BEYOND EXCELLENCE

THE FUTURE OF CANADA'S NETWORKS OF CENTRES OF EXCELLENCE

CANADA
HOUSE OF COMMONS

Report of the Standing Committee on
Industry, Science and Technology,
Regional and Northern Development

GUY RICARD, M.P., Chairman

MAY 1993

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THE FUTURE OF CANADA'S NETWORKS OF CENTRES OF EXCELLENCE

HOUSE OF COMMONS

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Chairman: Guy Ricard

CHAMBRE DES COMMUNES

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Le mardi 27 avril 1993

Président: Guy Ricard

Minutes of Proceedings and Evidence of the Standing Committee on

Industry, Science and Technology, Regional and Northern Development

Procès–verbaux et témoignages du Comité permanent de l'

Industrie, des Sciences et de la Technologie et du Développement Régional et du Nord

RESPECTING:

Pursuant to Standing Order 108(2), a study of the future of the Networks of Centres of Excellence

INCLUDING:

The Third Report to the House:
Beyond Excellence: The Future of Canada's Networks of Centres of Excellence

CONCERNANT:

Conformément à l'article 108(2) du Règlement, une étude du futur des Réseaux de Centres d'excellence

Y COMPRIS:

Le troisième rapport à la Chambre :
Au-delà de l'excellence : L'avenir des Réseaux de Centres d'excellence du Canada

Third Session of the Thirty–fourth Parliament,
1991–92–93

Troisième session de la trente–quatrième législature,
1991–1992–1993

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The Standing Committee on Industry, Science and Technology, Regional and Northern Development

has the honour to present its

THIRD REPORT

In accordance with its mandate under Standing Order 108(2), your Committee initiated an inquiry into the future of Canada's Networks of Centres of Excellence. After hearing evidence, the Committee has agreed to report to the House as follows:

Acknowledgements

The Committee wishes to thank all of the witnesses who came to Ottawa, sometimes at short notice, to speak on the future of the Networks of Centres of Excellence.

To our hosts at the four Networks whose laboratories we visited at the University of British Columbia: Dr. Michael Smith at PENCE, Dr. Robert Hancock at CBDN, Dr. Michael Hayden at Genetic Diseases and Dr. Richard Kerekes at the Wood Pulps Network, thank you all for your hospitality and for the thoughtful presentations you and your colleagues prepared for the Committee.

Thanks to Dr. Leroy Cogger and his colleagues at CNSR for setting aside almost an entire day for the benefit of the Committee, and also to our hosts at the University of Calgary.

Thanks to the staff of the Strategic Grants and Networks division of the Natural Sciences and Engineering Research Council for their cooperation throughout the study.

The Committee commends its own staff, Research Officer Dr. Ruth Fawcett, and Christine Fisher, the Clerk of the Committee, for their continued professional support, and acknowledges the essential role of Committee Reporting Services; the Centralized Support and Publications Service, in particular Project Coordinator Guy Rochon; the Translation Bureau of the Secretary of State; and the support services of the Library of Parliament and of the Committees Directorate of the House of Commons.

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THE FUTURE OF CANADA'S NETWORKS OF CENTRES OF EXCELLENCE

INTRODUCTION

In 1989, the government of Canada created fifteen Networks of Centres of Excellence, designed to link researchers in universities, government laboratories and private industries working across the country. These Networks received a total of $240 million over a four year period. The Networks cover a wide variety of subject areas from genetic diseases to high performance concrete to Canada's aging society.[1]

In December 1992, the Minister of Finance stated that the Networks program would be renewed but revealed no details about its future. Recognizing the importance of the program to Canada, both scientifically and economically, the members of the House of Commons Standing Committee on Industry, Science and Technology, Regional and Northern Development agreed to explore the future of Canada's Networks of Centres of Excellence. During the course of this study, the Committee invited representatives from ten Networks to express their views at public hearings in Ottawa and visited five Networks with laboratories in western Canada. The Committee also heard the Association of Universities and Colleges of Canada, the three granting councils (the Natural Sciences and Engineering Research Council (NSERC), the Social Sciences and Humanities Research Council (SSHRC), and the Medical Research Council (MRC) who jointly administer the program, representatives from industry and the Deputy Minister of Industry, Science and Technology Canada.

In the course of these discussions and visits the Committee was gratified to find that its early and continuing support for the NCE program as an initiative that holds tremendous potential for Canada's scientific and economic growth has been more than justified. In only four years, an impressive amount of scientific work of potential strategic importance to Canada has been achieved. Some findings will better inform economic and social policy decisions, others have already resulted in industrial applications. But the most important initial product of the program — and this can be said of all fifteen Networks — is a striking Canadian innovation in achieving nation-wide scientific collaboration. The enthusiasm and dedication of the researchers in each Network is impressive. A number of witnesses noted, almost with a feeling of astonishment, that links among scientists across the country contribute to national unity. One witness proclaimed that the Networks are "key to Canada's success as a technology innovator in the future".[2] The Committee wishes to emphasize its unanimous support of the program.

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[1] See Appendix B for a complete list of the Networks of Centres of Excellence along with a description of their scientific research.

[2] Minutes of Proceedings and Evidence of the House of Commons Standing Committee on Industry, Science and Technology, Regional and Northern Development (hereafter, Proceedings), Issue 27, p. 16.

Recommendation No. 1

The Committee recommends that the Networks of Centres of Excellence program be made permanent.

BACKGROUND

The Networks of Centres of Excellence (NCE) program brings together researchers from universities, government laboratories and industries to work together in areas of scientific and technological importance. Without constructing new buildings or laboratories, the program links scientists from across the country in a large network striving towards the same goals. The official objectives of the program are:

> (1) To stimulate the production of leading-edge fundamental [i.e. basic] and long-term applied research of importance to Canada.
>
> (2) To develop and retain world-class Canadian scientists and engineers in technologies that are critical to future industrial competitiveness.
>
> (3) To integrate Canadian research and technology development efforts into national networks with the participation of and in partnership with universities, the private sector, the federal government and the provinces, based on excellence as measured by international standards.
>
> (4) To develop strong university-industry partnerships to accelerate the diffusion of advanced technological knowledge to industry.[3]

The competition for the Networks program was announced in 1988. In order to apply, researchers had to prepare letters of intent by no later than 30 September 1988; the final deadline for submission of applications was 30 November 1988. In the end, program organizers received 238 letters of intent which resulted in 158 formal applications to the program.[4]

In June 1988 the then Minister of State (Science and Technology) established an advisory committee on the NCE program.[5] Chaired by Dr. John Evans and Dr. Gilles Cloutier, this committee included the Presidents of the three granting councils as well as individual from industry and the academic community. Its purpose was to devise a valid selection process, to ensure that it functioned as planned, and to make final recommendations to the Minister based on the outcome of the review process.

Responsibility for managing the Networks of Centres of Excellence program was given to the Tri-Council Steering Committee which is composed of the Presidents of the three granting councils (NSERC, SSHRC and MRC) with an observer from Industry, Science and Technology Canada. To

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3 ARA Consulting Group Inc., *Final Report NCE Interim Evaluation*, February 1993, p. 2-1 — 2-2.

4 *Ibid.*, p. 2-3.

5 This title was changed to 'Minister for Science' after passage of the Act to create the department of Industry, Science and Technology in 1990.

evaluate the proposals made for the program, the Tri-Council Steering Committee appointed an International Peer Review Committee (IPRC). Its members were chosen from the research community both in Canada and abroad. In an effort to ensure an international standard of evaluation and in order to avoid potential conflicts of interest within the Canadian scientific community, ten of the twenty-two members comprising this committee were from outside Canada.

After examining the 158 proposals made to the NCE program, the International Peer Review Committee eliminated 51 of them and further examined the remaining 107 applications. In the end, the IPRC recommended that 16 networks receive funding. In 1989, 14 of these were selected for the NCE program. Ten of these Networks are administered by NSERC and four by MRC, including two which encompass disciplines under both NSERC and MRC. In 1990, a fifteenth Network was created to be administered by SSHRC.

The process of selecting which proposals should receive funding was not an easy one. In order to guide the reviewers certain specific criteria were identified to help judge the applications. Table 1 lists the network selection criteria used by the International Peer Review Committee.

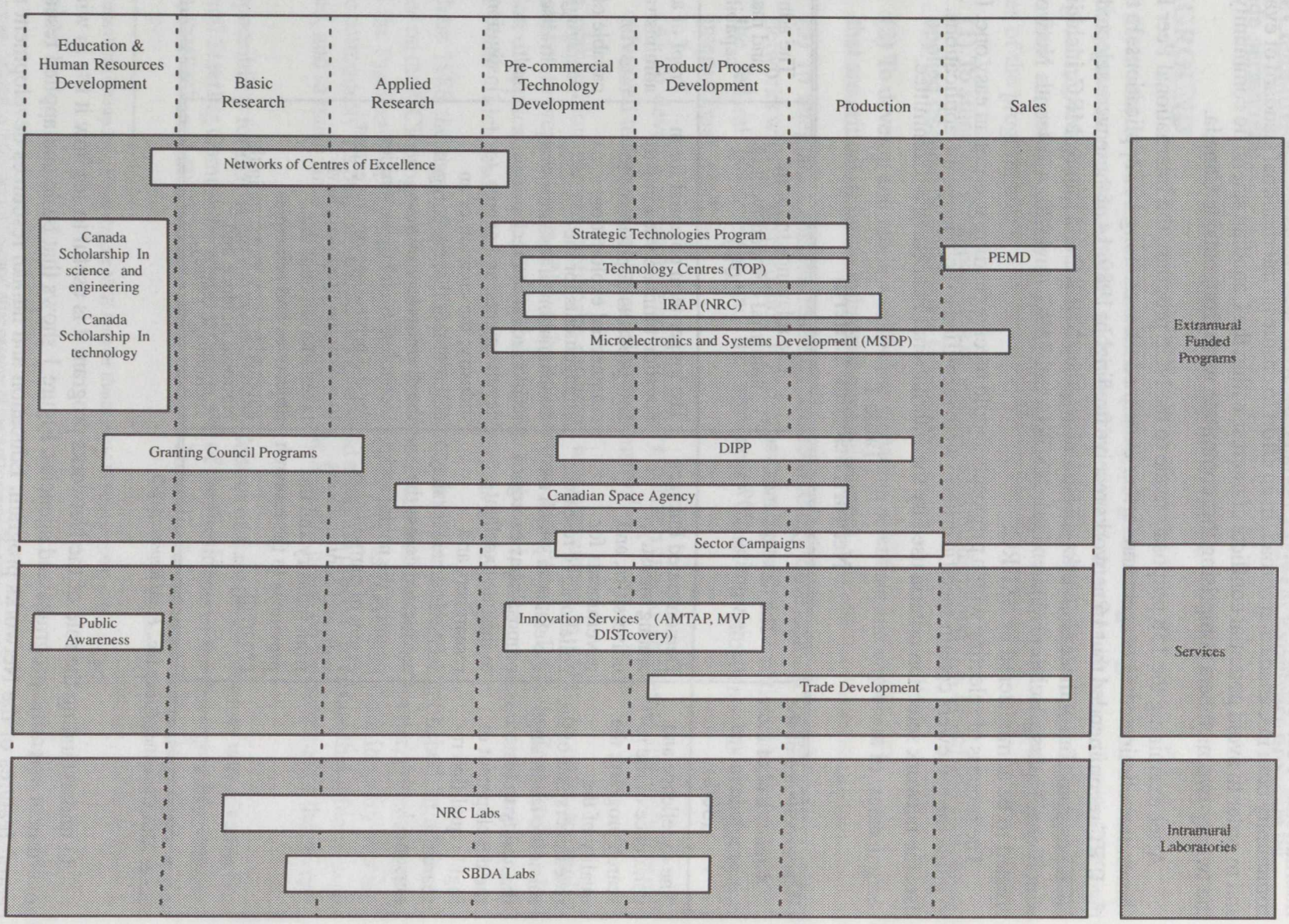
Table 1
Network Selection Criteria

The excellence of the science and of the people involved (50%)	The linkages and networking (20%)	The relevance to future industrial competitiveness (20%)	The administrative and management capability (10%)
The excellence and coherence of the research program; the quality of the researchers and of the scientific leadership; the ability to foster the development of highly qualified research personnel.	Demonstrated linkages among industry, universities, and governments for collaborative research; the extent to which the proposals have sought to include excellent researchers and facilities wherever they are located across the country; the nature and extent of partnerships with and contributions from industry and the provinces to the research program.	The longer-term potential for innovation ultimately leading to new products or processes for commercial exploitation; arrangements for the dissemination of research results, advanced technology developments, and people, to industry; the creation of an environment that encourages the development of new technologies and opportunities for the private sector; the extent to which the proposals have taken into account the objectives and principles adopted by governments in the National Science and Technology Policy.	Proof of an administrative structure capable of managing a complex multi-disciplinary, multi-institutional program.

Source: ARA Consulting Group Inc., *Final Report*, p. 2-5.

In understanding the role of the Networks program it is useful to see how it fits in with other government scientific programs and agencies. Figure 1 shows that basic and applied research are central features of the Networks program. Education and human resources development are also important as is pre-commercial technology development but as the figure indicates, these are not the primary components of the Networks program.

Elements of the Relationship Among Federal S & T Activities



Source: Industry, Science and Technology Canada

Figure 1

The Committee notes that use of the original selection criteria resulted in a group of Networks encompassing a wide variety of disciplines and covering the spectrum from basic through applied to pre-competitive research. The Committee believes that this range of types of research is a positive aspect of the NCE selection process and that it should be fostered.

Table 2 lists all the Networks of Centres of Excellence with the amount of funding they received for the four year period starting on the effective date of their internal agreements. The only exception to this is the Canadian Aging Research Network which will receive its funding over a five year period.

Table 2
Networks of Centres of Excellence

Network	Federal Funding $	Effective Date of Internal Agreement	Administering Council
Neural Regeneration and Functional Recovery	$25.5 million	1-Jul-90	MRC
Institute for Robotics and Intelligent Systems (IRIS)	$23.8 million	1-Jul-90	NSERC
Ocean Production Enhancement Network (OPEN)	$23.0 million	12-Jun-90	NSERC
Protein Engineering (PENCE)	$20.0 million	1-Jul-90	MRC
Centres of Excellence in Molecular & Inter-facial Dynamics (CEMAID)	$18.5 million	1-Nov-90	NSERC
Canadian Bacterial Diseases Network (CBDN)	$18.2 million	15-May-90	NSERC
Canadian Genetic Diseases Network (CGDN)	$17.5 million	1-Aug-90	MRC
Canadian Network for Space Research	$17.0 million	1-Jul-90	NSERC
Canadian Institute for Telecommunications Research (CITR)	$14.7 million	1-Jul-90	NSERC
Mechanical and Chemimechanical Wood-Pulps Network	$14.6 million	1-Aug-90	NSERC
Respiratory Health Network	$12.3 million	1-May-90	MRC
Micronet	$10.8 million	12-May-90	NSERC
Insect Biotech Canada (IBC)	$9.2 million	1-Jul-90	NSERC
High Performance Concrete Network	$6.4 million	1-Jul-90	NSERC
Canadian Aging Research Network (CARNET)	$5.0 million	1-Sep-90	SSHRC

Source: ARA Consulting Group Inc., *Final Report*, p. 2-6.

Many of the Networks developed similar administrative structures. Each Network is required to have a **Board of Directors** which oversees the activities of the Network and deals with major policy issues. The research program is guided by the **Scientific Program Leader** who reports to the Board of Directors and also chairs the **Research Management Committee**, which oversees the research program, keeps researchers informed about other projects, and adjusts the program as

necessary. A Network Manager is responsible for network administration and financial concerns and in some Networks also handles industry and government user organizations. A **Standing Committee**, comprised of at least three people who are not involved in the Network but who are experts in areas covered by Network researchers, reviews the progress of the Networks after the first nine months and annually thereafter. Finally, an **Industrial Advisory Committee** is used by some Networks to provide the views of industry and government organizations on the research program.[6]

COLLABORATION ACROSS DISCIPLINES

Many aspects of the NCE program make it unique. Dr. Maier Blostein, Scientific Leader of the Canadian Institute for Telecommunications Research (CITR), acknowledged that many of the individual scientists working within CITR had had contacts with industry prior to the establishment of the NCE program. He added that "what is unique in the NCE program, however, is the opportunity it provides to collaborate with colleagues across the country in forming critical masses of skills in particular areas of technology. In this way we can tackle research projects of greater scope and potential impact than would have been possible otherwise."[7]

Collaboration with other researchers has always been crucial when carrying out scientific work. This has tended to take place between researchers working in the same disciplines. By bringing together scientists from a wide variety of backgrounds to work on the same research projects, the Networks of Centres of Excellence program has encouraged interaction among researchers from different disciplines. Dr. Claude Lajeunesse, President of the Association of Universities and Colleges of Canada, stressed that during the second phase of the NCE program there should be a continued emphasis upon this interdisciplinary nature of the program. In particular, he suggested that phase two "should encourage proposals to include researchers from the social sciences in network projects, because very often, as you know, technology is not the problem; social impacts of technologies are the problem."[8]

Other witnesses stressed the importance of interdisciplinarity. Dr. Peter Morand, President of the Natural Sciences and Engineering Research Council, noted that the NCE program "is helping to bring about fundamental shifts in attitudes toward collaboration and an appreciation of the benefits of intersectoral interaction." Later he added that "it is important to recognize that complementarity in research can result in greater productivity and a much better return for the investment made."[9] This same point was made by Mr. Gordon MacNabb, Director of the Institute for Robotics and Intelligent Systems, who noted a "tremendous difference in the degree of collaboration among the academic researchers across the country." He continued:

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6 ARA Consulting Group Inc., *Final Report*, p. 2-8.

7 Proceedings, Issue 32, p. 6.

8 Proceedings, Issue 25, p. 6.

9 Proceedings, Issue 30, p. 5.

> A lot of the collaboration is now interdisciplinary, and I'm delighted to see that. It's a refreshing change from the individual grants that are awarded and often end up in research being done in isolation. A lot of our research challenges these days are interdisciplinary by nature, and [the Networks program] has been a valuable instrument for change to get off the isolation of doing research and work in teams.[10]

The importance of linking scientists from different disciplines to tackle problems on a broader front was emphasized by many Networks. The Networks of Centres of Excellence program has encouraged the formation of contacts across Canada and across disciplines. In doing so, it has introduced a new approach to research which will profoundly affect science in Canada.

TRAINING AND RETAINING SCIENTISTS

An important function of a university is to train the next generation of researchers. The Networks of Centres of Excellence program has been praised for enhancing this aspect of the universities' mandate. Two junior scientists working with the Canadian Genetic Diseases Network told Committee members how important participation in the Network had been for them. It provided the funding to allow them to stay in Canada and it put them into contact with the most important researchers in their fields. Both felt that without the Network, it is likely they would have left the country for their postdoctoral research.

Scientists with the Canadian Network for Space Research noted that since the Network provides enhanced support for collaboration both within the university and with industry, it provides an excellent training environment for young scientists. Many are exposed to the most exciting areas of research. They also gain a clearer understanding of the potential for fascinating work in industry—an area they might never have been aware of without Network contacts. Dr. Dennis Salahub, Scientific Leader of the Centres of Excellence in Molecular and Interfacial Dynamics (CEMAID), also underscored the importance of the training function of the Network.[11]

The importance of training young scientists is vital to the future of Canada's universities, government scientific laboratories, and industries. At the same time, however, it is equally critical that both these newly trained scientists and our more established researchers remain in Canada. It is clear from the discussions with representatives from the Networks that in this respect as well, the NCE program has proven invaluable. Dr. Pierre-Claude Aïtcin, Director of the Network of Centres of Excellence on High Performance Concrete, commented that the NCE program "will help the research community to keep our most promising young researchers in Canada while there is a very strong competition in the industrial countries to try to hire strongly performing researchers." He added that the attraction Canada held for researchers 25 years ago has faded and must be built up again by programs such as the Networks of Centres of Excellence.[12] Dr. Blostein of CITR noted that one of the central objectives of his Network was to develop and retain scientific and engineering talent.

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[10] Proceedings, Issue 28, p. 9.

[11] Proceedings, Issue 32, p. 10.

[12] Proceedings, Issue 25, p. 7.

The Committee commends the NCE program for performing the valuable functions both of training young researchers and keeping scientists from many different fields within the Canadian scientific community. The importance of science and technology continues to grow as the next century approaches. There can be no doubt that Canada will benefit enormously from a large pool of talented scientists and engineers.

RESEARCH CULTURE

The most important effect of the Networks of Centres of Excellence program is one that is impossible to quantify and difficult to describe: researchers from many different Networks impressed upon Committee members that the NCE program has brought about a dramatic change in the way research is carried out in this country. Dr. Robert Hancock, Scientific Director of the Canadian Bacterial Diseases Network, told Committee members as they toured the Network in Vancouver, British Columbia, that the NCE program is changing the culture of Canadian science. This view was reiterated and amplified by a number of the different Networks.

The Networks are changing the research culture in Canada in a number of ways. Collaboration among researchers from different fields has greatly enhanced the scope of topics under examination and in many instances provides fresh insight into old problems. In his testimony before the Committee Dr. Peter Morand noted that research performed by the Ocean Production Enhancement Network is an excellent example of the type of interaction stimulated by the Network program. Researchers from two fields, biological and physical oceanography, "have joined forces to better understand and help Canada manage a problem of national and economic concern. . .They are very different areas, but have joined forces to look at the very important problem of diminishing cod stocks."[13]

Gordon MacNabb expanded upon this point. He observed that "the greatest early benefit [of the NCE program] has been the different attitude to research by the academic researchers. Here they are effectively working together as a team—right across the country, in our case—on research projects. It is a much more efficient way of doing research and I think it can attack much bigger problems [than] the individual academic researcher."[14] Network researchers believe that a great many new opportunities are available to them through the Networks of Centres of Excellence both by working with scientists from different disciplines and from laboratories across the country.

A further aspect of the change in research culture is the increased collaboration occurring between academic and government scientists and their industrial counterparts. Dr. Henry Friesen, President of the Medical Research Council, stated that "the chief and initial benefit [of the NCE program] has been to try to effect a cultural change in the academic world, to recognize the

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[13] Proceedings, Issue 30, p. 5.

[14] Proceedings, Issue 28, p. 17.

opportunities that exist by working with industry."[15] Quoting one of the researchers in his Network, Dr. Dennis Salahub of CEMAID stated that "the change in attitude of participants towards industrial cooperation should be stressed. For me this has translated into thinking about the problems they bring up (largely laser applications) after their visit rather than telling them the physics and letting them figure it out."[16] Dr. John Maloney, President of Fisheries Resource Development Limited, a subsidiary of National Sea Products Limited, added that private sector participation "has had a very significant impact in focusing the research program in terms of what was needed to come to a basic understanding of what is driving this fishery. I think without the industrial support this program would not have had that kind of focus. So it is not only money, it is a kind of intellectual input that took place when OPEN was formed."[17] The change in attitude was summarized by Dr. Roger Gaudry, Chairman of the Board of Directors of the Neural Regeneration and Functional Recovery Network, who commented that "we are changing the research culture in universities by making the researchers aware for the first time that Canada must benefit from their work. Now, it is no longer taboo to speak of marketing in universities." [18]

The change in Canada's research culture is ongoing and significant. It appears to be something that in part was set in motion by the establishment of the Networks program but which continues to develop. It marks a profound shift in the way in which research is carried out in this country and one which will undoubtedly benefit Canada both scientifically and economically.

FURTHER RECOMMENDATIONS

During the course of its hearings, the Committee listened to presentations from all fifteen Networks of Centres of Excellence, ten in Ottawa and five Networks in western Canada. The presidents of the three granting councils appeared before the Committee to discuss the Networks and the Councils' role in administering them. The Committee listened to the President of the Association of Universities and Colleges of Canada and received a written brief from the Canadian Association of University Teachers. Finally, the Deputy Minister of Industry, Science and Technology Canada testified before the Committee. After taking into account all these representations about the NCE program the Committee has unanimously endorsed the Networks of Centres of Excellence program.

Recommendation No. 2

The Committee supports the Networks of Centres of Excellence program and recommends that the program be renewed at a funding level equal to or greater than that provided for the first phase of the program.

One of the central messages impressed upon Committee members throughout this study was the importance of an early announcement concerning both the future of the program and the amount of money that will be allotted to it. Network managers are concerned about retaining staff in the face of

[15] Proceedings, Issue 33, p. 6.

[16] Proceedings, Issue 32, p. 13.

[17] Proceedings, Issue 29, p. 9.

[18] Proceedings, Issue 31, p. 19.

no certainty about the future of the program. Most of the Networks agreed that ideally they would like to know about the program's renewal at least twelve months before funding is due to run out. Since three of the Networks (Micronet, the Respiratory Health Network of Centres of Excellence, and the Canadian Bacterial Diseases Network) will complete the first phase of the program in May 1994 it is imperative that they, and the other Networks, receive a firm commitment from the government that the NCE program will be extended into a second phase. This is essential first to retain highly trained researchers, second to attract new scientists and third to maintain links with industrial partners. Dr. Peter Morand put it very clearly:

> You have heard from several networks now that the timing for the next competition is critical. A lot of them are very concerned about where they're going. They realize this program has a definite time scale to it. The first of the networks runs out of funding in April 1994, a year from now. In this climate of uncertainty, maintaining momentum and critical mass and even keeping industrial partners have become major challenges. The partners want to know what the future holds and if it is worth investing. Is it worth putting energies and resources into these programs if they don't know what will happen in the next five years, for example?[19]

Recommendation No. 3

The Committee recommends that the government announce as soon as possible the amount of money that the Networks of Centres of Excellence program will receive for the next funding period.

When judging the proposals for the first phase of the NCE program specific weighted criteria were established. These were:

- excellence of the research and participants (50%)
- effective linkages and networking (20%)
- relevance to future industrial competitiveness (20%)
- administrative and management capacity (10%)

But will this same weighting be used for the second phase of the NCE program? Witnesses clearly indicate that scientific excellence should remain the main criterion in deciding which Networks should receive renewed funding. Claude Lajeunesse stated that "the quality of science is critical to the program's credibility".[20] This view was echoed by scientists and administrators alike.

Although scientific excellence was a central criterion by which the Networks were judged during the first competition, many witnesses expressed concern that their work was increasingly being assessed on the basis of its industrial relevance. This was not felt necessarily to be inappropriate but witnesses felt that the criteria against which their work is judged should not be changed during the course of the program. Dr. Salahub of CEMAID put it this way:

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[19] Proceedings, Issue 30, p. 9.

[20] Proceedings, Issue 25, p. 5.

> There is a perception that the rules have changed from the beginning. Everyone has felt that to some degree. Whether the shift in the rules is desirable or natural, I think many people, not all, would now say, yes, we want to insist on scientific excellence as the basis. But we admit we feel now that the value-added aspect of the socio-economic issues can be properly addressed.[21]

Dr. Blostein from the Canadian Institute for Telecommunications Research stated the problem succinctly:

> We would just like to know. We assume that excellence is going to be a necessary condition. It is simply a question of how sufficient it is. What else do we have to do? It would be very helpful to us if we had a better understanding of it because program planning is seriously impacted by these considerations.[22]

It would appear that there is some confusion over whether the Networks are being judged by the same criteria which were used in the first competition. Existing Networks need to know which criteria are being used to assess them; at the same time the criteria to be used for the second phase of this program should be clearly stated as soon as possible.

Recommendation No. 4

The Committee recommends that the same set of criteria with the same weighting that was used to select the Networks of Centres Excellence in the first phase of the program be used to judge existing Networks and to choose new Networks.

At present, a great deal still remains unknown about the second phase of the Networks of Centres of Excellence program. It is not known which of the fifteen Networks will receive funding during the second phase and whether any new Networks will be established. Harry Swain, the Deputy Minister of ISTC, stated that:

> The Minister of Finance, in his December statement, made it clear that it is possible that new networks may be founded, may be started up. It is not automatic that all of the existing networks will continue in being. I think the dilemma confronting the tri-council steering committee is to devise a process that is fair to the existing networks and yet leaves open the possibility that money can be reallocated to something completely new.[23]

In discussing this same problem of how to carry out the second competition Peter Morand recommended "a two-phase competition approach, with phase one being a competition among the existing networks and phase two an open competition for new networks."[24] The Committee endorses this view.

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[21] Proceedings, Issue 32, p. 28.

[22] *Ibid.*

[23] Proceedings, Issue 33, p. 18.

[24] Proceedings, Issue 30, p. 9.

Recommendation No. 5

The Committee recommends that an open competition be held to choose new Networks after a decision has been made about which established Networks will receive renewed funding.

The Committee heard evidence that Canadians generally know little about the Networks program and its successes. Canadians should be aware of the excellent scientific accomplishments of the Networks and of the importance of these accomplishments to the national welfare. Private sector businesses should also be aware of Network research programs and how industries can interact with scientists to develop new products and processes. Nick Hoffman, Business/Research Accounts Manager of ISG Technologies Inc., commented:

> Since the conception of the centres of excellence, which I believe is a very necessary function to take place in Canada, I think one of the key failing points of the centres of excellence has been a lack of communication to industry. In general, I think industry is very unaware of what is going on within the centres and there seems to be a lack of communication between the two groups.[25]

Recommendation No. 6

The Committee recommends that the Natural Sciences and Engineering Research Council and Industry, Science and Technology Canada work together to publicize the NCE program throughout the country with a particular focus on the private sector.

Efforts must be made by the government departments involved to publicize the Networks program but the Networks themselves must work to establish closer ties with industries. In his testimony Peter Morand suggested:

> Similarly, the networks must develop more mature links to the user sector that will speed the transfer of technology to the private sector. The networks have developed corporate identities, and with some successes behind them they now have something to attract the attention of industry. More effective communications will help heighten the awareness of their research activities in the private sector and the government. By encouraging the inclusion of new expertise within the network structures we can help them build on their own successes.[26]

One witness suggested that through these closer ties with industries the Networks should be able to become economically self-sufficient. Dr. Peter Macklem, President and Scientific Director of the Respiratory Health Network of Centres of Excellence, argued that:

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[25] Proceedings, Issue 27, p. 6.

[26] Proceedings, Issue 30, p. 8-9.

> It is unrealistic to expect the network program to continue to live on government handouts. Government expenditures, as you well know, are not very popular with the public. Because the networks are mandated to create wealth, I see no reason why they cannot achieve long–term network self–sufficiency. If they can create wealth for Canadian industry, they can create wealth for themselves.[27]

Dr. Robert Hancock of the Canadian Bacterial Diseases Network stressed that government funding is essential for the fundamental research which is a base out of which applied research can grow. Industries are often unwilling and sometimes unable to perform this type of basic research. Gordon MacNabb put it in stronger terms. He disagreed vehemently with Dr. Macklem's assertion that the Networks should become economically self–sufficient, arguing that it is not only an unrealistic expectation but also a dangerous one. He continued:

> It's dangerous because to expect them to do that will create pressure for the research to become shorter– term, almost problem–solving for industry, and that is not the role for university researchers. You cannot do the education, you cannot provide the graduate thesis work, and you can't do the research that attacks new frontiers if you're pushed to do more and more short–term work.
>
> Short–term problem–solving is the role of industry, it's not the role of the universities. I think the expectation of self–sufficiency is unreasonable because industry will never invest heavily in research that is long–term, high–risk and pre–competitive, especially if the results are broadly disseminated and not held captive to one company. They don't do this elsewhere in the world and I don't expect them to do it in Canada.[28]

The Committee agrees that it is unrealistic to expect the Networks to become economically self–sufficient but at the same time would like to see an increase in industrial contributions to the program. Dr. Morand noted that "industry investment in the networks is increasing, with total contribution, in kind and in cash approximating $4.3 million in 1992." He added that more needs to be done in this area.[29] The problem stems, in large part, from the lack of "receptor capacity" in many industrial sectors in Canada. IRIS has close links with an industrial consortium, and some medical Networks have close contact with pharmaceutical companies and they have been able to build strong ties with industrial partners. Other Networks need to work harder to establish these ties. At the same time, industries must be receptive to new ideas from the Networks and be prepared to work with Network researchers to develop innovative products.

Recommendation No. 7

The Committee recommends that during the second phase of the program the Networks of Centres of Excellence work to establish stronger links with the industrial sector.

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[27] Proceedings, Issue 26, p. 6.

[28] Proceedings, Issue 28, p. 11.

[29] Proceedings, Issue 30, p. 6.

During the course of this study the Committee listened to presentations from all fifteen Networks of Centres of Excellence. This was necessary because although the structure of each Network is similar, in fact each Network has a unique way of functioning. For example, the Networks were able to allocate their budgets in the most practical way possible. In the case of the Protein Engineering Network of Centres of Excellence (PENCE), for example, 40% of the budget was put towards equipment which was essential for carrying out the work of the Network. Other Networks are free to allocate their funds in the most practical way. The Network model allows for this type of flexibility in budget, research program, personnel and other aspects. This flexibility is particularly important since the Networks link together scientists from university, government and industrial laboratories. Dr. J. Clare Rennie, Chairman of the Board of Directors of Insect Biotech Canada, commented that "the unique aspect of the NCE program is an independent board and science planning structure that involves all three research sectors that I referred to, the university scientists, government laboratories and industry. The research program has benefited from the creative tension that arises when no one group dominates".[30] Dr. Rennie also noted that "the NCE model permits considerable flexibility to make program changes compared with what happens in a brick and mortar institution..." and declared that "the network concept in the science community is the wave of the future".[31] The advantage of maintaining a great deal of flexibility in the Networks program was echoed by many of the Networks.

Recommendation No. 8

The Committee recommends that the flexibility which now exists within the Networks of Centres of Excellence in fulfilling their mandates be allowed to flourish.

There is concern among a few of the Networks about the restrictive funding rules under which they have to operate. For example, the Canadian Network for Space Research found that because it was unable to use Network funding for indirect costs, there were lengthy and difficult delays in completing the necessary renovations.

Recommendation No. 9

The Committee recommends that the Networks be allowed to use their funds for indirect costs during the next phase of the program.

The Committee is impressed by the scientific and economic importance of the Networks of Centres of Excellence program to the future of Canada. Witnesses appearing before the Committee stated clearly that the future of the program must be established as soon as possible. The future of the scientists involved, the continuity of their research efforts and the growing links with the private sector will only remain secure if the government announces the details of the next phase of the program immediately.

Recommendation No. 10

The Committee requests that the Government table a comprehensive response to the report within 30 days.

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[30] Proceedings, Issue 31, p. 6.

[31] *Ibid.*

CONCLUSION

The Networks of Centres of Excellence program is a success. It has fostered leading-edge research in a number of diverse fields and has led to discoveries of both scientific and economic importance. The Networks program encouraged collaboration among university, government and private sector researchers which has been of central importance to the growth of scientific research in this country. In the next phase of the program, it is hoped that these linkages will continue to grow and new ones will be formed. Junior scientists have received the benefit of interaction with researchers across the country while many established scientists have decided to stay in Canada to pursue their work. Interaction has also occurred among researchers in different disciplines to a greater degree than is often possible. The Networks program has contributed in many ways to developing a new research culture in Canada which encourages collaboration of scientists from a variety of backgrounds, from different universities and industries and with many goals in mind. It is hoped that the Networks of Centres of Excellence program will be allowed to grow and flourish in the years to come.

Appendix A

Witnesses

WEDNESDAY, FEBRUARY 24, 1993 — **Issue No. 25**

Association of Universities and Colleges of Canada:
Claude Lajeunesse, President;
Robert Davidson, Director,
Research Policy Analysis
Network of Centres of Excellence on High–performance Concrete:
Pierre–Claude Aïtcin, Director

THURSDAY, FEBRUARY 25, 1993 — **Issue No. 26**

Respiratory Health Network of Centres of Excellence:
Dr. Peter Macklem,
President and Scientific Director

WEDNESDAY, MARCH 10, 1993 — **Issue No. 27**

ISG Technologies Inc.:
Nick Hoffman,
Business/Research Accounts
Manager

THURSDAY, MARCH 11, 1993 — **Issue No. 28**

Institute for Robotics and Intelligent Systems (IRIS):
Gordon MacNabb, Director

TUESDAY, MARCH 16, 1993 — **Issue No. 29**

Ocean Production Enhancement Network (OPEN):
Dr. John Maloney,
Vice–Chairman of the Board
and President of FRDL/NatSea;
Dr. Joe Brown,
Professor of Marine Biology,
Memorial University;
Denise Cassidy,
Executive Director

Canadian Aging Research Network (CARNET):
Dr. Victor Marshall

WEDNESDAY, MARCH 17, 1993 **Issue No. 30**

Natural Sciences and Engineering Research Council of Canada:
Dr. Peter Morand, President
Social Sciences and Humanities Research Council of Canada:
Dr. Paule Leduc, President

THURSDAY, MARCH 25, 1993 **Issue No. 31**

Insect Biotech Canada (IBC):
Dr. Bruce Hutchinson,
Executive Director;
Dr. J. Clare Rennie,
Chair, Board of Directors
Cyanamid Canada:
Dr. Kent Jennings,
Manager, Regulatory and Environmental Affairs
N.R. Network (Neural Regeneration and Recovery):
Warren Bull,
Network Manager;
Dr. Roger Gaudry,
Chair, Board of Directors
Allelix Biopharmaceuticals:
Dr. Jackie Spayne,
Director of Corporate Development

TUESDAY, MARCH 30, 1993 **Issue No. 32**

Canadian Institute for Telecommunications Research (CITR):
Dr. Maier Blostein,
Scientific Leader
Micronet – Microelectronic Devices, Circuits and Systems for Ultra Large Scale Integration (ULSI):
Dr. André Salama,
Scientific Leader
Centres of Excellence for Molecular and Interfacial Dynamics (CEMAID):
Dr. Dennis Salahub,
Scientific Leader;
Marc Escaravage,
Director, Industrial Development;

Centres of Excellence for Molecular and Interfacial Dynamics (CEMAID): (cont'd)

Dr. Hutch Holton,
Member, Board of Directors (General Manager, Planning and Development ICI Canada Inc.);
Professor Martin Moskovits,
Member, Board of Directors,
(Professor of Chemistry, University of Toronto)

WEDNESDAY, MARCH 31, 1993 **Issue No. 33**

Medical Research Council:

Dr. Henry Friesen, President;
Dr. Mary Ann Linseman,
NCE Program Officer

Industry, Science and Technology Canada:

Harry Swain, Deputy Minister;
Henri Rothschild,
Assistant Deputy Minister,
Science and Technology;
Nora Hockin,
Director, University Research Policy

Networks visited

MONDAY, MARCH 22, 1993

Protein Engineering Network of Centres of Excellence (PENCE) ;

Canadian Bacterial Diseases Network (CBDN);

Canadian Genetic Diseases Network;

Mechanical and Chemimechanical Pulps Network;

TUESDAY, MARCH 23, 1993

Canadian Network for Space Research (CNSR)

Canadian Association of University Teachers;

Merck–Frosst Canada;

Paprican, Dr. Gordon Robertson

Appendix B

Description of the Networks

CANADIAN AGING RESEARCH NETWORK (CARNET)*

Scientific Leader:	Dr. Victor Marshall
Network Manager:	Ms. Wendy Green
Chair, Board of Directors:	Dr. Barry McPherson
Number of Scientists/Engineers:	23
Number of Participating Institutions:	10 universities 2 corporate partners 1 government liaison organization
Number of Industrial Affiliates:	5 corporate affiliates
Administrative Centre:	University of Toronto
Award:	$5 million over 5 fiscal years
Start-up date:	September 1990

Canadian Aging Research Network (CARNET)

Within 40 years, it is predicted one Canadian in four will be over 65. The combination of an aging workforce and rising costs for health and social care could pose threats to our national economic competitiveness. The goal of this network is to investigate conditions that can help Canadians maintain their productivity and independence in their later years.

Network researchers investigate how workplace and home environments affect cognitive performance and work behaviour. Expected benefits include a better understanding of the problems faced by older workers and their employers, as well as the development of innovative workplace environments tailored to maintain workers productivity. A second study investigates new health care products and community-based services that provide a better quality of life for seniors and that reduce or delay the need for medical care or institutionalization. Still, other researchers look at family care-givers, the home and work stresses they face in taking on responsibility for an older relative, and how these can be mitigated. Finally, a program involving a national survey and eldercare studies in the corporate sector is investigating the management of an aging labour force.

The major research areas are:

- products and services (e.g., needs surveys);
- work and eldercare research;
- cognitive functions (including cognitive aging, productivity workplace participation, and promoting independence); and
- managing the aging Canadian labour force.

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* Source : Natural Sciences and Engineering Research Council.

CARNET

Universities

Concordia University
McMaster University
Trent University
Université de Montréal
University of Alberta
University of Guelph
University of Manitoba
University of Toronto
University of Victoria
University of Waterloo

Fed. Govt Dept. & Other

Min. of Community and Social Services (ON)
Health & Welfare Can
Empl. and Immi. Can.
The Canada Council
Waterloo County Board of Education
Doctors Hospital
Guelph General Hospital
Numerous long-term care facilities in Ontario and Manitoba
The Manitoba Govt.
Ontario Workers Compensation Institute

*** Corporate Affiliates**

The Good Samaritan Society
Lynnwood Extended Care Centre
Edmonton General Hosp
Alberta Occupational Health and Safety
Innomed Christie Group Ltd.

Industrial Partners

CHC (Corporate Health Consultants)
ARCOR (The Canadian Aging and Rehabilitation Product Dev. Corp.)

Industrial Involvement/ Participation

Sunlife of Canada
The Mutual Group
Amersham Canada
New York Business Group on Health, Inc.
International Ladies' Garment Workers' Union (New York)
Quebec Fashion Apparel Manufacturers' Guild
Toyota Motor Manufacturing
Kellogg's
McNeil Consumer Production
MDS
Imperial Oil
Bank of Nova Scotia
Creative Retirement
Alliance of Canadian Travel Associations
Canadian Bankers Association
Kelly Temporary Services
Barrier Free Design
Manitoba Hydro
Manitoba Telephone System
Ontario Hydro
William M. Mercer Ltd.
Bank of Montreal

* these organizations have a formal link to CARNET

Industrial Involvement/Participation (continued)

Mainstream Access Corporation
Electrohome Electronics
Centre for Research on Human Development
Veterans Affairs
ETHOS
Canadian Institute of Travel Counsellors of Manitoba
Melita Senior Centre
Therapeutic Applications, Buffalo
Institute for Technology Development, Oxford, Miss.
Atlantic Canada Economic Development
The Messanger Telephone System
Manitoba Fashion Institute
Furniture West
Dauphin and District Community Resource Council
Community Help Centre, Roblin
Senior Services of Antler River, Melita
New Horizons, Killarney
Resource Council of Caman

CANADIAN BACTERIAL DISEASES NETWORK (CBDN)

Scientific Director:	Dr. Robert Hancock, University of British Columbia
Managing Director:	Dr. Henry Geraedts
Chair, Board of Directors:	Mr. Eric Geddes, Advanced Technology Project,
Number of Scientists:	38 full/6 associate members
Number of Participating Institutions:	Seven universities, two government labs
Number of Industrial Affiliates:	Ten
Administrative Centre:	University of British Columbia
Award:	$18.2 million over four years
Start-up Date:	May 1990

Canadian Bacterial Diseases Network (CBDN)

Bacteria often cause rapidly progressing, highly infectious diseases that exact human suffering as well as billions of dollars of losses worldwide in the agriculture, forestry and aquaculture industries. New technologies including monoclonal antibodies and genetic engineering offer considerable promise in turning the tables against these bacteria. This network studies bacterial attack and host response in very different biological systems (humans, animals, plants). Some of the projects involve strengthening the host's defences, others are aimed at developing models for human infections.

CBDN studies the causative agents of such diseases in humans as whopping cough, gonorrhoea, toxic shock syndrome, lung infections in cystic fibrosis, bacterial meningitis, and hospital-derived infections. In addition, researchers investigate major bacterial pathogens affecting the aquaculture industry (such as bacterial kidney disease in fish), the causative agents of plant wilt and crown gall diseases, and chipping fever in cattle. Products that may result include vaccines, antibiotics, diagnostics, and novel reagents and biomedical technologies.

The eight major research thrusts of CBDN are:

- antibiotics;
- intracellular bacteria/adherence/macrophages;
- live attenuated and subcellular vaccines;
- diagnostics;
- aquaculture and food animal vaccines;
- toxins;
- Helicobacter; and
- sexually transmitted diseases.

Canadian Bacterial Diseases Network

Universities	Fed. Govt. Dept. & Other	Industrial Partners
Université Laval	LCDC, Health & Welfare	ASTRA Pharma
University of Alberta	N.R.C. - Division of	AGTI
Univ. of British Columbia	Biological Sciences	Beckman Instruments
University of Calgary		Biophotonics Inc.
University of Guelph		Biosignal Inc.
University of Victoria		Biostar
VIDO, Saskatoon		Microtek R & D Ltd.
		Synthetic Peptides Inc.
		Syndel Laboratories
		StressGen

CANADIAN GENETIC DISEASES NETWORK

Scientific Leader:	Dr. Michael Hayden
Network Manager:	Dr. David Shindler
Chair, Board of Directors:	Dr. Martin Hollenberg
Number of Scientists/Engineers:	39
Number of Participating Institutions:	8 universities, 2 industries, 6 hospitals
Number of Industrial Affiliates:	0
Administrative Centre:	University of British Columbia
Award:	$17,500,000 over 4 years
Start-up Date:	August 1, 1990

Canadian Genetic Diseases Network

This network is investigating the genes that directly cause or predispose us to disease. The goal is to determine the biological function of each of the relevant genes, and to discover how mutation in each gene causes disease. From the new knowledge, it may be possible to detect carriers of most of the common genetic diseases, and, for some, to devise a treatment or cure. This research could lead to commercial opportunities for Canada in the area of DNA diagnostics and therapeutics. The results could be fewer affected persons and reduced health care costs. Specific diseases focused on include cystic fibrosis, muscular dystrophy, Huntington's disease, cancer and heart disease.

Major research themes are:

- identification of disease-causing genes;
- study of the disease process; and
- therapy.

Canadian Genetic Diseases Network

Universities

McGill University
Queen's University
Univ. of British Columbia
University of Calgary
University of Manitoba
University of Montreal
University of Ottawa
University of Toronto

Fed. Govt. Dept. & Other

Hosp. for Sick Children
Montreal Children's Hospital Research Inst.
Montreal General Hosp.
Children's Hospital of Eastern Ontario
University Hospital, Vancouver
Hôpital Ste-Justine

Industrial Partners

MDS Health Group Ltd.
Merck Frosst

Industrial Collaborators

Allelix Biopharmaceuticals
Biochem Pharma
Bristol Myer Squibb
Sci-Ex
Stress Gen Biotechnologies Corp.

CANADIAN INSTITUTE FOR TELECOMMUNICATIONS RESEARCH (CITR)

Scientific Leader:	Dr. Maier Blostein, CITR, McGill University
Network Manager:	Dr. Maier Blostein, President & CEO, CITR
Chair, Board of Directors:	Dr. John Elliott, BNR Ltd.
Number of Scientists/Engineers:	67
Number of Participating Institutions:	15 universities, two research centres
Number of Industrial Affiliates:	11
Administrative Centre:	CITR office (McGill University)
Award:	$14.7 million over four years
Start-up Date:	July 1990

Canadian Institute for Telecommunications Research (CITR)

CITR is a co-ordinated effort to boost Canada's position in telecommunications services and manufacturing, especially in the 'network of the future', which will allow subscribers easy access to telecommunications services involving voice, data, images, or multimedia services from virtually anywhere.

The network focuses on broadband and wireless communications, two rapidly growing areas that present important emerging markets for telecommunications over the next decade. Broadband communications refers to high-speed communications that will permit a diverse array of affordable, high-bandwidth, multi-point, interactive, audio/data/video teleconferencing, information and entertainment services for both business and residential markets. These will be made possible through advances in photonic, microelectronic and software technologies and by the development of novel telecommunication network design techniques. The affordability of broadband communications is critically dependent on integrating lasers and light detectors into micro-chips. Further, broadband systems must be so designed that each of thousands of subscribers receive just the required amount of network resources in a timely and efficient manner. Sophisticated new software technologies are needed to manage the availability of network resources and to maintain the integrity of network operations.

The companion study in wireless personal communications is concerned with providing subscribers access to telecommunications, information and entertainment services from wherever they may be located; at home, at work, at a remote location or in a moving plane, train or car. The critical technologies under investigation here are low power radio systems that are tightly organized into microcells, cells or macrocells, and that are interconnected to the terrestrial network in a manner permitting easy access to a wide range of multi-point, multi-media services.

Major project areas are:

- broadband services
- broadband networks
- optoelectronic devices and systems
- mobile and personal communications
- wireless indoor broadband communications

CITR

Universities	Fed. Govt. Dept. & Other	Industrial Affiliates
Carleton University	Communications Research Centre (CRC)	BNR Ltd.
Concordia University	TR Labs	NovAtel Communications Ltd.
École Polytechnique		MPR Teltech
INRS-Telecommunications		Teleglobe Inc.
McGill University		Gandalf Technologies
McMaster University		Spar Aerospace Ltd.
Simon Fraser University		CAL Corporation
Univ. of British Columbia		Newbridge Networks
Université Laval		Hewlett Packard Canada Ltd.
Université de Montréal		IBM Canada Ltd.
University of Ottawa		Stentor Resource Centre Inc.
University of Toronto		
University of Victoria		
University of Waterloo		

CANADIAN NETWORK FOR SPACE RESEARCH (CNSR)

Scientific Leader:	Dr. Leroy Cogger, University of Calgary
Network Manager:	Dr. Dennis Green
Chair, Board of Directors:	Dr. Ian McDiarmid
Number of Scientists/Engineers:	38
Number of Participating Institutions:	Six universities, two federal departments, one Ontario Centre of Excellence, six companies
Number of Industrial Affiliates:	Three
Administrative Centre:	University of Calgary
Award:	$17.0 million over four years
Start-up Date:	July 1990

Canadian Network for Space Research (CNSR)

The network seeks to integrate knowledge of processes in the atmospheric and near-Earth space environments, and to increase the competitiveness of its industrial participants through the transfer of technology, through the cooperative development of innovative instruments and also through personnel interchange. Examples of topical CNSR research thrusts include:

- the study of space plasmas, their harmful effects on space vehicles and structures, and the primary role they play in catastrophic, geomagnetically induced failure of electric power grids;
- intensive studies of middle and high atmospheric processes of direct relevance to global climatic change and ozone depletion, especially in the polar region. These network-sponsored, ground-based studies are closely coordinated with observations made by network researchers using instruments on board the recently launched UARS and Freja satellites;
- acquisition by industrial participants of advanced spacecraft instrumentation technologies which are relevant to anticipated space research needs and which offer possible applications in other markets.

CNSR research and development activities are organized into five closely related themes:

- Structure and dynamics of the middle atmosphere;
- Auroral processes;
- The polar atmospheric environment;
- The plasma environment in space;
- Space science instrumentation development.

Canadian Network for Space Research

Universities	Fed. Govt. Dept & Other	Industries
University of Alberta	Atmos. Envir. Service	Can. Astronautics Ltd.
University of Calgary	NRC - Herzburg Inst.	COM DEV Ltd.
Univ. of Saskatchewan	ISTS	ITRES Research Ltd.
Trent University		S.I.L.
Univ. of Western Ontario		SCI-TEC Instruments Inc.
York University		SED Systems Inc.

Industrial Associates

Myrias Computer Technologies Inc.
Applied Physics Specialties Ltd.
London Research and Development Ltd.

CENTRE OF EXCELLENCE FOR MOLECULAR AND INTERFACIAL DYNAMICS (CEMAID)

Scientific Leader:	Dr. Dennis Salahub, University of Montreal
Network Manager:	Ms. Kelley Plumpton
Director, Industrial Development:	Mr. Marc Escaravage
Chair, Board of Directors:	Dr. Alain Caillé, University of Sherbrooke
Chair, Industrial Development Committee:	Dr. Steven Wallace, University of Toronto
Number of Scientists/Engineers:	49
Number of Participating Institutions:	15 universities
Administrative Centre:	University of Montreal
Award:	$18.5 million over four years
Start-up Date:	November 1990

Centre of Excellence for Molecular and Interfacial Dynamics (CEMAID)

Chemical physics, the area at the boundary of chemistry and physics, seeks to understand the behaviour of atoms and molecules at surfaces. This is important to the development of complex instrumentation such as analytical instruments, lasers, spectrometers of all kinds and specialized monitoring, measurement and process control instruments.

Spectroscopy is one of three areas that the network focuses on, with researchers in optical, laser and mass spectroscopy combining their work. A second study area, reaction dynamics, is a key to understanding such important processes as ozone depletion, combustion and atmospheric pollution, as well as industrial technologies such as the fabrication of integrated circuits. The final study area-interfacial dynamics-is a new field that looks at the properties of surfaces and may be relevant for the fabrication of new materials.

CEMAID

Universities	Fed. Govt. Dept & Other	Industries
Dalhousie University		
Laval University		
McMaster University		
Queen's University		
Univ. of British Columbia		
University of Guelph		
University of Montreal		
Univ. of New Brunswick		
University of Ottawa		
Univ. of Saskatchewan		
University of Sherbrooke		
University of Toronto		
University of Victoria		
University of Waterloo		
Univ. of Western Ontario		

INSECT BIOTECH CANADA (IBC)

Scientific Leader:	Dr. Gerard Wyatt, Queen's University
Network Manager:	Dr. Bruce Hutchinson
Chair, Board of Directors:	Dr. J. Clare Rennie
Number of Scientists/Engineers:	29
Number of Participating Institutions:	10 universities, three government labs and two industries
Number of Industrial Affiliates:	Seven signatory
Administrative Centre:	Queen's University
Award:	$9.158 million over four years
Start-up Date:	July 1990

Insect Biotech Canada (IBC)

Insect pest control is important to Canadian agriculture and forestry. Agricultural crop losses due to insects range up to 35 percent, while, in forestry, insects are estimated to destroy up to 65 million cubic meters of timbers annually, fully one-third of Canada's annual cut.

With demand growing for new, environmentally acceptable methods of pest control, integrated biological management strategies are expected to be the major wave of the future. The network's program focuses on developing new, acceptable methods of pest control through biotechnology. Researchers explore means to alter naturally occuring insect viruses to render them more effective and selective in their attack on insects. Studies are also conducted on the molecular basis of pesticide resistance in insects with the twin goals of minimizing resistance in pests and transferring protecting genes to beneficial species. Researchers also look at genes responsible for hormonal mechanisms that can be used in new insect pest control strategies. One early practical result of molecular biology studies on insects is the development of DNA techniques for identifying closely related pest species. Products arising from this research will be tested in collaboration with industry and government laboratories.

Major research thrusts of IBC are:

- molecular engineering of baculoviruses (which infect and could control the spruce budworm, among others);
- characterization and molecular biology of insect neuropeptides (a class of hormones that control essential processes in insects);
- molecular genetics of pesticide resistance;
- juvenile hormone (a unique insect hormone) and juvenoid insect growth regulators;
- cell and molecular biology of insects.

Insect Biotech Canada

Universities

Queen's University
Université Laval
Univ. of British Columbia
University of Calgary
University of Guelph
Univ. of New Brunswick
University of Ottawa
University of Toronto
Univ. of Western Ontario
York University

Fed. Govt. Dept. & Other

Ag. Canada Res. Cntr. London
NRC - Biotech Res. Inst.
Forestry Canada - Forest Pest Management Inst.

Industries

Industrial Associates (2)

Cyanamid Canada
DowElanco

Industrial Affiliates (7)

DuPont Canada
Entotech (Novo Nordisk)
FMC Corporation - Agricultural Chemical Gr.
S.C. Johnson & Son, Inc.
Rhône-Poulenc Agriculture Company
Sandoz Agro Canada Inc.
Plant Genetic Systems

INSPIRAPLEX (RESPIRATORY HEALTH NCE)

Scientific Leader:	Dr. Peter Macklem
Network Manager:	Ms. Anne Vezina
Chair, Board of Directors:	Mr. David Weinstein
Number of Scientists/Engineers:	60
Number of Participating Institutions:	9 universities, 9 industries, 17 hospitals 3 government departments/agencies
Number of Industrial Affiliates:	0
Administrative Centre:	McGill University
Award:	$12,300,000 over 4 years
Start-up Date:	May 1, 1990

The Respiratory Health Network of Centres of Excellence (RHNCE)

RHNCE focuses on diseases leading to airways obstruction and inhalational lung disease. Its research programs represent traditional medical approaches to disease, namely pathology and pathophysiology, diagnosis, treatment, prevention and rehabilitation. These approaches represent the network's research themes:

1. Structure and Function (pathology and pathophysiology);
2. Physiologic Diagnosis;
3. Viral Diagnosis;
4. Asthma treatment;
5. Cystic Fibrosis treatment;
6. Environmental Health (prevention) subdivided into subthemes investigating indoor air quality in office buildings in relation to the sick building syndrome, homes in relation to asthma in school children and farm buildings in relation to hypersensitivity pneumonia;
7. Rehabilitation which includes intensive care medicine.

Eighteen disciplines ranging from molecular genetics through physiology, cellular immunology and pharmacology to biomathematics, computer sciences and engineering participate in the network's inter-disciplinary research programs. The products are equally diverse and include viral-specific DNA probes for the rapid diagnosis of viral lung disease, the development of living human lung explants, quantitative dynamic 3 dimensional imaging of moving cells, sophisticated image analysis systems, a machine to assess diaphragmatic contractility, a new generation mechanical ventilator in which patients choose their own rate of breathing, a patient transport vehicle which eliminates backstrain and a new heating, ventilation and air conditioning system designed to alleviate the symptoms of the sick building syndrome.

INSPIRAPLEX

Universities	Fed. Govt Dept. & Other	Industries
McGill University	St. Paul's Hospital	Engineering Interface
McMaster University	Vancouver General Hosp	Glenwilliam Industrial Designer
Univ. of British Columbia	Royal Victoria Hospital	Infrascan
University of Calgary	Montreal General Hosp.	Merck Frosst
Université Laval	Mtl. Chest Hosp Cntr	Omega
Université de Montréal	Hôpital Laval	Puritan-Bennett
University of Manitoba	Hôpital Notre-Dame	Raytech Instruments
Univ. of Saskatchewan	Hôpital Sacré-Coeur	Respironics
University of Toronto	Hôpital St. Luc	RHT-Infodat
	West Park Hospital	
	Res. Institute of the Hosp. for Sick Children	
	Foothills Hospital	
	Winnipeg Health Sciences Centre	
	St-Boniface Hospital	
	McMaster Health Sciences Centre	
	St-Joseph's Hospital	
	Univ. of Sask Health Sciences Centre	
	Dept. of Health & Welfare	
	Dept. of Public Works	
	Centre de la recherche industrielle du Québec	

INSTITUTE FOR ROBOTICS AND INTELLIGENT SYSTEMS (IRIS)

Scientific Leader:	Dr. Pierre Bélanger, McGill University
Program Leader/Director:	Mr. Gordon MacNabb, PRECARN Associates
Network Manager:	Mr. Paul Johnston, PRECARN Associates
Chair, Board of Directors:	Dr. Joseph Wright, Xerox Research Centre of Canada
Number of Scientists/Engineers:	130
Number of Participating Institutions:	18 universities, 31 industries, five government departments and three other institutes
Administrative Centre:	PRECARN Associates Inc.
Award:	$23.8 million over four years
Start-up Date:	July 1990

Institute for Robotics and Intelligent Systems (IRIS)

The network is managed by PRECARN Associates Inc., a consortium of 39 companies and other organizations whose mission is to carry out advanced research and development in robotics and artificial intelligence (AI). Members of PRECARN include resource and energy companies, suppliers of AI and robotics products, and communications and aerospace companies. Also integrated into the network are the 14 AI and Robotics Fellows of the Canadian Institute for Advanced Research.

The research program of IRIS includes 24 projects arranged within three related areas of enquiry-computational perception, knowledge-based systems, and intelligent robotic devices-the essential elements of a system's ability to perceive, reason and act. The search for technical advances focuses on the development of artificial intelligence, expert systems and robotics technology for the resource and manufacturing industries. Specific niches for Canada are also being identified in robotic devices for use in difficult and hazardous environments.

IRIS

Universities	Fed. Govt. Dept & Other	Industries
Concordia University	Alberta Research Council	Ainsworth Automation
École Polytechnique	Can. Inst. for Adv. Res.	Alcan International Ltd.
INRS-Telecom.	Canadian Space Agency	Asea Brown Boveri Inc.
Laval University	Communications Can.	Atomic Energy of Canada
McGill University	C.R.I.M.	B.C. Hydro
McMaster University	Energy, Mines & Resources	Bell Northern Research
Queen's University	National Defence	Bristol Aerospace Ltd.
Simon Fraser University	NRC-Inst. for Info. Tech.	B.C. Adv. Sys. Foundation
Tech. Univ. of Nova Scoti		CAE Electronics Ltd.
University of Alberta		Ernst & Young
Univ. of British Columbia		Falconbridge Ltd.
University of Guelph		H.A. Simons Ltd.
Univ. if Saskatchewan		Hatch Associates Ltd.
University of Toronto		Hewlett-Packard (Canada) Ltd.
University of Victoria		Husky Inject. Mould. Sys.
University of Waterloo		Hydro-Québec
Univ. of Western Ontario		Inco Ltd.
York University		LAC Minerals
		MacDonald Dettwiler & Associates
		Manalta Coal Ltd.
		MPB Technologies Inc.
		MPR Teltech Ltd.
		N.-B. Power Commission
		Ontario Hydro
		Petro-Canada Resources
		Shell Canada
		Spar Aerospace Ltd.
		Syncrude Research
		TransAlta Utilities Corp.
		Virtual Prototypes Inc.
		Xerox Res. Cntr.

MECHANICAL and CHEMIMECHANICAL WOOD-PULPS NETWORK

Scientific Leader & Managing Director:	Dr. Henry Bolker, PAPRICAN
Chair, Board of Directors:	Mr. Peter Wrist, PAPRICAN
Number of Scientists/Engineers:	27
Number of Participating Institutions:	Ten universities, one government laboratory, two industries and two PAPRICAN research centres
Administrative Centre:	PAPRICAN, Pointe Claire
Award:	$14.6 million over four years
Start-up Date:	August 1990

Mechanical and Chemimechanical Wood-Pulps Network

The goal of this network is to develop the mechanical pulping process to the point where it can produce superior grade papers that will not yellow. The process relies primarily on the mechanical breakdown of wood fibres as opposed to the chemical separation used in various "kraft" processes. It accepts a much wider range of common northern tree species and allows Canada to take advantage of its inexpensive hydro power. Mechanical pulping has the additional attraction of being intrinsically much less wasteful of trees. Mills that use the process have lower start-up costs, and produce less effluent.

The researchers, who include chemical, mechanical and electrical engineers, and chemists look at all stages of pulping. Key among their objectives is an understanding of lignin, a highly complex polymer whose components are responsible for photochemical yellowing. Success in eliminating this problem could create a new, and more efficient paper industry, plus the opportunity to develop a unique Canadian processing technology.

Major project areas are:

- pulping;
- processing;
- control;
- bleaching; and
- reversion.

Mechanical and Chemimechanical Wood-Pulps

Universities	Fed. Govt. Dept. & Other	Industries
Lakehead University	N.R.C.	PAPRICAN
McGill University		DuPont Canada
McMaster University		JWI Group
Mount Allison Univ.		
Queen's University		
Université du Québec à Trois-Rivières		
Univ. of British Columbia		
University of Ottawa		
University of Toronto		
Univ of Western Ontario		

MICRONET

Scientific Leader:	Dr. André Salama, University of Toronto
Network Manager:	Dr. Zahir Parpia
Chair, Board of Directors:	Dr. Douglas Barber, Gennum Corporation
Number of Scientists/Engineers:	76
Participating Institutions:	16 universities
Number of Industrial Affiliates:	14 industries 2 Ontario Centres of Excellence 3 government laboratories
Administrative Centre:	University of Toronto
Award:	$10.8 million over four years
Start-up Date:	May 1990

Microelectronic Devices, Circuits and Systems for Ultra Large Scale Integration (Micronet)

Ultra large scale integration (ULSI) describes the technological challenge of squeezing more than ten million functioning electronic components onto a microchip layer smaller than a fingernail and thinner than soap film. The technology is expected to become the mainstay of the next generation of telecommunications and computer systems. Micronet ties together efforts in devices, circuits and systems in a coordinated, vertically integrated, approach. There are three project areas:

- Devices;
- Circuits; and
- Systems.

The network's device research program deals with the complex design, modelling, and process techniques needed to fabricate the different types of microscopic devices on the chip. Circuit researchers take the device models and build efficiently designed, functioning circuit blocks. Finally, systems researchers smooth the way for ULSI applications in the areas of personal communication and information based systems. Efficient signal processing hardware, new networks and structures specifically for ULSI, and the ability to test for and repair faulty components are a few of the fundamental areas that are addressed.

Micronet

Universities	Fed. Govt. Dept. & Other	Industrial Affiliates
Carleton University	Alberta Microelec. Cntr.	Bell Northern Research
Concordia University	B.C. Adv. Systems Institute	Can Semicon Design Assoc
École Polytechnique	Canadian Microelect. Corp.	Canadian Marconi
INRS-Energie	Electronics Net. of Alberta	Gennum Corporation
McGill University	Inform. Tech. Res. Centre	Glenayre Electronics
Queen's University	N.R.C.	MacDonald Detwiller Assoc
Simon Fraser University	TRIO	Matrox Electronic Systems
TUNS	TRIUMF	Mitel
University of Alberta		MPR Teltech
Univ. of British Columbia		Newbridge Microsystems
University of Calgary		Northern Telecom Elect.
University of Manitoba		NovAtel Communications
University of Toronto		PMC-Sierra
University of Victoria		Teleglobe Inc.
University of Waterloo		
University of Windsor		

NETWORK OF CENTRES OF EXCELLENCE ON HIGH-PERFORMANCE CONCRETE

Scientific Leader:	Dr. Pierre-Claude Aitcin, Université de Sherbrooke
Network Manager:	Mr. Matthew Garriss
Chair, Board of Directors:	Mr. Philip Seabrook, Levelton Associates, Vancouver
Chair, Consulting Board:	Mr. Eric Fines, Canadian Portland Cement Association, Toronto
Number of Scientists/Engineers:	11
Number of Participating Institutions:	Seven universities, two industrial engineering firms
Administrative Centre:	University of Sherbrooke
Award:	$6.4 million over four years
Start-up Date:	July 1990

High-performance Concrete Network

For material scientists and engineers, concrete is a complex composite for which behavioral models and applications are still in their infancy. Recent developments in reinforcing agents provide a strong thrust for the development of new concretes that rank with other "high-tech" composite materials. Members of the High-performance Concrete Network are attempting to tailor the properties of concrete to specialized uses. The new knowledge should help Canadian consulting firms add to their success in bidding on large international construction projects.

Researchers investigate the whole concrete-making process, from colloidal phenomena in fluid concrete through to problems in the design of large structures. The anticipated benefits of this research include more durable and corrosion-resistant concrete for highways and bridges, as well as better testing methods for the safe use of high-performance concrete in offshore platforms, tall buildings, hydro-electric dams, and structures used to store nuclear waste. There will also be contributions to the development of codes, designs, and other applications. There are four major research themes:

- development of a new generation of building materials;
- design of high-strength concrete structures;
- development of new products and techniques (including testing); and
- contributions to national building codes and standards of practice.

HIGH PERFORMANCE CONCRETE

Universities	Fed. Govt. Dept. & Other	Industries
		John A. Bickley
University of Alberta		Associates Ltd.
Univ. of British Columbia		HBT AGRA
Université Laval		
McGill University		
University of Ottawa		
Université de Sherbrooke		
University of Toronto		

N.R. NETWORK (NEURAL REGENERATION and RECOVERY)

Scientific Leader:	Dr. Albert Aguayo
Network Manager:	Mr. Warren Bull
Chair, Board of Directors:	Dr. Roger Gaudry
Number of Scientists/Engineers:	24 Principal Investigators; 100 Associates, 50 Trainees
Number of Participating Institutions:	14 universities, 40 industries
Number of Industrial Affiliates:	8
Administrative Centre:	McGill University
Award:	$25,500,000 over 4 years
Start-up Date:	November 1, 1990

Neural Regeneration and Functional Recovery

The objective of the research is to promote nervous system regeneration and recovery of functions lost as a result of trauma or disease. A major reason for the permanent disability caused by injuries to the brain and spinal cord by common neurological disorders such as Alzheimer's or Huntington's disease is that damaged nerve cells are not replaced, nor do they restore connections with their natural targets. Major advances have been made recently in uncovering a previously unsuspected potential of the nervous system to re-grow after injury. The field is expected to undergo a further explosion of knowledge with the application of new technologies in molecular biology and genetic engineering.

Research by the network will lead to a better understanding of the underlying causes of neurodegenerative disorders, which in turn would allow for the design of better drugs for the treatment of these diseases. Indirect benefits could be reduced health care costs and re-entry into the workforce by the disabled.

There are six major research themes:

- neuronal survival and protection;-"rescuing & protecting nerve cells"
- neurotrophic factors;- "food for nerve cells"
- growth inhibitory molecules;- "blocking the blockers"
- regrowth and reconnection in damaged nervous systems;- "rewiring the circuitry"
- new gene technology; and -"newest tool for brain repair"
- functional recovery- "electronic replacement parts"

N.R. Network

Universities	Fed. Govt. Dept. & Other	Industrial Interests
Concordia University		Allelix
Dalhousie University		Allergan
McGill University		Amgen
McMaster University		Anteca Ltée
Queen's University		Biomech Designs
University of Alberta		Biostar Inc.
Univ. of British Columbia		Bristol-Myers Squibb
University of Calgary		BRL
Université Laval		BTS
University of Manitoba		Cangene Corporation
Université de Montréal		Cedarlane Labs
University of Ottawa		Ciba Gigy
University of Saskatchewan		Deprenyl Research
University of Toronto		Dupont
		Eli Lilly
		Fidia
		Genentech
		Gibco
		Hoffman LaRoche
		IBM
		Immunex Corp.
		Leaf Electronics Ltd.
		MDS Health Group
		Medicorp. Canada
		Medtronic Corp.
		Merck, Sharp, Dohme
		Merck Frosst
		Miles
		Minimed Technologies
		Neurex Corp.
		Neurodyne Canada
		Northern Digital
		Novapharm
		Organon
		Parke-Davis
		Q Life Systems
		Regeneron
		Sandoz
		Synergan
		UBI
		Upjohn
		Waterloo Scientific Inc.
		Zymo Genetics

THE OCEAN PRODUCTION ENHANCEMENT NETWORK (OPEN)

Scientific Leader:	Dr. Paul Leblond, University of British Columbia
Network Manager:	Ms. Denise Cassidy
Chair, Board of Directors:	Dr. Robert Fournier, Dalhousie University
Number of Scientists/Engineers:	43
Number of Participating Institutions:	Seven universities, two government labs and three industries
Administrative Centre:	Dalhousie University
Award:	$23.0 million over four years
Start-up Date:	June 1990

Ocean Production Enhancement Network (OPEN)

OPEN brings together fisheries biologists and oceanographers in an integrated research program. The initial focus of the program is on two species which are of great commercial value: the sea scallop and the Atlantic cod. Using these species as models, the scientists are investigating the processes which control the survival, growth, reproduction and distribution of fish and shellfish. The results of these investigations will be relevant to commercial fisheries. Other network scientists are developing new techniques in molecular genetics and new instrumentation for studying the oceans.

There are nine major project areas:

- larval scallops;
- juvenile scallops;
- adult scallops;
- cod/salmon recruitment;
- cod/salmon distribution;
- cod physiology;
- marine genetics;
- costal ocean dynamics; and
- marine technology-operational systems.

OPEN

Universities	Fed. Govt Dept. & Other	Industries
Dalhousie University	Fisheries and Oceans	National Sea Products
Laval University	(B.I.O. and N.W.A.F.C.)	Fishery Prod. Int. Ltd.
McGill University		Clearwater Fine Food
Memorial University		Inc.
Simon Fraser Univ.		
Univ. of British Columbia		
Université du Québec		
à Rimouski		

PROTEIN ENGINEERING NCE

Scientific Leader:	Dr. Michael Smith
Network Manager:	Mr. Stephen Herst
Chair, Board of Directors:	Dr. Eric Geddes
Number of Scientists/Engineers:	41
Number of Participating Institutions:	3 universities; 7 industries; 2 government laboratories
Number of Industrial Affiliates:	0
Administrative Centre:	University of British Columbia
Award:	$20,000,000 over 4 years
Start-up Date:	July 1, 1990

Protein Engineering: Network of Centres of Excellence (PENCE)

Protein Engineering is directed at establishing the relationship between the molecular structure and the function of proteins by chemical and molecular biological synthesis of systematically modified proteins. As well as defining how the molecular structure of proteins determines their function as enzymes (catalysts), hormones and growth factors (extracellular messengers), receptors (on cell surfaces or as antibodies) or as structural molecules (in muscle and connective tissue), protein engineering has the potential to provide molecular insights into almost all aspects of biology. In the long term, it will lead to the design of new pharmaceuticals and of new proteins of potential industrial importance. As such, it provides an essential infrastructure to studies of bacterial and viral infection and of inherited defects. Improved proteins can be of enormous benefit in the treatment of infectious diseases. They can also be used in the food industry, and in a variety of industrial products including pulp and paper and in biomass conversion into fuels.

PENCE studies concentrate on developing new peptide hormones and vaccines, cell growth factors for the treatment of cancer and infectious diseases, improved diagnostic reagents, and enzymes that will be able to operate in the various conditions found in pulp and paper processes to reduce the amount of chlorine used. In addition to a program of fundamental studies on protein design, the network can setup collaborations for protein structure determination with scientists from other universities, research institutes and industries.

The five major research areas are:

- growth factors and receptors;
- new oxidation and reduction enzymes;
- enzymes that hydrolyze polysaccharides;
- proteases of disease, novel inhibitors with potential therapeutic value; and
- design of proteins, glycoproteins and peptide pharmaceuticals.

PENCE

Universities	Fed. Govt Dept. & Other	Industries
University of Alberta	N.R.C. - Biotechnology Research Institute	Allelix Biopharmaceutical Inc.
Univ. of British Columbia	N.R.C. - Division of Biological Sciences	Connaught Laboratories Ltd.
University of Toronto	Biomedical Res. Centre	Hemosol Inc.
		Hypercube Inc.
		PAPRICAN
		Syntex Inc.
		Synthetic Peptides Inc.

Request for Government Response

Your Committee requests that the Government table a comprehensive response to the Report within 30 days.

A copy of the relevant Minutes of Proceedings and Evidence of the Standing Committee on Industry, Science and Technology, Regional and Northern Development (*Issues Nos. 25, 26, 27, 28, 29, 30, 31, 32, 33 and 34, which includes this report*) is tabled.

Respectfully submitted,

GUY RICARD,
Chairman.

Minutes of Proceedings

TUESDAY, APRIL 27, 1993
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[*Text*]

The Standing Committee on Industry, Science and Technology, Regional and Northern Development met *in camera* at 9:36 o'clock a.m. this day, in Room 208, West Block, the Chairman, Guy Ricard, presiding.

Members of the Committee present: David Bjornson, Bill Domm, Howard McCurdy, Jim Peterson, Guy Ricard and Jacques Vien.

Acting Members present: David Berger for Len Hopkins; Ross Belsher for Peter McCreath.

In attendance: From the Research Branch of the Library of Parliament: Ruth Fawcett, Research Officer.

In accordance with its mandate under Standing Order 108(2), the Committee resumed consideration of the future of the Networks of Centres of Excellence (*See Minutes of Proceedings and Evidence, dated Wednesday, February 24, 1993, Issue No. 25*).

The Committee commenced consideration of its Draft Report to the House.

It was agreed,—That the Draft Report, as amended, be concurred in.

It was agreed,—That the said Report be entitled: Beyond Excellence: The Future of Canada's Networks of Centres of Excellence.

It was agreed,—That the draft report, as amended, be adopted as the Committee's third Report to the House and that the Chairman be authorized to make such typographical and editorial changes as may be necessary without changing the substance of the report and that the Chairman be instructed to present the said report to the House.

It was agreed,—That the Committee request that the Government table a comprehensive response to this Report within 30 days.

It was agreed,—That the Committee print 2,000 copies of this Report, in tumble bilingual format, with a distinctive cover.

At 11:55 o'clock a.m., the Committee adjourned to the call of the Chair.

Christine Fisher
Clerk of the Committee