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Department of Electrical Engineering  
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Fax: (514) 398-4470

### **Micronet - Microelectronic Devices, Circuits and Systems for Ultra Large Scale Integration (ULSI)**

University of Toronto  
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Toronto, Ontario M5S 1A4  
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### **N.R. Network (neural regeneration and recovery)**

Montreal General Hospital  
#7807 Livingston Hall  
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Montreal, Quebec H3G 1A4  
Phone: (514) 937-6011 ext. 2514  
Fax: (514) 934-8216

### **Respiratory Health Network of Centres of Excellence**

Montreal Chest Hospital Centre  
3650 St. Urbain Street  
Montreal, Quebec H2X 2P4  
Phone: (514) 845-5750  
Fax: (514) 845-6740

**Canadian Bacterial Diseases Network (CBDN)**

University of British Columbia  
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**Canadian Genetic Diseases Network**

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Fax: (416) 978-4771

**Mechanical and Chemimechanical Pulp Network**

570 boulevard Saint-Jean  
Pointe-Claire, Québec H9R 3J9  
Phone: (514) 630-4104  
Fax: (514) 630-9444

**Ocean Production Enhancement Network (OPEN)**

Department of Biology  
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Phone: (902) 494-2182  
Fax: (902) 494-5118

**Protein Engineering Network of Centres of Excellence (PENCE)**

University of British Columbia  
Room 345, 2125 East Mall  
Vancouver, B.C. V6T 1Z4  
Phone: (604) 822-6821  
Fax: (604) 822-2005

**Insect Biotech Canada (IBC) - Biotechnology for Insect Pest Management**

Queen's University  
Kingston, Ontario K7L 3N6  
Phone: (613) 545-6557  
Fax: (613) 545-6806

**Network of Centres of Excellence on High-performance Concrete**

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Université de Sherbrooke  
Sherbrooke, Québec J1K 2R1  
Phone: (819) 821-8061  
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