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iCORE YEAR IN REVIEW



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## MESSAGE FROM THE PRESIDENT

It is an error to imagine that evolution signifies a constant tendency to increased perfection. That process undoubtedly involves a constant remodelling of the organism in adaptation to new conditions; but it depends on the nature of those conditions whether the directions of the modifications effected shall be upward or downward.

THOMAS H. HUXLEY (1825 - 1895)

### ICORE AND ALBERTA: EVOLUTION AMIDST EXCELLENT CONDITIONS

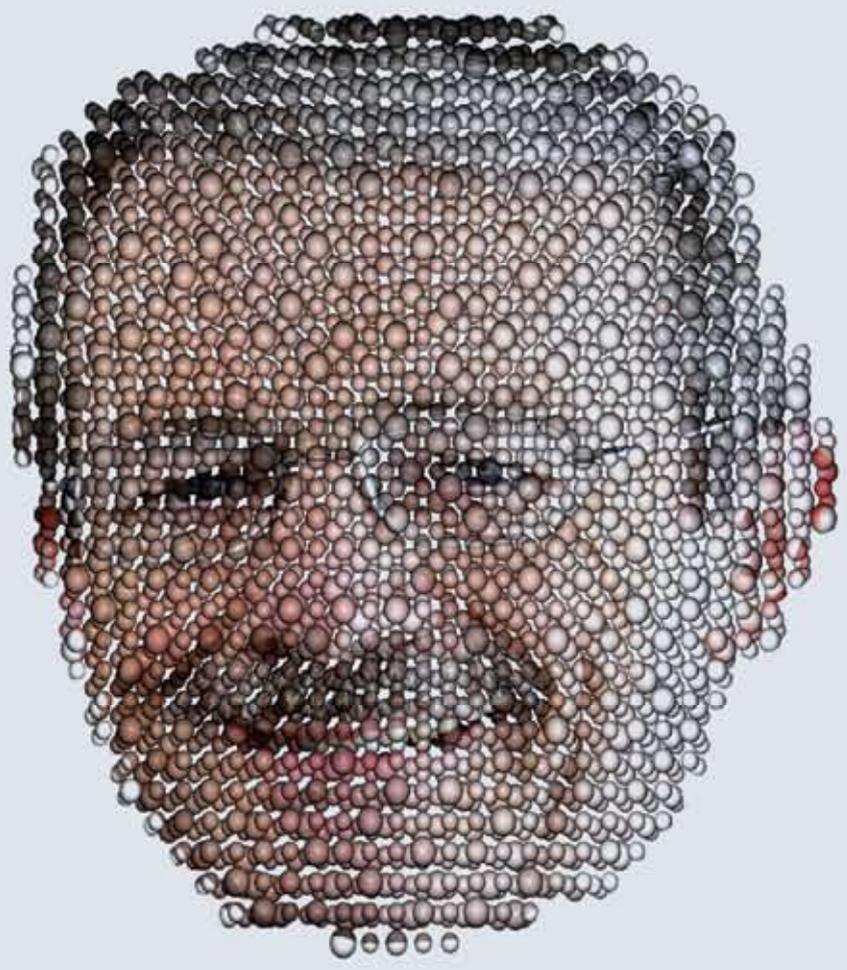
Most organisms aren't offered a choice about whether to participate in an evolutionary environment or not, but their adaptability to a shifting environment determines whether they survive or misalign and then weaken and die. In a man-made environment an organization is not dissimilar to an organism, except that it is created in response to a need. iCORE was created to help build informatics research capacity, and as a unique Alberta organization its creation was based on a belief that informatics is a fundamental core of all modern research and that research leadership in disciplines that rely on informatics is the foundation to a strong and productive knowledge economy.

That principle has not changed: information technology continues to occupy a central role in all modern research. Since iCORE's first appointment in 2000, the Academy has grown to 28 research chairs working across nine departments and six faculties. In 2006-2007 we saw changes to the Ministry, but iCORE's flexibility and the Government of Alberta's continued commitment to supporting innovation in Alberta allowed us to continue to build strong programs, recruit new chairs as well as embark on new projects. We saw significant partnerships evolve through our Industry Chair program, making it one of our most successful programs to date.

Just surviving in the turmoil of an evolutionary knowledge economy is not good enough. Proactive leadership requires nimbleness and managed risk in order to succeed. That is why iCORE is supporting research leaders in sensor networks, systems biology, and cyberinfrastructure, before the Alberta knowledge economy evolution has confirmed the infrastructure for those platform technologies.

That is iCORE's role: to lead in recruiting the franchise leaders even while the team is being designed. While the rest of the teams are being planned, the stadiums are being designed, and the expected performance is being estimated, iCORE is working in collaboration with universities and the government's public agenda to create a steady stream of innovative leaders that will help us all pre-adapt to the evolutionary turmoil of the global knowledge economy.

**Randy Goebel**  
**President and CEO**  
**iCORE**



## MESSAGE FROM THE CHAIR OF THE BOARD

**“For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution.”**

ALBERT EINSTEIN (1875-1955)

### iCORE IS BUILT TO EVOLVE

iCORE is the product of aspiration, determination and inspiration. Albertans aspire to make Alberta the best place on earth to live and work. Their determination shows itself in commitment and energy in pursuit of this ideal; supporting and encouraging outstanding performance in areas critical to the economic and social wellbeing of the province. The inspiration was to recruit some of the world's best to lead the way in pursuit of excellence in informatics, a set of foundational technologies underpinning many aspects of modern life. iCORE was formed to implement that objective.

To ensure that those recruited are working in areas of special importance to the province, iCORE formed the International Research Advisory Committee composed of recognized international leaders in informatics, many with personal ties to Alberta. They helped iCORE identify key areas to be targeted for attention. The process of recruitment was implemented in close collaboration with the universities using independent, external reviewers to ensure that those recruited are indeed the best. iCORE now has successful clusters in the areas of quantum encryption, wireless networks, machine learning, visualization, information security, biological modelling, and nanotechnology.

In a relatively short time, iCORE has succeeded in accomplishing its initial objective of recruiting outstanding researchers. It has taken steps to maximize their impact by providing incentives for the best graduate students to come to Alberta to work with them, with remarkable success. Furthermore, it has created a means by which collaborations involving both industry and federal partners can extend the economic and social reach of the resulting pool of expertise.

By focusing on the best, a modest investment by the province has accelerated Alberta's growth in these crucial technologies. iCORE works closely with partners, such as the universities, Alberta Ingenuity Fund, Alberta Heritage Foundation for Medical Research, and industry to maximize the benefit for Alberta and Canada.

The challenge for iCORE now is to adapt its approach to capitalize on the evolution of information technology and its use in Alberta to support the quality of life of Albertans. This means supporting foundational research with particular promise for the long term, and supporting efforts to transfer knowledge for the benefit of the province and the country. As information technology becomes more pervasive the opportunities increase, but so does the challenge of choosing well. Fortunately, the education of so many highly qualified and highly motivated people guarantees that the investment in iCORE is risk-free.

**Seamus O'Shea**

**Chair**

**iCORE Board of Directors**

**Vice-president (Academic) and Provost**

**University of Lethbridge**



**DR SHEELAGH CARPENDALE**  
British Columbia > Ontario >  
University of Alberta

**DR CAREY WILLIAMSON**  
Saskatchewan > University of Calgary

**DR SAUL GREENBERG**  
Quebec > University of Calgary

**DR GERARD LACHAPPELLE**  
Quebec > UK > Finland > Austria >  
University of Calgary

**DR HUGH WILLIAMS**  
Ontario > Manitoba >  
University of Calgary

**DR JONATHAN SCHAEFFER**  
Ontario > University of Alberta

**DR MICHAEL BRETT**  
Ontario > University of  
Alberta

**DR PIERRE BOULANGER**  
Laval & Montreal, Quebec >  
Ottawa > University of Alberta

**DR ROBERT WOLKOW**  
Waterloo > Toronto > Ottawa >  
University of Alberta

**DR NORMAN C. BEAULIEU**  
Ontario > University of Alberta

**DR FADHEL GHANNOUCHI**  
Quebec > University of Calgary

**DR BARRY SANDERS**  
UK > Australia >  
University of Calgary

**DR RICHARD SUTTON**  
California > Boston > New Jersey  
> University of Alberta

**DR GRAHAM JULLIEN**  
Ontario > University of Calgary

**DR SIRISH SHAH**  
UK > Alberta > Japan >  
University of Alberta

**DR STUART KAUFFMAN**  
New Mexico > University of Calgary

**DR MICHAEL FREEMAN**  
New York > University of Alberta

**DR HONG ZHANG**  
Boston > Indiana > University of Alberta

**DR REI SAFAVI-NAINI**  
Australia > University of Calgary

**DR GUENTHER RUHE**

Germany > University of Calgary

**DR WOLFGANG TITTEL**

Germany > Switzerland > Denmark >  
Switzerland > University of Alberta

**DR CHRISTIAN SCHLEGEL**

Switzerland > Indiana >  
Switzerland > Hawaii >  
Australia > Texas > Utah >  
University of Alberta

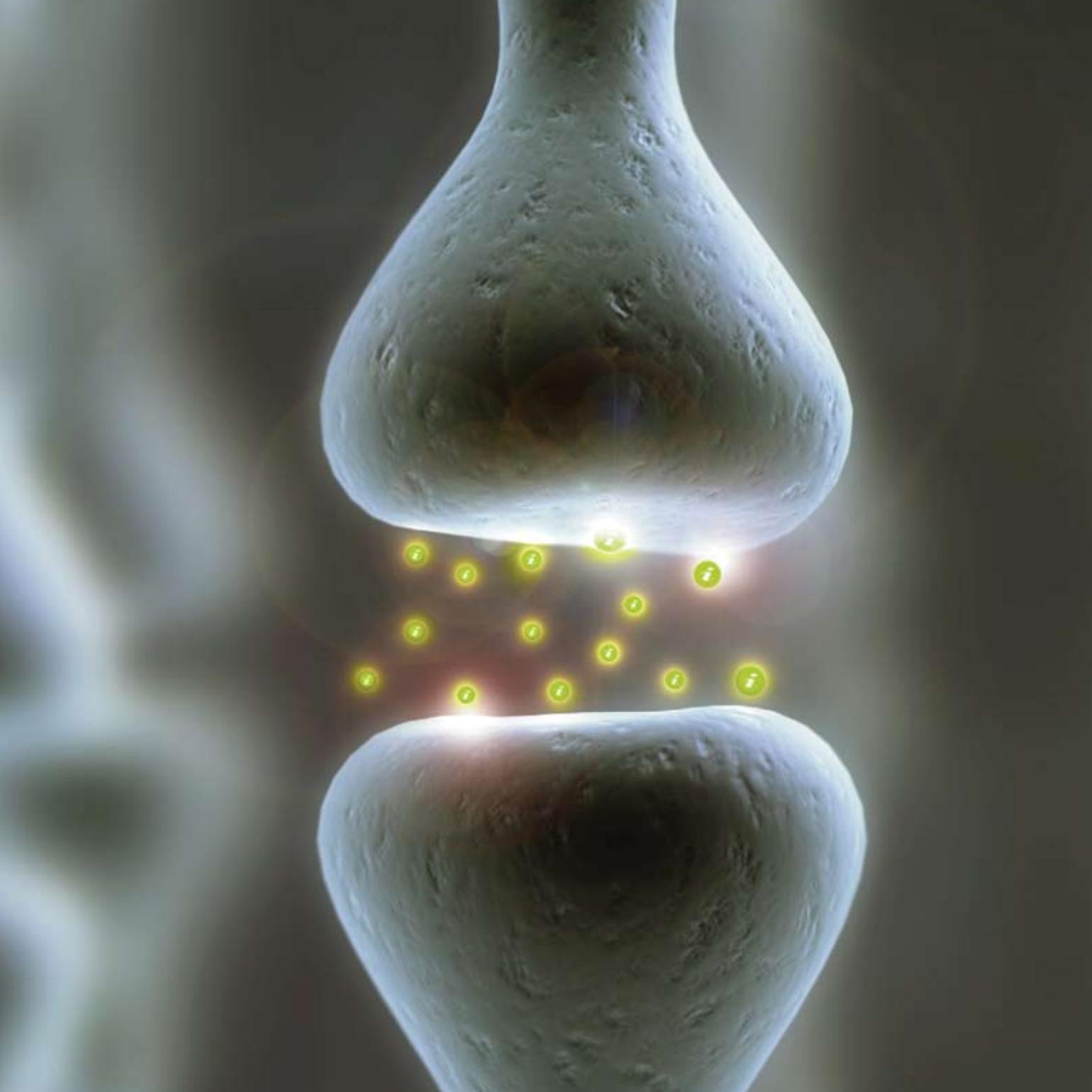
**DR CHRISTOPHER SENSEN**

Germany > Halifax >  
University of Calgary

**DR ANUP BASU**

India > New York > Maryland >  
University of Alberta

**EVOLUTIONARY MIGRATION  
OF iCORE CHAIRS**



# IDEAS > RESEARCH > INNOVATION

in Alberta universities and industry

In October 1999, iCORE was tasked to foster an expanding community of exceptional researchers in information and communications technology (ICT). To help accomplish this goal, iCORE founded crucial advisory committees; IRAC, ERC, IRC, BoD. With the help of these teams, iCORE developed grant programs that would work to recruit high quality people while ensuring their work would have a home in Alberta. The key to success for iCORE has been the flexibility built into the committees and programs. Over the years, these programs have succeeded in bringing unique researchers from the world over to Alberta. These researchers have in turn developed internationally recognized research teams at Alberta universities. The work of these research teams has garnered attention and support from industry leaders worldwide. Locally, iCORE has worked with industry to nurture intellectual property and knowledge workers for the benefit of the entire province.



# NEWEST ARRIVALS

## 2006-2007 iCORE Chairs

This year iCORE Chairs represent the flexibility within iCORE programs that allows Alberta to benefit from high quality people doing research in this province. Dr Rei Safavi-Naini, iCORE's first independent female Chair, brings expertise that complements research being conducted by two other iCORE teams; Dr Barry Sanders' Institute for Quantum Information Science and Dr Tittel's Quantum Cryptography group. The second Chair is an industry and co-Chair position, also including a talented female Chair. This co-Chair is not only bringing a world class company into the mix, but also allowing two talented researchers to make their contributions as well.





## DR REI SAFAVI-NAINI

### iCORE Chair in Information Security

Security has always been a concern for humans. As we have progressed into the Information Age, the need for Information Security has become a serious concern. Human confidence in the protected collection, storage, and exchange of information underpins our economy and social fabric. This confidence impacts the potential for, and growth of, information products and services in sectors ranging from banking to health to transportation to entertainment to communications and defense. Dr Rei Safavi-Naini, an acclaimed information security researcher, will lead a research team dedicated to evolving information security from theoretical work to applied cryptography, multimedia security and rights management, and network and wireless security.

Dr Safavi-Naini and her team will aim to produce novel security algorithms, technologies, tools, and applications. Her team will also be able to contribute to the development of "Made in Alberta" information security solutions that can be developed and commercialized. Aligning with other iCORE researchers in the areas of human computer interfaces, networks and communications, new architectures and devices, high performance computing, intelligent information systems, and software systems will allow the team to build leading-edge knowledge to be incorporated into diverse training and outreach activities, leading to further capacity building, partnerships, collaborations, and the attraction of investment to the proposed research program and Alberta.

*Dr Safavi-Naini has received a Chair and Professorship Establishment Grant from iCORE of \$3.85M over 5 years, in addition to contributions from the University of Calgary, Canada Foundation for Innovation and the Natural Sciences and Engineering Research Council (NSERC).*





## DR SHEELAGH CARPENDALE AND DR SAUL GREENBERG iCORE/SMART Technologies Industry Chairs in Interactive Technologies Research

Since the beginning of time, humans have used graphics to communicate.

As technology has evolved, so has human ability to communicate through that technology. New iCORE Chairs Drs Carpendale and Greenberg are heading one of the few research groups in the world that study the development of communication using ubiquitous computing technologies such as interactive table-top displays and digital appliances. In an established lab at the University of Calgary, Drs Greenberg and Carpendale lead a collaborative effort involving several researchers and numerous graduate students.

Their projects include the ethnographic study of human-computer interactions to determine what is most effective for the user; the design of technology that supports and enhances the way humans normally interact; the development of technologies that use natural input such as voice and hand-gesture commands rather than buttons, menus, or keyboards; the design of technology interfaces and other software that facilitates group collaboration; visualization and manipulation of complex data sets; the design of interactive table-top and wall displays that allow users to manipulate and share digitized information and to stay aware of each other's activities; the development of home appliances and other so-called ubiquitous computing devices as new ways of fluidly embedding technology within the real world, and the study of the ethical implications of "always on" technology such as webcams. Working with Industry partner SMART Technologies will allow their research to impact new technologies as they evolve.

*Drs Carpendale and Greenberg have received an Industrial Chair Establishment grant from iCORE and SMART Technologies Inc. of \$200,000 per year, for 5 years, in addition to various contributions from the Department of Computer Science and University of Calgary*

# EVOLUTION OF iCORE WORK AND PROGRAMS

iCORE's seventh year included the evolution of the founding Ministry, of two grant programs and the ICT Atlas project.



## PROVINCIAL EVOLUTION: ALBERTA'S MINISTRY FOR ADVANCED EDUCATION AND TECHNOLOGY

Premier Ed Stelmach announced the creation of the new Ministry of Advanced Education and Technology on December 13, 2006. A natural evolution of the Ministries of Innovation and Science and Advanced Education, the new portfolio is responsible for the whole innovation cycle; providing Albertans with affordable opportunities to learn and apply new knowledge and new skills to strengthen the province's capacity for innovation; and building capabilities of firms and institutions to engage in R & D activities in areas of strategic importance to the province, as well as continuing to lay the foundation for commercial success.

## INDUSTRIAL EVOLUTION: THE ICORE INDUSTRIAL CHAIR ESTABLISHMENT PROGRAM

Over the years, the iCORE Industrial Chair Establishment (ICE) program has brought iCORE researchers together with private companies to create Industrial Chairs in targeted areas at Alberta universities. It has become such a win-win partnership that its growth has gone beyond the initial iCORE plan. iCORE's flexibility allows us to embrace this growth and adapt to further interest from industry. Each successful grant has given companies access to internationally competitive research and graduate students while at the same time connecting researchers to practical problems facing industry. Each iCORE ICE team is developing practical solutions that benefit industry while adding real-world value to the work universities are doing.

## EVOLUTION OF ALBERTA'S ICT STRATEGY: FROM ROADMAP TO ATLAS

In 2005, iCORE was asked by Alberta Innovation and Science to produce an ICT Sector Roadmap for the province. After examining the role of ICT in the province's energy, agriculture, and forestry industries as well as the health care, finance, biotechnology, and educational sectors, the ICT project team increased the scope from a strategic ICT 'roadmap' to a more dynamic forward-looking analysis of how the needs of Alberta industries could shape opportunities for new research, development, and commercialization in the ICT sector. The completed ICT Atlas also integrates the roles of ICT suppliers, research, and infrastructure. Now designed to be a dynamic document, the ICT Atlas will be continually updated to reveal opportunities for the province's ICT sector to meet the emerging needs of the province's industrial infrastructure.

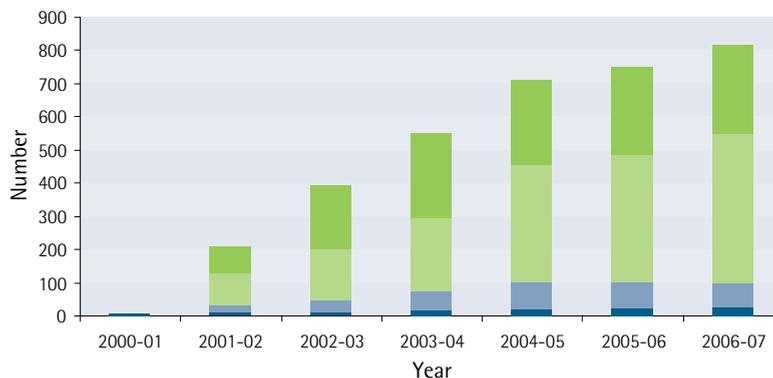
## EVOLVING PROGRAM: CHANGING BOUNDARIES FOR GRADUATE STUDENT SCHOLARSHIPS

iCORE's graduate student scholarship program was designed to foster a strong graduate student population in Alberta. These students support the development of strong informatics research teams, which in turn elevate the research reputation and productivity of the universities. As the definition of ICT expands with new technology and iCORE research teams grow to include researchers from diverse backgrounds, the shape of the graduate student community needed to support this research is changing as well. This year, to better meet Alberta's needs, iCORE expanded the Graduate Student Scholarship program to include non-computer science and electrical and computer engineering students who are enrolled at Alberta universities, who hold an NSERC Canada Graduate Scholarship (CGS) or Post Graduate Scholarship (PGS) and who are supervised by an iCORE Chair, Professor, or Industry Chair. With continued support from the Ministry of Advanced Education and Technology, and all its counterparts, iCORE will continue to measure and adjust programming as needed.

# MEASURING PERFORMANCE EVOLUTION

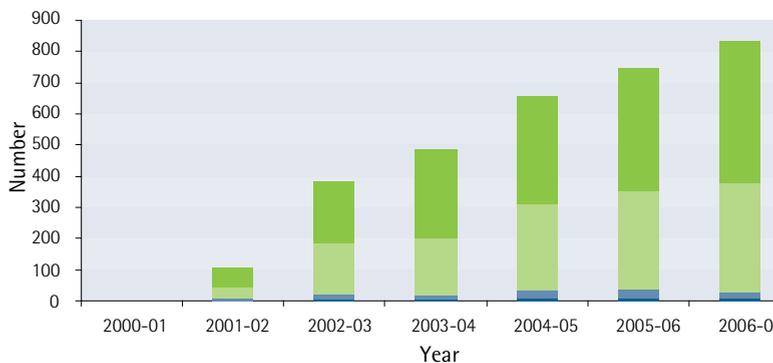
## Active High Quality People supported by iCORE

- Student Scholarships
- Students on Teams
- Faculty
- iCORE Chairs



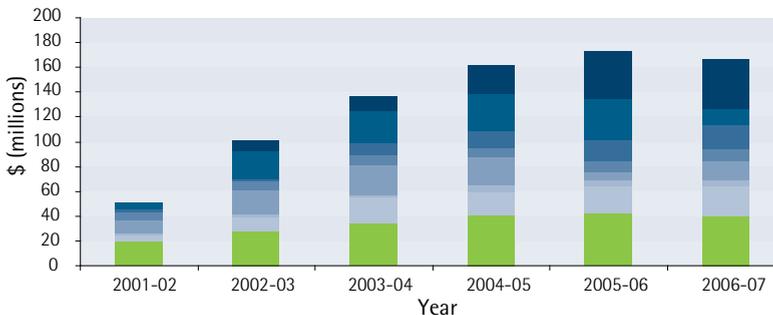
## Annual Intellectual Property created by iCORE Researchers

- Conference Papers
- Journal Papers
- Books
- Patents & Licences



## iCORE Researchers Active Sources of Funding

- Other
- Industry
- NSERC
- CRC
- CFI
- Universities
- ASRA/AIF
- iCORE



# iCORE AND THE COMMUNITY

iCORE brings researchers together with private companies:

## iCORE/Smart Technologies

Dr Sheelagh Carpendale - Interactive Technologies

## iCORE/Smart Technologies

Dr Saul Greenberg - Interactive Technologies

## iCORE/General Dynamics

Dr Wolfgang Tittel - Quantum Cryptography

## iCORE/Castle Rock Research

Dr Anup Basu - Multimedia

## iCORE/NSERC/Syncrude/Matrikon

Dr Hong Zhang - Intelligent Sensing Systems

## iCORE/NSERC/Suncor/Matrikon

Dr Sirish Shah - Computer Process Control

## iCORE/TRLabs

Dr Pierre Boulanger - Collaborative Virtual Environments

## iCORE/Sun Microsystems

Dr Christoph Sensen - Applied Bioinformatics

## iCORE/NSERC/TRLabs

Dr Jim Haslett - Wireless Science and Technology

## iCORE/NSERC/Micralyne

Dr Michael Brett - Thin Film Engineering  
/ Nanoengineered ICT Devices

## iCORE/NSERC/Telus Mobility

Dr Carey Williamson - Wireless Traffic Modeling

iCORE supports the development of Alberta's ICT industry through supporting programs aimed at developing entrepreneurial talent particularly with students:

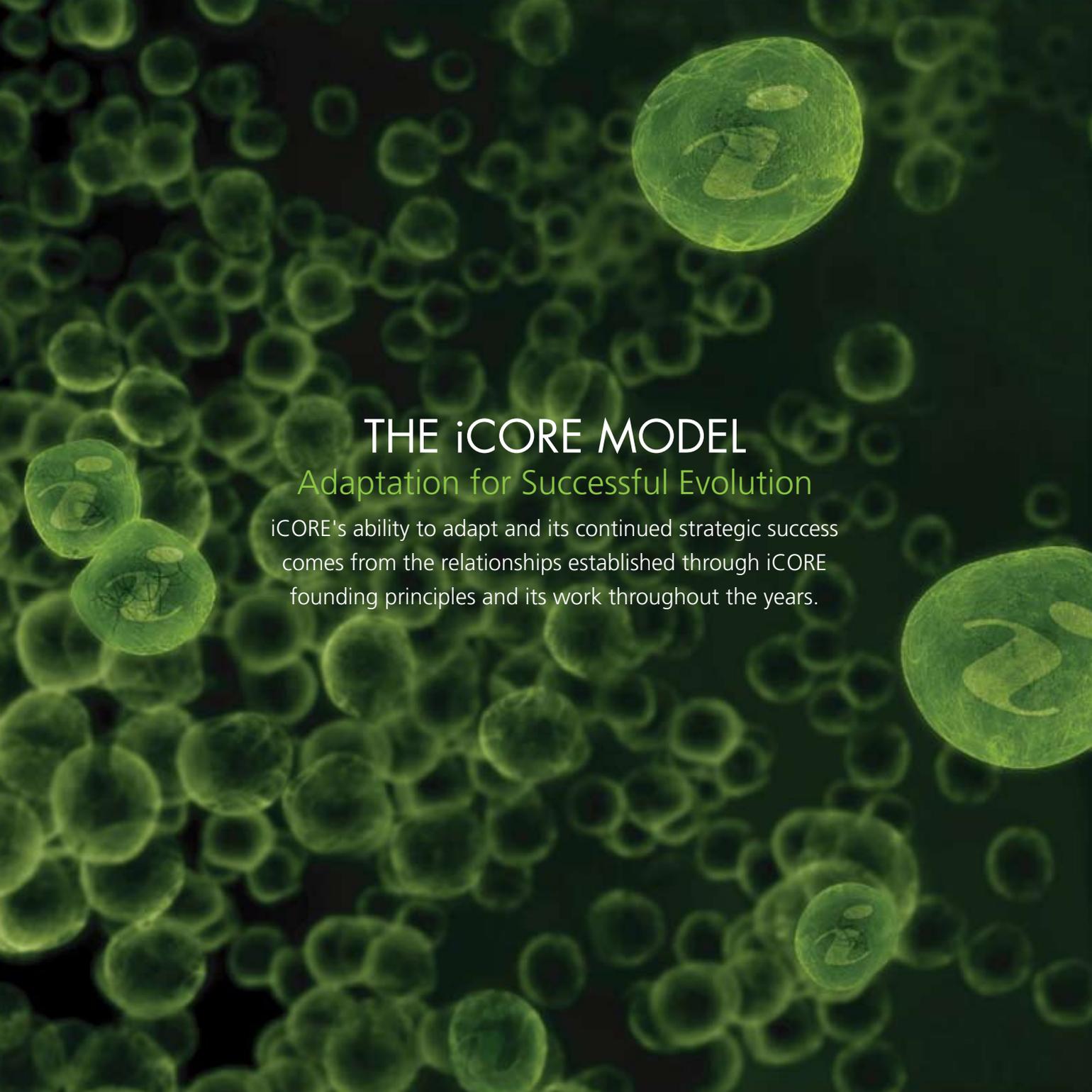
- Collegiate Computer Programming Contests – iCORE supports regional contests, teams attending international contests and Alberta's bid to host the International Collegiate Programming Contest in 2008
- Science to Society (THECIS) – Entrepreneurial training workshop for graduate students and junior faculty
- Shad Valley Summer Internship Program (NRC) – Entrepreneurship training camp for exceptional grade 11-12 students
- Student Technology Innovation Challenge (STIC) – A business plan competition for students with technology-based ventures
- Dragon's Den Workshop – Entrepreneurship workshop for students and the public

iCORE supports international events which showcase Alberta to both academics and industry:

- The 16th International World Wide Web Conference (WWW2007), Banff, Alberta, May 2007
- 20th Anniversary Computer Supported Cooperative Work Conference (CSCW2006), Banff, Alberta, November 2006

iCORE supports the development of innovative communities within Alberta that enable people and organizations to leverage each others strengths in multidisciplinary and creative work:

- Support of and leadership in the Alberta Science & Technology Leadership Foundation (ASTech Awards).
- Supporting creative workshops at the Banff Centre, the PIMS Graduate Mathematics Modeling Camp (2005), and Alberta's Robot Soccer Team 2005.

A microscopic view of numerous green fluorescent cells, likely yeast, against a dark background. The cells are spherical and contain internal structures. Some cells are in focus, showing internal organelles, while others are blurred in the foreground and background, creating a sense of depth. The overall color palette is dominated by various shades of green and black.

## THE iCORE MODEL

### Adaptation for Successful Evolution

iCORE's ability to adapt and its continued strategic success comes from the relationships established through iCORE founding principles and its work throughout the years.

**Leverage existing processes and facilities where they already exist:** iCORE uses existing NSERC evaluation processes for Industrial Chair and Graduate Student review. iCORE resides in the Alberta Research Council building, which provides high-tech facilities and reception.

**Partner closely with the Universities to leverage their expertise and motivation to achieve mutual goals:** iCORE provides some "top down" direction by selecting the research areas and defining the program criteria, but taps into the partnerships and resources of the Universities for them to provide the specific opportunities and candidates. iCORE publishes clear program criteria and processes and provides a program that supports the universities in developing proposals/recruiting.

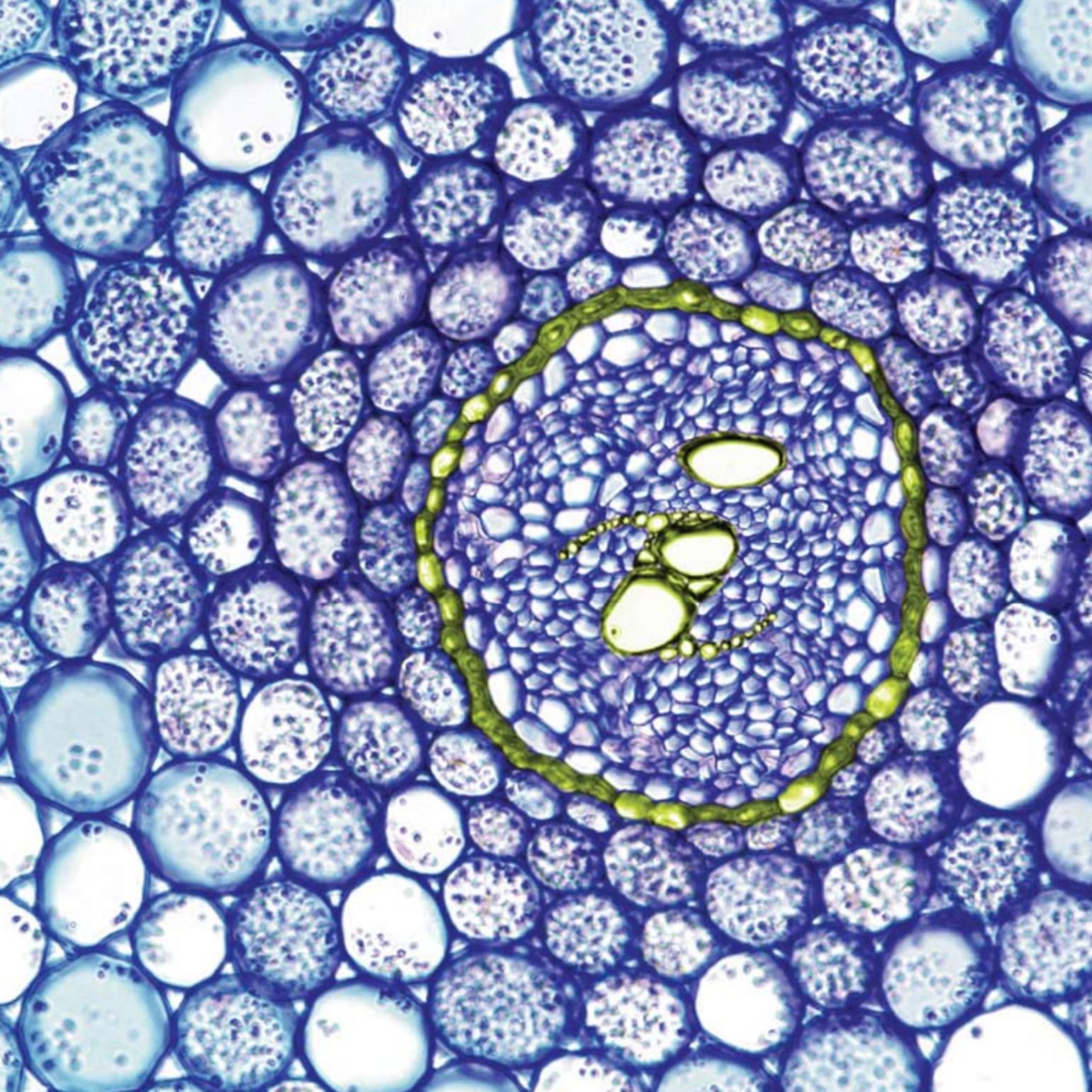
**Stay connected to the "customers" – the Universities and Government, Chairs, ICT Faculty, and Senior Administration:** iCORE management meets with iCORE researchers and other faculty regularly, has individual meetings throughout the year with each Department Head/Chair, holds an annual stakeholders meeting to solicit input and feedback from all levels of University and Government Senior Administration (Vice Presidents, Deans, Department Heads/Chairs, Assistant and Deputy Ministers), and participates on many joint initiatives with these partners.

**Provide very high quality and frequent communications about mandate, programs, and results:** iCORE publishes: a quarterly electronic newsletter, an annual glossy Year In Review that provides color for the Annual Financial Statements, an Annual Research Report that provides the detailed results of each team, and an annual Performance Measures Report that summarizes the annual results to show trends and performance in quantitative terms.

**Ensure regular communications/reports from the research teams:** iCORE requires short quarterly reports (2-4 pages) and detailed annual reports (10 pages). The quarterly reports keep the Secretariat informed about ongoing progress. The annual reports are reviewed to monitor progress and are used to report in aggregate on iCORE's performance.

**Provide opportunities for researchers to get together, to find out about each others work, to network, and to create clusters of research excellence in certain areas:** iCORE believes that researchers will find natural synergies if they have the opportunity to find out about each others work. The annual iCORE Summit allows all iCORE researchers and their students to get together and present their work to each other and other invited guests.

**Excellent people provide excellent results:** This statement is fundamental to iCORE's philosophy. iCORE recruits the best "world-class" researchers who have established track records in research and leading a research team. iCORE also diversifies this "portfolio" by funding "rising stars", who are more junior faculty, but have proven themselves to be far above their peers. iCORE also funds the best graduate students from Canada and internationally, and Industry Chairs, who may have more applied research focus, but have proven themselves in their ability to be strong partners with industry.



# THE iCORE ORGANIZATION

## BOARD OF DIRECTORS

### Dan Bader

(Retired) Corporate Chief Information Officer  
Government of Alberta

### Dr Murray S. Campbell

Manager  
Intelligent Information Analysis Department  
IBM T.J. Watson Research Center

### Dr Peter C. Flynn

Poole Chair in Management for Engineers  
Faculty of Engineering, University of Alberta

### Dr Peter Hackett

President, Alberta Ingenuity

### Mary E. Hofstetter

President & CEO, The Banff Centre

### Dr Gary Kachanoski

Vice President (Research), University of Alberta

### Robert Lai

Branch Head, ICT Industries Branch  
Advanced Education and Technology  
(Observer)

### Dr Seamus O'Shea (Chair)

Vice-president (Academic) and Provost  
University of Lethbridge

### Dr Dennis Salahub

Vice President (Research), University of Calgary

### J.R. (Rolf) Sherlock (Vice Chair)

Senior Partner, BVIS Consulting Services

## SECRETARIAT

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President and CEO

### Lynn Sutherland

Vice President, Programs

### Fred A. Stewart

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### Terry Ross

Business Officer

### Carole Carlton

Office Manager

### Sho Sengupta

Director of Communications

### Lilly Wong

Programs Officer

### Aileen Gautron

Communications Officer

## INTERNAL REVIEW COMMITTEE

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University of Calgary

### Dr Michel Fattouche

Professor, Department of Electrical  
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Chief Technical Officer  
Cell-Loc Location Technologies Inc.

### Dr Robert Fedosejevs

C.R. James/MPBT/NSERC Senior Industrial Research Chair  
in Laser and Spectroscopic Techniques Applied  
to the Natural Resources Industry  
Electrical and Computer Engineering  
University of Alberta

### Ken Gamble

Industrial Technology Advisor  
Alberta Research Council  
National Research Council's  
Industrial Research Assistance Program (IRAP)

### Dr R.G. (Randy) Goebel

President and CEO of iCORE

### Dr Jim Haslett

Professor of Electrical and Computer Engineering  
Leader, VLSI Group  
University of Calgary

### Dr Tony Marsland

Professor of Computer Science  
University of Alberta

### Bruce Matichuk

Founder, Chair and CTO of Celcorp

### Dan Wilson

Chief Scientist  
Invict Technologies Corporation

## EXTERNAL REVIEW COMMITTEE

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Professor Emeritus  
Electrical and Computer Engineering  
McGill

### Dr Eric Grimson

Professor of Computer Science and Engineering  
Massachusetts Institute of Technology  
Bernard Gordon Chair of Medical Engineering

### Dr John Hollerbach

Professor and Director of Graduate Studies  
University of Utah School of Computing

### Dr Gordon MacNabb

Officer of the Order of Canada  
Founding Fellow  
Former President of the Canadian Academy of Engineering  
Fellow of the Royal Society of Canada

### Dr John Mylopoulos

Professor of Computer Science  
Bahen Centre for Information Technology  
University of Toronto

### Dr Nicholas Pippenger

Professor of Computer Science  
Princeton University

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University of Toronto

### Dr James Gosling

Chief Scientist, Java, Vice President and Fellow  
Sun Microsystems

### Dr Eric George Manning

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University of Victoria

### Dr Raymond Perrault

Director, Artificial Intelligence Center  
SRI International

### Dr Richard E. Taylor

Professor, Stanford University  
Nobel Laureate

### Dr Wolfgang Wahlster

Professor, Universität des Saarlandes  
Saarbrücken Director and CEO  
German Research Center for Artificial Intelligence

# iCORE: THE NEXT EVOLUTION

As the province of Alberta continues to evolve, developing new economies, adapting to rapid growth, and feeling growing pains, iCORE will continue to look for opportunities to strengthen the economy via leadership in Information and Communications Technology. iCORE is evolving its focus into the areas of: sensor networks, cyberinfrastructure, and systems biology. These areas represent expansions of current clusters of ICT expertise supported by iCORE. We align and adapt to provincial focus areas and capacity building needs in Alberta. In this growing and adapting province, iCORE understands that these areas represent initiatives that are much larger than the iCORE programs. Each of these areas has a fundamental need for ICT research and development in addition to application in the other key focus areas in Alberta: Life Sciences (including Medicine, Agriculture, Forestry), Energy & Environment, and Nanotechnology. They also have potential social benefits in supporting other areas of research, and education and health applications. iCORE will look to working with other programs and institutions in the province to embrace these opportunities, bringing our successful model to the partnership.