




THE EXPLORATION EDITION

Annual Report 08-09



CIFAR

CANADIAN INSTITUTE
for ADVANCED RESEARCH

A topographic map of Canada, rendered in a dark brown color scheme. The map shows the outlines of the provinces and territories, with contour lines indicating elevation. The text is centered over the map.

To create knowledge that enriches
human life, improves understanding
of the world, and advances the
research community in Canada.

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TABLE OF CONTENTS

2	Message from the Chairman of the Board
3	Message from the President and CEO
4	CIFAR by the Numbers
6	Priorities and Strategic Objectives
6	Launch of the Junior Fellow Academy
6	International Reach and Knowledge Transfer
7	Program Review and Renewal
8	Exploring New Research Questions
9	Humanities Initiative
10	Cosmology and Gravity
11	Earth System Evolution
12	Experience-based Brain and Biological Development
13	Genetic Networks
14	Institutions, Organizations and Growth
15	Integrated Microbial Biodiversity
16	Nanoelectronics
17	Neural Computation and Adaptive Perception
18	Quantum Information Processing
19	Quantum Materials
20	Social Interactions, Identity and Well-Being
21	Successful Societies
22	Message from the Chair, Advancement and Communications Committee
23	CIFAR'S Donors are Explorers Too
24	CIFAR Lunar Circle
25	Government
26	CIFAR Annual Donors
28	Management's Discussion and Analysis of Financial Results
30	Auditor's Report
31	Summarized Financial Statements
36	Board of Directors
37	Council of Advisors
38	Program Advisory Committees
40	Research Council
41	Directors Emeriti
42	CIFAR Staff



MESSAGE FROM THE CHAIRMAN OF THE BOARD

I have always been deeply impressed with CIFAR researchers and their research – learning about their work is one of the great rewards of my association with the Institute. It is worth remembering, though, that there are many other people and groups who contribute to the success of the organization.

Even a cursory perusal of the members of CIFAR’s Board of Directors gives some sense of what an outstanding, diverse group of bold thinkers they are. CIFAR’s Board meets five times a year, to oversee the Institute’s business affairs, set a strategic course for the organization, and to assist with fundraising, governance, accountability and all the other vital components that make the organization so successful. They exemplify the same kinds of collaboration and innovative thinking that characterize CIFAR research.

CIFAR’s equally illustrious Research Council, comprising some of Canada’s most esteemed academic leaders, helps guide the organization’s intellectual explorations. They provide input into searches for new programs and reviews of existing ones. They also help the Institute identify emerging research areas where CIFAR could and should lead the way.

Finally, there is CIFAR’s staff: a talented and dedicated group of individuals who support all of the Institute’s activities, including research, knowledge transfer, fundraising and much, much more. CIFAR staff plan more than 30 program meetings every year, along with many major fundraising initiatives, plus lectures, tours, debates, publications and more.

I congratulate all of these people – researchers, volunteers and staff alike – and thank them all for another highly successful year of discovery.

Richard W. Ivey

Chairman, CIFAR Board of Directors



MESSAGE FROM THE PRESIDENT AND CEO

In 1492, Columbus discovered the Americas. In 1906, Roald Amundsen navigated the Northwest Passage, tracing out a new northern sea route from the Atlantic to the Pacific. In 1953, Tenzing Norgay and Sir Edmund Hillary stood on top of the highest mountain in the world.

Bit by bit, intrepid men and women have traveled to every nook and cranny on the planet. They have found the source of the Amazon River, and spelunked the most inaccessible caves. They have conquered both poles, and circumnavigated the globe in every way imaginable. Today, a standard cell-phone will tell you your location almost anywhere in the world to an accuracy of a few metres. While Google Earth and Mapquest are marvelous tools, they also destroy the hope that a modern person could be the first to set foot anywhere on the planet, ever again.

The age of exploration, though, is not over. CIFAR's 350 researchers spend every working day on the frontiers. They navigate through unmapped territory. They round a corner in their research and discover sights so surprising and exciting it leaves them in awe. And they leave behind them paths and trails that others can follow, opening up new realms of research where tomorrow's intellectual and technological revolutions will happen.

This exploration is more than a simple metaphor. The pursuit of new knowledge taps all of the same aspects of human nature as physical travel: the willingness to risk the unknown, the thrill of discovery, and the knowledge that today's new territory may be tomorrow's economic boon.

This report will give you some sense of where these explorations have taken our researchers this year. Of course, we could not include all their stories; their journeys go in so many directions, to so many unknown territories, that our main purpose can only be to remind you that this is not the end of the age of exploration, but merely the beginning.

Chaviva M. Hošek

President and CEO and
Lawson Family Foundation Fellow
Canadian Institute for Advanced Research

CIFAR BY THE NUMBERS

Year CIFAR was founded:

1982

Current annual budget
(in millions of dollars):

14.5

Number of programs CIFAR
has supported since 1982:

19

Number of CIFAR researchers
as of June 30, 2009:

358

Percentage growth in
program membership over
the last five years:

54

Percentage of CIFAR
senior members ranked
by *Thomson Reuters
Essential Science
Indicators* to be in
the top one per cent
of their field:

44

Number of current
CIFAR programs:

12

Number of program members
recruited to Canada from
abroad since 1982:

62

Percentage of CIFAR
members in the early
stages of their career as
of June 30, 2009:

24

Number of Nobel laureates who
have been associated with the
Institute's programs:

14

Percentage of CIFAR members
who received major awards
in 2008-2009:

20

Percentage of Advisory
Committee members based
in countries other than Canada:

77

Number of countries where CIFAR
researchers are based as of June 30, 2009:

15

Percentage of CIFAR program
members based in countries
other than Canada:

39



Number of institutions where CIFAR researchers conducted their work as of June 30, 2009:

110

Of these, number of institutions in Canada:

27

Current number of graduate students and postdoctoral fellows mentored by CIFAR members:

1,400

Current number of people in CIFAR's Lunar Circle, a group of donors with lifetime giving of \$100,000 or more:

94

Number of program meetings held in 2008-2009:

27

Percentage of researchers reporting ongoing projects or new ideas resulting from CIFAR interactions this year:

89

Number of program members reporting active engagement in knowledge transfer and public outreach this year:

123

Number of governments (Federal and Provincial) that supported CIFAR this year:

5

Number of CIFAR meeting attendees in the last year:

1,158

Number of publications authored by CIFAR members in 2008-2009:

1,731

Of these, number of publications co-authored by 2 or more CIFAR members:

236

Average private sector donation to CIFAR in 2008-2009:

\$10,652

PROGRAMS AND RESEARCH

PRIORITIES & STRATEGIC OBJECTIVES for 2008-2009

The 2008-2009 year was the first full year of implementation of the CIFAR strategic plan.

This plan identified five key goals:

- 1) to expand and enhance CIFAR research by building programs, extending and expanding global reach and developing the research model
- 2) to support and build capacity in gifted young researchers
- 3) to position CIFAR to benefit Canada within the global research community
- 4) to develop the capabilities, capacity and international reach of CIFAR's organization
- 5) to establish stable and balanced funding capable of sustaining growth.

Significant progress has been made on all of these goals.

LAUNCH OF THE JUNIOR FELLOW ACADEMY

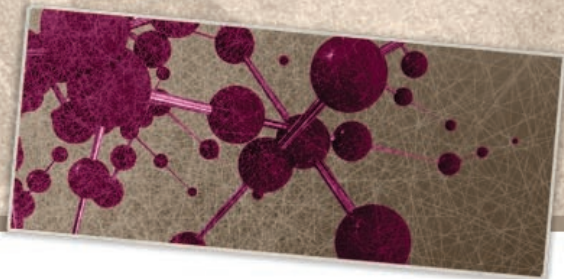
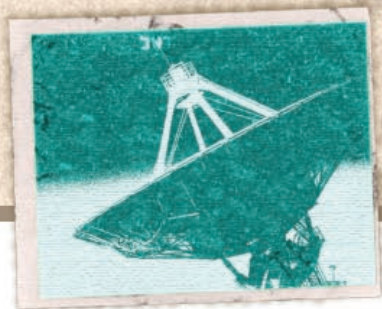
Designed to be a prestigious, two-year fellowship program attracting some of the world's best young researchers to CIFAR and the Canadian research community, we identified funding for 24 such positions, two in each of our existing programs. A total of 22 Junior Fellows were approved by CIFAR's Board of Directors over the course of the year, with nine beginning their formal appointments in 2008-2009. CIFAR also created a Steering Committee to review nominations and give advice on implementation strategy, guidelines and policy for the program. The inaugural meeting of the Academy was held in April 2009. The next will be held in November 2009.

INTERNATIONAL REACH AND KNOWLEDGE TRANSFER

CIFAR identified in its Strategic Plan a goal to strengthen its international reach. During 2008-2009, the total number of international researchers involved in CIFAR's programs (both as program members and advisors) rose slightly to 45 per cent. We also maintained or increased the representation of international researchers as invited guests to program meetings.

Senior CIFAR staff conducted a ten-day mission to India where they met with research leaders in the physical sciences and explored opportunities for strengthening CIFAR's engagement with the Indian research community and for building on existing CIFAR initiatives in that country. The Institute also met with Canadian science and technology consular staff to discuss opportunities for further engagement in Brazil, Europe and the United States. In late 2008-2009, CIFAR also began planning a China initiative. Altogether, this year involved much exploration of different models for deeper institutional engagement. The Institute is using these experiences to prioritize and refine our strategic goals.

CIFAR continued work on a robust Knowledge Transfer strategy. Knowledge Transfer activities reported by CIFAR researchers over the 2006-2007 and 2007-2008 years were compiled and entered into a new database. This exercise showed that CIFAR researchers undertake a broad range of such activities. The frequency and type of event varies from program to program.



PROGRAM REVIEW AND RENEWAL

Three of our research programs, *Earth System Evolution*, *Institutions, Organizations and Growth*, and *Neural Computation and Adaptive Perception* underwent external peer review in 2008-2009, as part of their normal life cycle. All three reviews drew outstanding arm's-length senior scientists, primarily from outside Canada, to assess each program in terms of past achievements, future plans and potential to lead internationally. The review committees also rigorously evaluated the individual core members appointed in each program from the perspective of their scientific stature/achievements and ability to contribute to the program. The review committees were thorough and exacting, spending two to three days in evaluation of written material and interviews with program members. Their assessments resulted in significant observations and recommendations to CIFAR that have been influential in guiding future research content of these programs as well as initiating changes in management and program leadership.

Earth System Evolution underwent its third review, having been established in 1993. The panel concluded that the program had made major advances in each of the themes proposed at the time of its previous review in 2003 (determinants of sea-level; the Earth's rotation; long- and short-term climate change; the cooling event in the last 65 million years; and consideration of the "snowball Earth" hypothesis that integrates these interconnecting processes). The panel strongly recommended renewal of the program, with a new focus on secular and abrupt changes in earth history, ice-age dynamics, coupling and feedback among solid earth and earth surface processes such as glaciation or changes in sea level, interactions among physical, chemical, biological and climate processes at Earth's surface, and studies of extrasolar planets. These new foci demanded significant changes in program membership.

The first review of *Institutions, Organizations and Growth* was held in October 2008. The program set out to consider such issues as how institutions and organizations affect economic growth, which are best suited to different stages of

development and what mechanisms can cause them to change. The review panel reported that the research produced by members of the IOG program made fundamental contributions and defined the state of the art in the areas under study. The panel found that the participation in the program shaped members' research agendas and elevated the research. The panel supported the proposed future directions and found that the group has the distinction and talent to maintain their impact with only minor adjustments in membership to address under-represented disciplines.

The *Neural Computation and Adaptive Perception* program underwent its first five-year review, having been established in 2003 with a focus on three goals: understanding human vision processing and object recognition; developing learning algorithms to reproduce this ability in machines; and exploring ways to communicate information in multilayer neural networks. The review panel noted significant progress in all three areas, highlighting two achievements in particular that changed their respective fields: introduction of the concept of "deep belief networks" by Program Director Geoff Hinton in the field of machine learning; and publication of a new computer sciences algorithm by Fellow David Lowe called SIFT (scale-invariant feature transformation) that allows a computer to identify an element in an image – a car or a tree, for instance – regardless of what size the element is depicted. This has become the most referenced paper in the machine vision literature.

Although *Nanoelectronics* underwent its own review a year earlier, subsequent action was taken as a result in 2008-2009. The panel recommended the program maintain a "big tent" intellectual focus, noting the challenge of this strategy with a program having "disparate areas of excellence". Based on the panel's endorsement, priority has been given to the areas of quantum cavities and resonators; light localization and nanophotonics; and nano-bioelectronics using DNA structures/ materials.

The recommendations from all four reviews were subsequently accepted by the Institute's Board of Directors.



EXPLORING NEW RESEARCH QUESTIONS

CIFAR maintains an active search process for new research topics and “big questions,” using informal input from its stakeholders.

One such search explores the physics of ultracold matter by studying gases cooled to extremely low temperatures via a combination of lasers and electromagnetic trapping techniques. The exploration has become an established theme within the *Quantum Materials* program. CIFAR hosted a series of focused annual workshops bringing the small Canadian “cold atoms” community together with international research leaders. *Cold Atoms* workshops attracted members of three other CIFAR programs, especially those interested in possible application to quantum computing. The Institute plans to continue to foster this topic through future workshops.

CIFAR senior staff continued searches in two other areas during 2008-2009: the role of poorly understood chemical cycles that are critical to the health of oceans; and the mechanisms used by cells to make decisions on how energies are directed toward specific functions.

A second *Oceans* search workshop was held in November 2008, which brought together researchers to discuss key questions concerning the role of nitrogen in oceanic cycles. The search in *Cellular Decision Making* engages researchers at the interface between biology and the physical sciences. It began with a highly successful two-day workshop in June 2008 in Toronto, with 26 Canadian and international participants. The main themes addressed were:

- 1) cellular decision processes studied at the single cell level in real time;
- 2) reducing biological decision-making machinery to simpler modules;
- 3) quantitative modeling of biological decision processes; and
- 4) the role of stochasticity within biological systems.

CIFAR is now organizing a second workshop in conjunction with the United States National Sciences Foundation, the Engineering and Physical Sciences Research Council and the Biotechnology and Biological Sciences Research Council in the United Kingdom, all of which have an interest in promoting interdisciplinary research in this area. This workshop is scheduled for April 2010.

In response to an initiative promoted by several senior Canadian scientists involved with the Canadian Space Agency, as well as CIFAR researchers in the *Integrated Microbial Biodiversity* and *Earth System Evolution* programs, CIFAR hosted a workshop in May 2009 focused on Astrobiology. Bringing 27 of the world’s most significant researchers in this area together with their Canadian colleagues involved in searching for extraterrestrial life, inhabitable planets outside our solar system and life in extreme terrestrial environments, this workshop was recognized by the participants as an important contribution to the Canadian research environment. CIFAR anticipates that a proposal for a follow-up workshop will be made by the Canadian organizers of this effort.

CIFAR also began discussions with several Canadian research groups on a potential search into the effects of climate on human development, from both anthropological and cultural perspectives. A workshop in Human-Climate Interactions is being tentatively planned for 2009-2010.

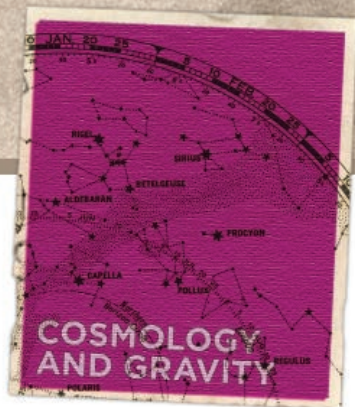


HUMANITIES INITIATIVE

CIFAR has supported research programs in the social and natural sciences, and its research model has been very successful in pushing intellectual and knowledge boundaries in these areas. However, despite searches that had significant humanities engagement, CIFAR has not identified a research program in the “core” of the humanities. In order to understand how CIFAR would best support advanced research in these areas, a member of the CIFAR Research Council prepared a green paper on the nature of advanced research in humanities. Using this as a framework, CIFAR organized a discussion with senior humanities researchers drawn from institutions across North America in May 2009.

The two-day meeting concluded that CIFAR could play a role in the humanities, though its approach would have to be appropriately flexible to accommodate how humanists understand and perform knowledge creation. The meeting participants recommended the creation of an ad hoc Steering Committee that would undertake the process of identifying in detail how CIFAR should approach and support advanced humanities research. This Humanities Initiative will continue in 2009-2010, with a meeting of the Steering Committee planned for December 2009.

For more information about CIFAR programs and activities, or to make a tax-deductible donation to the Institute, visit www.cifar.ca.



COSMOLOGY AND GRAVITY

Program Director: Dick Bond

ORIENTATION

The *Cosmology and Gravity* program attempts to tell a comprehensive story of the structure and evolution of the entire Universe, from its first moment of existence to its ultimate fate.

HIGHLIGHTS

The past year has marked major advances in understanding our Universe. Theorists and experimentalists in the group made many discoveries that were important in their own right that together took cosmological research to new levels.

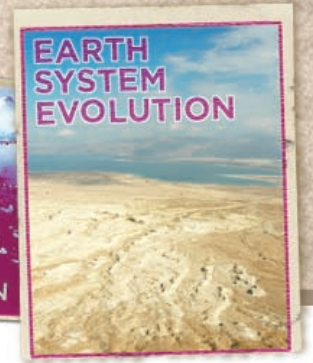
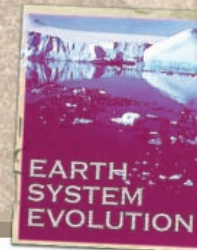
Member Vicky Kaspi was part of an international effort that discovered a fascinating celestial act called “cosmic recycling,” in which a dying neutron star (the remnants of a massive collapsed star) is brought back to life and transformed into a fast spinning pulsar (a neutron star that emits regular bursts of radiation). The discovery was made in data analyzed at McGill and suggests that the neutron star, which was one of a pair, was “siphoning” matter from its companion. The act occurred extremely recently in astronomical time scales (in the past decade). Researchers hope that this means they will be able to observe other such events as they happen.

One of the great unsolved questions in Einstein’s Theory of General Relativity is what happens when two black holes merge? After decades of effort, CIFAR Member Frans Pretorius simulated this complicated problem on a computer. Subsequent simulations turned out to be related to one another by surprisingly simple patterns. This year, Latham Boyle, a Junior Fellow in the program, co-published a theory explaining the origin of these patterns, and predicting many others. These theoretical developments will play a role in understanding the ripples in space-time that are produced by such a merging.

A large portion of the Universe comprises something called “dark energy”, a phenomenon that accelerates the expansion of the Universe. Scientists know it exists, but face great challenges in studying it directly. The Canada-France-Hawaii Telescope Legacy Survey attempts to quantify dark energy by measuring the distances to supernova explosions, which also provides a reliable indicator of the Universe’s rate of expansion. This year, Member Ray Carlberg and his collaborators set a new accuracy standard for measuring these distances, bringing cosmologists closer to understanding dark energy. The journal *Astronomy & Astrophysics* called one of the team’s recent papers one of the most influential of the past 40 years.

LANGUAGE TIP

Cosmic Microwave Background: noun • the leftover radiation from the Big Bang that created our Universe about 13.7 billion years ago. Cosmic microwave background radiation fills the Universe and provides a snapshot of the first moments of existence as we know it. This year, Director Dick Bond and Member Barth Netterfield were involved with the launch of the Planck satellite, the most sensitive telescope ever designed to study the CMB.



EARTH SYSTEM EVOLUTION

Program Director: Jerry X. Mitrovica

ORIENTATION

At a time when global warming weighs heavily on the public consciousness, the *Earth System Evolution* program provides the larger context of how our world has evolved over hundreds of millions of years.

HIGHLIGHTS

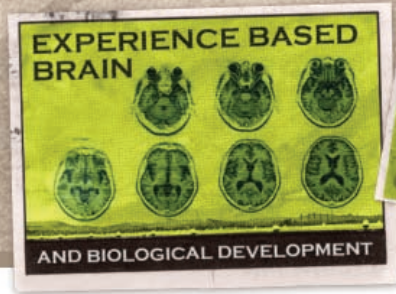
In its epic history, the Earth has passed through many periods of relative cold and heat. This year, the *Earth System Evolution* program learned more about both of these climate extremes. Lee Kump and his colleagues solved a perplexing question about one of the major historical causes of extreme global warming. They identified a biological mechanism associated with certain algae that produce gases that help clouds form. If the Earth heats up just a little, it reduces these algae's biological productivity, which results in fewer clouds. As the sky gets less cloudy, the Earth heats more quickly. This biological feedback or "climate amplifier," as Dr. Kump has described it, is profoundly important to our understanding of climate change and points to a possible further cause for concern in our current warming world.

More chilling thoughts come from CIFAR climate scientists who are concerned about the stability of the West Antarctic Ice Sheet. The United Nations Intergovernmental Panel on Climate Change estimated that the collapse and melting of this ice sheet, which may take several centuries to complete, would raise global sea levels by about five metres.

This past year, however, Program Director Jerry Mitrovica and colleagues showed that the sea-level rise would not distribute evenly. North American coastlines and a southern region of the Indian Ocean would see sea levels rise by up to seven metres, inundating many populated coastal regions and cities. At the same time, the southern portion of South America would experience very little change in sea level. This prediction of sea-level change is explained by the huge gravitational pull of the ice sheet itself. If the ice were to melt, this pull would disappear, causing sea levels in the Antarctic region to drop while water flowed back into the northern hemisphere. Dr. Mitrovica's group also found that the melting would cause the Earth's rotational axis to tilt by about 500 metres, which would further shift water from the southern to the northern hemisphere.

LANGUAGE TIP

The dryline: noun • the narrow boundary separating hot, dry, mountain air from very moist air. In western North America, the dryline results from the mixing of dry, westerly air from the Rocky Mountains with humid air ascending from the prairies. The collision of these masses can create severe weather such as hail or tornadoes.



EXPERIENCE-BASED BRAIN AND BIOLOGICAL DEVELOPMENT

Program Co-Directors: Marla Sokolowski and Tom Boyce

ORIENTATION

Experience-based Brain and Biological Development explores the core question of how social experiences affect developmental biology and help set early trajectories of lifelong development and health.

HIGHLIGHTS

Program Member Michael Kobor studies how early social adversity may program an individual's biological systems. He and his collaborators recently released a striking study of adults who were raised in low socioeconomic circumstances. In these individuals, the genes responsible for regulating the stress hormone cortisol were less active and the genes responsible for inflammation were more active. The childhood stress of being poor shaped how these genes were expressed, even if the person's situation improved later in life. This helps to explain how adverse early experiences can lead to a lifelong increase in the risk of certain chronic diseases.

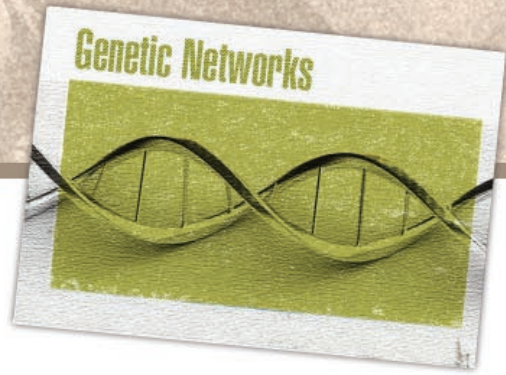
The study of how environmental factors affect the way genes behave is known as "epigenetics." In another epigenetic study, Members Michael Meaney and Moshe Szyf found that the expression of genes differs systematically between the average population and suicide victims who have histories of child abuse. This finding in humans follows from previous studies by Drs. Meaney and Szyf on the effect of stress in infant rats.

Dr. Szyf also collaborated with CIFAR Member Clyde Hertzman on the first study in the world to search the entire human genome for socioeconomic effects. It should serve as a profound and authoritative reference for understanding how social environments influence children's health and well-being. Their early results already show that children raised in less affluent settings have highly distinctive patterns of gene activation.

Also this past year, public intellectual and renowned researcher Robert Sapolsky became a member of the program. Dr. Sapolsky is an expert on the social behaviour of baboons in the wild. He studies how some personality types are better suited to coping with stress than others, and how stress affects the ability of brain neurons to survive trauma. His laboratory was among the first to discover that sustained stress can damage the hippocampus, a region of the brain concerned with learning and memory. Dr. Sapolsky brings a vast knowledge of social and molecular neuroscience to the program, along with a strong collaborative spirit.

LANGUAGE TIP

Methylome: noun • the comprehensive set of methylation patterns in a genome. Methylation is one of the best understood ways to turn genes on and off. By comparing the methylomes of monkeys raised in different environments, for example, program members learn how external factors affect the way genes are expressed.



GENETIC NETWORKS

Program Director: Brenda Andrews

ORIENTATION

The *Genetic Networks* program is devoted to discovering how genes interact with one another, research that could identify the root causes of many complex genetic diseases, and lead to new treatments and preventive measures.

HIGHLIGHTS

Crammed into every human cell is a colossal three kilometres of DNA. The DNA compacts into this tiny space by winding around special proteins called “nucleosomes.” Almost all of any DNA strand is in contact with nucleosomes but some of the most interesting phenomena happen with the ten to twenty per cent that is not. Areas on human DNA where nucleosomes are absent tend to be regulatory sites – the parts of the genome that regulate gene expression.

Program Member Tim Hughes uses this information in his research into how regulatory information is encoded in the genome. Dr. Hughes studies the budding yeast, the single-celled organism that is used to make beer and bread. This yeast also happens to be a powerful tool for understanding how human cells function – it is just genetically similar enough to draw meaningful parallels. His results show that the yeast genome is programmed to keep regulatory regions nucleosome-free. These regions are instead bound by other proteins called “transcription factors,” which regulate gene expression. Dr. Hughes is now studying what genetic interactions might control how these transcription factors are expressed.

Program Member Charlie Boone and Director Brenda Andrews completed another project on the budding yeast this year. They examined more than five million gene pairs and generated genetic interaction profiles for 75 per cent of all yeast genes. The result – a map that clusters genes according to their key roles – represents the first genetic interaction map of its kind for any organism.

This map is already finding therapeutic applications. Phil Hieter, a medical geneticist in the program, discovered a genetic interaction between two yeast genes that is involved in chromosome activity. These genes – and their interaction – also exist in humans. Certain tumor cells have an abnormal mutation in one of these two genes. This makes the tumor cells susceptible to “selective killing.” Dr. Hieter can knock out one of these mutated genes and thereby selectively kill the tumor cell. Healthy cells don’t have this mutation, and are therefore unaffected.

LANGUAGE TIP

Phenomics: noun • a field of study that characterizes phenomes, the collection of phenotypes that make up a living being. A phenotype is any observable trait of an organism. These traits result from the way an organism’s genes are expressed, the influences of its surrounding environment, and the interactions between the two.



INSTITUTIONS, ORGANIZATIONS AND GROWTH

Program Director: Elhanan Helpman

ORIENTATION

The question of what makes some countries rich and others poor has vexed economists for more than 200 years. *Institutions, Organizations and Growth* takes an integrated approach to this issue, examining the effect of many types of institutions and organizations on economic growth.

HIGHLIGHTS

King Philip II of Spain was “The Borrower from Hell.” In the 16th century, he accumulated debts totaling more than half his GDP. He defaulted on four consecutive occasions. Member Mauricio Drelichman has found that Philip only managed to keep borrowing during his four-decade reign by employing a vast international network of lenders, whose overlapping structure meant he always had someone who would lend him money.

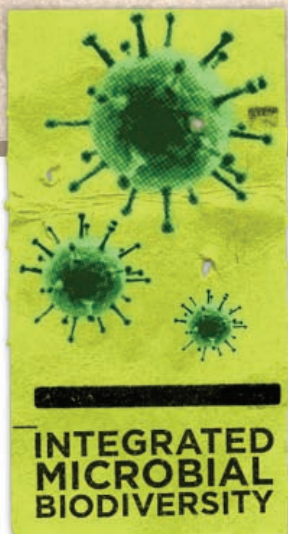
Around the turn of the 19th century, the French Revolutionary armies invaded and controlled large parts of Europe. With the invasion came radical institutional reform: The French removed legal and economic barriers, and established the principle of equality before the law. These reforms led directly to more rapid urbanization and economic growth in invaded countries. Members Daron Acemoglu, James Robinson and others have concluded two things from this story: First, ‘designed’ institutions can be at least as beneficial as those that evolve. Second, contrary to widespread belief, institutions can be beneficially ‘transplanted’ from one place to another, despite different contexts.

In the 21st century, it seems that people who work in highly competitive business sectors tend to be more trusting of their co-workers. Patrick Francois has documented how a competitive work environment leaves less room for laziness or poor performance and encourages high contributions from employees. This makes employees more trustworthy and increases trust in the industry.

This kind of research is not only fascinating, but it also increases our ability to help poor nations grow out of poverty, to improve policy-making processes, and to better the functioning of international institutions such as the World Bank and the International Monetary Fund.

LANGUAGE TIP

The Ultimatum Game: noun • a hypothetical game that aids researchers studying economic behaviour. In the game, two players are given a sum of money and must decide how to split it. Player A proposes a division of the funds. Player B must either accept or reject A’s proposal. Acceptance means each gets the share that A proposed. Rejection means neither player gets anything. This game has demonstrated an important fact about human motivation: it has shown that people are motivated by a sense of fairness as much as by economic considerations. Players will reject an unfair deal, even if it means they get nothing rather than something.



INTEGRATED MICROBIAL BIODIVERSITY

Program Director: Patrick Keeling

ORIENTATION

Integrated Microbial Biodiversity explores the diverse microbial world that surrounds and permeates human life. Program members are transforming human understanding of biodiversity, and changing approaches to medicine and health, environmental sustainability, and evolutionary biology itself.

HIGHLIGHTS

A major question for *Integrated Microbial Biodiversity* concerns how, exactly, multicellular animals evolved from single-celled organisms. Program Member Nicole King studies single-celled members of a class of organisms called “opisthokonts.” This classification includes both the simple organisms, and all multicellular animals. With Program Member Andrew Roger and Advisory Committee Chair Michael Gray, Dr. King is working on an international effort called the UNICORN Project, which sequences and explores opisthokont genomes. Their work provides critical insight into the genes involved in the evolution of multicellularity.

In another strand of the program, Director Patrick Keeling is working with Dr. Gray and Members John Archibald and Alexandra Worden to better understand photosynthesis. Photosynthesis, which allows microbes to create energy from sunlight, transformed the Earth’s biosphere more than two billion years ago and created the breathable atmosphere that exists today. Certain photosynthetic microbes are the most genetically complex organisms known to science. This team of researchers has sequenced the genomes of two such organisms and hopes this information will explain how photosynthesis evolved and spread.

Program Members Forest Rohwer, Curtis Suttle and Steven Hallam study microbial diversity via “metagenomics.” Metagenomics is arguably the quickest, cheapest and most predictive way to understand a particular ecosystem’s biodiversity. It involves studying the DNA sequences of all viruses and microbes found in a single environment. One of their studies has shown how viruses contain the main reservoir of global genetic diversity.

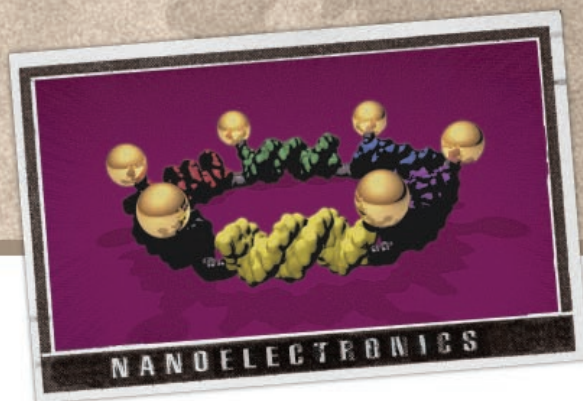
The *Integrated Microbial Biodiversity* program is also working to obtain a deeper picture of life in many environments. Members are researching how seemingly discrete components of an ecosystem might actually work together as a fully integrated system. They are planning a series of workshops focusing on large data sets gathered from Saanich Inlet, a saltwater ecosystem near Vancouver. These workshops will produce a unique, comprehensive picture of this particular system’s microbial inhabitants, and provide a template for many other such studies in other parts of the world.

LANGUAGE TIP

Karyoklepty: noun • the act of stealing nuclei. It comes from the Greek words karydi, for kernel, and kleptis, for thief. One cell or organism steals the nucleus of another for survival – inside the nucleus of each cell is the genetic material that is the blueprint for life and a source of energy potential. This word was coined by Diane Stoecker, a University of Maryland researcher who was a guest speaker at an *Integrated Microbial Biodiversity* meeting.

NANOELECTRONICS

Program Director: Peter Grütter



ORIENTATION

Nanoelectronics aims to understand and harness the power of materials at the nanometre (one billionth of a metre) scale. This work holds the potential to create computer circuits orders of magnitude smaller than those found on today’s microchips.

HIGHLIGHTS

This year, materials chemist and Program Member Geoffery Ozin’s research group created the world’s thinnest metal-containing nanowires. Although these wires are classified as inorganic, they share some very useful properties with complex organic molecules known as polymers. Dr. Ozin and other CIFAR researchers are now investigating potential applications for these nanowires, which include producing “nanothermoelectric materials” that directly convert heat into electricity, and tools for nanomedicine that would enable new kinds of diagnostic, therapeutic and imaging techniques.

A relatively new focus for the *Nanoelectronics* program is “spintronics,” a field of research that uses the spin of electrons as a tool for computation. Currently, researchers manipulate electrons’ spin by applying high frequency electric or magnetic fields to a material. This past year, Member Joshua Folk and his research team discovered a new way to manipulate spin in semiconductors, which are the foundation of all electronic devices. Their method no longer requires high frequency fields. Instead, it takes advantage of the intense electric fields inherent in semiconductors.

Nanoelectronics Program Member Mark Freeman and CIFAR-supported Postdoctoral Fellow Ning Liu advanced another electronics platform this year – they developed new ways to control structures called “nanocantilevers.” Nanocantilevers resemble tiny vibrating springboards (though they vibrate a billion times faster than a swimming pool springboard). Working with academic and industry collaborators, Dr. Freeman and Dr. Liu discovered a new approach for understanding and manipulating the vibration of nanocantilevers. Their work helps to realize the promise of nanomechanical devices that can be used for digital devices and computer memory storage. They could also be used as ultrasensitive sensors for detecting viruses, bacteria and other pathogens.

LANGUAGE TIP

Plasmonics: noun • plasmons are waves of electrons that are created when light hits a metal surface. The field of plasmonics aims to squeeze plasmons into minuscule nanostructures that can be used to probe nanoscale objects and develop new microscopes and sensors.



NEURAL COMPUTATION AND ADAPTIVE PERCEPTION

Program Director: Geoffrey Hinton

ORIENTATION

Neural Computation and Adaptive Perception program members are unlocking the mystery of how our brains convert sensory stimuli into information. They are also trying to recreate human-style learning in computers.

HIGHLIGHTS

Because so much of a human's knowledge of the world comes through visual information, *Neural Computation and Adaptive Perception* focuses in particular on making computers that can understand the world by looking at it. That said, learning is learning, and the program's discoveries have applications that extend well beyond the visual.

Many aspects of human vision are both useful and difficult to simulate in machines. The human brain discriminates between different styles of walking and can recognize the identity of a person from their gait, for instance. Computers have much more difficulty with such tasks. A group of program members including David Fleet and Aaron Hertzmann, though, has narrowed the gap.

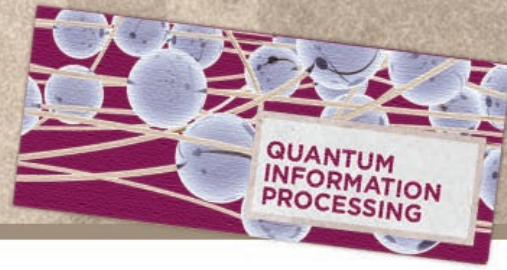
They have developed one type of model that allows computers to represent complex motions with just a few parameters, making it easier for a machine to "know" what it is looking at. Another model, developed by Director Geoff Hinton and his collaborators, uses comprehensive data describing how a person's joint angles change as they walk in various styles. Computers can learn these styles so well that they can produce convincing new motions that faithfully retain the original style. This work is of great interest to animation companies.

Both of these motion models are very good at predicting where parts of the body will be in the immediate future and can be used to help track the motion of people through cluttered scenes. This is very important for video surveillance.

Last year, we reported on the development of a very fast document retrieval method called "semantic hashing." Using advanced pattern recognition, this system allowed a computer to sort and find documents of a similar nature – subject matter, writing style, etc. – more efficiently than current search engines. This year, Members Yair Weiss, Rob Fergus and others collaborated to develop a much faster way to do semantic hashing, making it an even more useful tool for retrieving information.

LANGUAGE TIP

Voxel: noun • a fusion of the words "volumetric" and "pixel," a voxel represents a value on a grid in three-dimensional space. A voxel is analogous to a pixel, which represents two-dimensional image data. Just as a group of pixels covers an area, a group of voxels occupies a volume of space. Voxels are frequently used to visualize and analyze scientific data.



QUANTUM INFORMATION PROCESSING

Program Director: Raymond Laflamme

ORIENTATION

Quantum Information Processing unites computer scientists and physicists in an effort to harness the strange and fascinating properties of the quantum world, where the mere act of observing an object changes its nature, with the aim of building quantum computers.

HIGHLIGHTS

To apply the counterintuitive and powerful principles of the quantum world, *Quantum Information Processing* researchers seek to better understand them. This year, Program Member John Watrous and his collaborators resolved a decade-old puzzle in the theory of quantum computing.

One of the key motivations for building a quantum computer is to efficiently solve difficult problems that the classical computers we use today cannot. Dr. Watrous' work assesses the potential of quantum computers for solving some of these difficult problems. Sometimes finding out what you can't solve is every bit as useful as finding out what you can.

Some of the computational problems that quantum computing might (or might not) help solve include: How can you optimally schedule courses in a way that minimizes conflict for students? Or how can you plan efficient shipping routes for distributing products around the world? Dr. Watrous studied a different set of computational problems that arise in the area of secure storage, transfer and processing of information known as cryptography. He compared two types of computational problems, one based on cryptographic interactions between classical computers and one based on the same sorts of interactions between quantum computers. His findings show that these two types of problems are equivalent, which means that the power of quantum computing is not a significant advantage for solving them. This theoretical work helps researchers better understand both the promise – and limits – of quantum information processing, allowing them to focus their efforts in other areas that show greater promise.

Program Member Alexandre Blais and Junior Fellow Jay Gambetta, in collaboration with a Yale University team, recently turned quantum theory into a processing reality. They created the first electrical, circuit-based two-qubit quantum information processor. In other words, they built a simple quantum computer. Their superconducting circuits take advantage of the well-developed micro-fabrication technology that is used to build today's conventional computers. These circuits are therefore promising platforms for constructing scalable quantum systems, opening the door to quantum computers with more qubits, larger quantum processors and ultimately, dramatic speed gains over today's classical computers.

LANGUAGE TIP

Rabi cycle: noun • describes the cycling behaviour between two states of a quantum system, such as a qubit. For example, when an atom is illuminated by a beam of light, it will absorb the light's photons and re-emit them. One such cycle of absorption and re-emission is called a Rabi cycle and the inverse of the cycle's duration is the Rabi frequency of the light beam. The concept is named after Isidor Isaac Rabi, a physicist who won the 1944 Nobel Prize in physics for his discovery of nuclear magnetic resonance.

QUANTUM MATERIALS

Program Director: Louis Taillefer



ORIENTATION

Quantum Materials invents and explores materials whose novel and unusual electronic properties, like superconductivity, could revolutionize technology.

HIGHLIGHTS

Quantum materials can become endowed with superconductivity, a remarkable ability to conduct electricity without resistance. In their quest to understand and exploit this phenomenon, *Quantum Materials* program members have mainly focused on copper-based superconducting materials. But in early 2008, scientists in Tokyo found superconducting behaviour in iron-based materials as well. This news came as a very pleasant surprise – iron is one of the world’s most abundant metals and it was previously thought to form only magnets, not superconductors. There is now intense global research to understand how this new class of superconductors works. The great hope is that this very different family of compounds will help solve the mystery of the nature of certain kinds of superconductivity.

One of the most active research groups in iron-based superconductors is that of Hai-Hu Wen, who joined the program last year. His group discovered an iron-based material that holds the current record for the highest critical temperature for superconductivity. This achievement brings the field that much closer to its holy grail: to create materials that superconduct at room temperature. Dr. Wen supplied samples to a number of program members across Canada, including Takashi Imai, Walter Hardy and Louis Taillefer. This past year, Dr. Imai used these samples to explain how electrons orient themselves in iron-based materials, and how that orientation affects superconductivity.

Two other researchers also joined the program this year: Randy Hulet from the United States and Immanuel Bloch from Germany. Both researchers are experts on “cold atoms,” a new and promising research area. Cold atoms are gaseous entities that interact very strongly below a certain temperature. In this state, they act like a superfluid – a fluid that flows without friction. These researchers will help the program through their efforts to find out whether new quantum states of matter can be created with cold atoms. With these appointments, the program now has twenty non-Canadian members based in France, the United Kingdom, China, Japan and the United States. *Quantum Materials* is truly a global research effort.

LANGUAGE TIP

Pseudogap: noun • a mysterious “dark” phase that electrons in copper oxide materials enter on their way to becoming superconductors. Just as liquid water and solid ice are two phases of water, the pseudogap phase and superconductivity are two phases of electrons. Elucidating the nature of the pseudogap phase in high-temperature superconductors is one of the top research priorities of the *Quantum Materials* program.



SOCIAL INTERACTIONS, IDENTITY AND WELL-BEING

Program Co-Directors: John Helliwell and George A. Akerlof

ORIENTATION

Social Interactions, Identity and Well-Being stands on three eponymous pillars of research. Historically, *identity* research has been largely theoretical, and *well-being* largely empirical. *Social interactions* bridges the two, influencing both identity and well-being.

HIGHLIGHTS

Program members have done new theoretical *and* empirical work this year, and have applied both to a diverse set of pressing issues: quality of education, macroeconomics, child welfare, gender issues, definitions of confidence and trust, global warming, poverty, politics and corruption in underdeveloped countries, immigrant status (especially in Canada), and health and well-being in the workplace.

Given the topicality of the group’s research, it is not surprising that so many program members received major media attention this year for their contributions on schooling programs, the earnings of Canadian immigrants, and many other urgent issues. In addition, three program members participated in a “Festival of Economics” for the general public in Trento, Italy that attracted tens of thousands people.

Two specific research accomplishments of this year truly speak to the entirety of the program.

First, a range of studies known collectively as “The Social Cure”, uses theory, experiments and field trials to show how well-being can be improved simply by helping people to engage with each other more. Member Alex Haslam pioneered these efforts, and a large fraction of the *SIIWB* team is now actively engaged in these issues and experiments.

Second, *SIIWB* Advisory Committee Member Robert Putnam showed that the well-being benefits of religious involvement (which are large and many) in the United States derive specifically from church-based friendships, and are concentrated in those whose social identities are centred in the church.

Just as social interactions, identity and well-being have mutually reinforced one another within this program, the resulting advances help them do the same for society as a whole.

LANGUAGE TIP

Criminogenic: adjective • causing crime. Part of Program Member Rafael DiTella’s research addresses the question of whether prisons are criminogenic. His controlled study found that first-time convicts sentenced to Electronic Monitoring – an alternative to jail whereby convicts wear an electronic bracelet that allows law enforcement to track and restrict their movements – are about one-third as likely to recommit crimes as those given long prison sentences.



SUCCESSFUL SOCIETIES

Program Co-Directors: Michèle Lamont and Peter Hall

ORIENTATION

Successful Societies explores the roots of social inequalities and asks the question: What makes a society successful?

HIGHLIGHTS

The *Successful Societies* program influences important work that has the potential to make direct changes to our quality of life. This was apparent this year in the work of *Successful Societies* Program Member Jane Jenson, who focused on “social investment” and how it has spread around the world. Social investment emphasizes investing in early childhood care, in education, and in helping people transition from one life stage to the next. Dr. Jenson is advising Sweden and the United Kingdom about her work and has published related papers in two important international journals, *Global Social Politics* and *Social Politics*.

This year, Ontario’s Ministry of Research and Innovation awarded Member Will Kymlicka the *Premier’s Discovery Award for the Social Sciences*. It cites Dr. Kymlicka as the “world’s leading expert on multiculturalism and minority rights in democratic societies.”

Dr. Kymlicka studies multiculturalism as well as efforts by international organizations to create standards for the treatment of minorities. He works to integrate the divergent views of political scientists and international law scholars. Political scientists tend to believe organizations respond to security fears, while international law scholars emphasize human rights. His recent book *Multicultural Odysseys* outlines the means of reconciling these two approaches. It won the North American Society for Social Philosophy Book Prize.

This past year, program members published a collective volume entitled *Successful Societies: How Institutions and Culture Affect Health*. Chapters were written by several researchers and the book was edited by Co-Directors Michèle Lamont and Peter Hall. It offers new perspectives on how social interactions and public policies affect our overall health. The collective knowledge provided in this volume offers a new understanding of population health and related factors that speak to significant global issues, from enfranchisement to economic development.

LANGUAGE TIP

Collective Imaginary: noun • the collection of symbolic markers through which a group of people inserts itself in time and space. It is also referred to as the repertoire of forms that feed human cultures.

A collective imaginary is formed by establishing four relationships:

- A relationship to space, resulting in a territoriality
- A relationship to Self and to Other, giving shape to an identity
- A relationship to the past, which is expressed in a collective memory
- A relationship to the future, which is expressed in utopias

This term was used during the commission into the reasonable accommodation of minorities in the province of Quebec. Program Member Gérard Bouchard co-chaired the commission, which sought to explore the Québécois collective imaginary.

ADVANCEMENT AND COMMUNICATIONS



MESSAGE FROM THE CHAIR, ADVANCEMENT AND COMMUNICATIONS COMMITTEE

Difficult economic times mean greater challenges for a not-for-profit organization. CIFAR is fortunate to have a community of supporters whose generosity and commitment do not wane with the turn of the financial tide, and we never take this for granted. I wish to thank all those who support the Institute – you help ensure that we always move onward, upward and outward into important new areas of research and knowledge creation.

This year, we have stepped up our activities both to draw in new donors, and to provide our existing donors with better reasons than ever to remain active members of CIFAR's community. CIFAR offers its financial supporters something money cannot buy: the experience of traveling with our researchers on their journeys of discovery.

CIFAR donors get special access to the bold new ideas that are shaping all of our futures. At donor-only events like lab tours, lectures, debates, and exclusive one-on-one conversations, and through innovative publications that place supporters right at the frontiers of human knowledge, CIFAR donors are more than just patrons: they are themselves explorers.

If you are not a CIFAR donor, I invite you to join us on this journey. I guarantee you will see wonders you have never seen before.

George A. Fierheller

Chair, Advancement and Communications Committee



CIFAR'S DONORS ARE EXPLORERS TOO

CIFAR planned and executed many activities in 2008-2009 aimed at bringing its researchers in touch with some of the forward-thinking individuals who make their work possible. CIFAR donors provide more than just financial support to these researchers – they are part of the exploration. This is why CIFAR gives its donors many opportunities to attend exclusive lectures and debates.

In 2008-2009, CIFAR held many such events across the country. The Institute showcased researchers such as Jerry Mitrovica, who shared surprising discoveries concerning global sea-level rise. Guests were taken on a journey that began in West Antarctica: there, huge ice sheets are in danger of melting away, causing sea levels to rise all over the world. The most surprising thing, though, is that these frozen sheets are so large that they exert a gravitational pull on the ocean around them. Should they melt, the change in gravity would be so severe that sea levels in the Antarctic region would drop and water would rush from the southern oceans to the north. This means that many places in the Northern Hemisphere would face even greater sea-level change.

At another event, in Calgary, social psychologist Alex Haslam spoke about the “Glass Cliff.” This is a metaphor for women who dare scale the heights of power. When women break through the glass ceiling, becoming presidents, CEOs or taking on other leadership roles, it tends to be in organizations that are experiencing severe difficulty. As a result, the ground beneath them is more likely to crumble, sending them plummeting over the Glass Cliff. This has led to a widespread and dangerous misperception that women leaders cause poor performance, when in fact, CIFAR research suggests it is the other way around.

CIFAR donors also had the exclusive chance to see their support at work in the laboratories of select program members. The Institute began arranging special lab tours this year, including those of *Experience-based Brain and Biological Development*'s Marla Sokolowski and *Genetic Networks*' Brenda Andrews and Charlie Boone.

Join us in our travels. The Institute has begun gearing up for a major, cross-country public event series in Spring 2010. Building on a successful 2007 tour, CIFAR is now planning a second *Next Big Question* series, which will again feature lively debates and discussions touching on the many issues emerging from the world of advanced research.

If you'd like to join CIFAR on this journey, please contact us for information, or to make a tax-deductible donation.

CIFAR LUNAR CIRCLE

The Lunar Circle comprises an elite group of individuals and organizations with lifetime giving of \$100,000 or more to CIFAR. It was inspired by the 1760s *Lunar Society* – a group of philosophers, business leaders, scientists, and amateur experimenters who met on the nights of the full moon to share and debate ideas over long dinners. Through their collaborations, these individuals together became the catalyst for the Industrial Revolution.

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The collaborations that come with the CIFAR network are invaluable. The secure financial support of my Junior Fellowship has allowed me to focus my energies fully on my current research undertakings. I remain honoured and grateful for the support I receive through CIFAR and from RBC.

Dr. Chris Barrington-Leigh

*Junior Fellow, Social Interactions, Identity
and Well-Being program, CIFAR*

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MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL RESULTS

As at June 30, 2009

RESULTS OF OPERATIONS

Despite challenging external economic circumstances, CIFAR increased its research investments by 15%. The fiscal year ending in June 2009 represented the second year of CIFAR's five-year strategic plan, and the Institute made good progress on all of its initiatives.

Income for the year to June 30, 2009 totaled \$15.4 million, made up of \$2.6 million from the private sector (17%), \$11.7 million from five governments (77%) and \$1.1 million in investment income (6%). All government income came from five previously negotiated funding agreements. No change occurred in any of these arrangements.

As planned, income dropped from \$20.3 million in 2008 to \$15.4 million in 2009 due mainly to an expected decrease in provincial funding. Previously negotiated arrangements dictated that provincial funding drop \$4.5 million in 2009, returning to prior grant levels for some provinces. Income from the federal government (\$5 million) is the same as the prior year. While private sector support was down \$72 thousand, or 3%, from the previous year, the number of donors increased slightly. Investment income of \$1 million increased by \$50 thousand due to higher returns on deposits and bond portfolios, as well as currency gains on a US-dollar-denominated bond portfolio.

Expenses were \$14.5 million for the year, up from \$13.4 million. The increase related to growth and new activity in CIFAR's twelve research programs, as well as the newly launched Junior Fellow Academy.

Program expenses were \$11.7 million for the fiscal year 2008-2009, which is \$1.6 million, or 15%, higher than the prior year of \$10.1 million. They are comprised as follows:

Active Programs – Direct expenditures of \$9.6 million for researchers' compensation and interaction costs were \$1.3 million higher than last year's \$8.3 million. Increased expenditures related to:

- the new Junior Fellow Academy
- increased support for research (including more program members. Program members at June 30 totaled 299, up from 291 one year previous.)
- larger summer school activity
- higher costs for payments to non-Canadian researchers due to currency fluctuations.

Active Programs – Support expenditures of \$2.1 million were \$225 thousand higher than the prior year. The increase was related to higher infrastructure costs required to support the research programs, as well as greater levels of activity in knowledge transfer, international reach and an interdisciplinary study. Expenses related to program reviews and new program development were lower due to cyclically normal decreased activity.

Non-program expenses, consisting of Advancement and Communications and Governance and Administration, were higher than expenditure levels for the prior year due largely to more activity related to donor stewardship and outreach activities. There was also a higher number of employees to support the growth in activity.

25th Anniversary expenses of \$14 thousand were much lower than last year's \$754 thousand. This dramatic change relates to expenditures associated with CIFAR's 25th anniversary, which was primarily celebrated in the 2007-2008 fiscal year.

BALANCE SHEET, LIQUIDITY AND CAPITAL RESOURCES

The Institute concluded the year with a strong balance sheet. The **working capital** of the Institute was \$5.5 million at the year end, due to high cash and short-term deposit balances, and a high current portion of investments balance.

Long-term investments of \$32 million remained flat. The Institute increased investments in the unrestricted bond portfolio by more than \$4 million. There was a decrease of \$2 million due to the maturing of bonds relating to the Province of British Columbia grant. A further net decrease of \$2.6 million was due to an unrealized loss in long-term portfolio values during the year, an unfortunate result of turmoil in the financial markets. Overall, CIFAR's investment portfolio yielded realized income of 2.9%, an unrealized loss of 5.2%, for a net overall loss of 2.3%.

During the 2006-2007 fiscal year, the Board approved the establishment of the **See Far Fund** for the purpose of setting aside funds for the future needs of the Institute. The assets of the fund consist of an equity portfolio (\$7 million) and a bond portfolio (\$11.1 million). The See Far Fund also holds the endowment funds of \$364 thousand.

The **net asset position** decreased by \$1.4 million during the year, as a result of an excess of income over expenditures of \$857 thousand, an unrealized foreign currency gain of \$343 thousand, offset by an unrealized loss in portfolio values of \$2.6 million during the year. The level of Unrestricted Net Assets, combined with the current portion of deferred income, (\$13 million), represents the equivalent of approximately nine months of 2009-2010 budgeted expenditures.

RISKS AND UNCERTAINTIES

The activities of the Institute are funded entirely by **public sector grants and private sector donations**.

CIFAR has agreements or received commitments for \$23.2 million from four provincial governments and the federal government to fund CIFAR's research over the next three years. Although these agreements and commitments remove some of the uncertainty from CIFAR's public sector grants, CIFAR will seek renewed support from two of the four provincial governments in 2010, as well as from the private sector. While the Institute has met its private sector funding requirements in the past, there is no guarantee that it will continue to do so in the future.

The ability to budget **program expenditures** to discrete periods is affected by many factors outside the control of the Institute, including the timing of appointments to various programs. This is especially the case when new programs are being established.

The **market value** of investments varies over time. The funds held for long-term investment in the See Far Fund, currently invested with the University of Toronto's LTCAP fund, were at a market value of \$7.4 million on June 30, 2009, \$2.3 million below the original cost of \$9.7 million for the portfolio. The Institute may realize losses if it is required to liquidate investments prematurely or if the decline in value of the underlying securities is permanent.

AUDITORS' REPORT

2009 SUMMARIZED FINANCIAL STATEMENTS

To the Board of Directors of
The Canadian Institute for Advanced Research -
L'Institut Canadien de Recherches Avancées

The accompanying summarized statement of financial position and summarized statements of operations, changes in net assets and cash flows are derived from the complete financial statements of The Canadian Institute for Advanced Research - L'Institut Canadien de Recherches Avancées as at June 30, 2009 and for the year then ended on which we expressed an opinion without reservation in our report dated August 20, 2009. The fair summarization of the complete financial statements is the responsibility of management. Our responsibility, in accordance with the applicable Assurance Guideline of The Canadian Institute of Chartered Accountants, is to report on the summarized financial statements.

In our opinion, the accompanying financial statements fairly summarize, in all material respects, the related complete financial statements in accordance with the criteria described in the Guideline referred to above.

These summarized financial statements do not contain all the disclosures required by Canadian generally accepted accounting principles. Readers are cautioned that these statements may not be appropriate for their purposes. For more information on the entity's financial position, results of operations and cash flows, reference should be made to the related complete financial statements.

PKF Hill LLP

Chartered Accountants, Licensed Public Accountants
August 20, 2009



SUMMARIZED STATEMENT OF FINANCIAL POSITION

As at June 30, 2009

	2009	2008
ASSETS		
Cash and short-term deposits	\$ 4,193,948	\$ 8,507,437
Accounts receivable and prepaid expenses	1,445,668	1,341,552
	5,639,616	9,848,989
Investments, including current portion	31,695,859	31,815,188
Equipment and leasehold improvements, at net book value	277,964	275,204
Total assets	\$ 37,613,439	\$ 41,939,381
LIABILITIES AND NET ASSETS		
Accounts payable and accrued liabilities	\$ 2,913,940	\$ 2,458,209
Deferred income, including current portion	7,012,593	10,401,049
Total liabilities	9,926,533	12,859,258
Net assets		
Invested in equipment and leasehold improvements	277,964	275,204
See Far Fund		
Externally restricted for endowment	500,000	500,000
Internally restricted	20,348,700	20,324,600
Cumulative unrealized gain on available-for-sale investments	(2,332,600)	476,100
Unrestricted	8,892,842	7,504,219
Total net assets	27,686,906	29,080,123
Total liabilities and net assets	\$ 37,613,439	\$ 41,939,381

See accompanying note

SUMMARIZED STATEMENT OF OPERATIONS

Year ended June 30, 2009

	2009	2008
INCOME		
Program contributions		
Private sector	\$ 2,609,653	\$ 2,681,623
Federal government	5,000,000	5,000,000
Provincial governments	6,700,000	11,268,750
Other contributions	22,000	320,000
Investment income	1,048,984	998,057
Total income	15,380,637	20,268,430
EXPENSES		
Program expenses		
Active programs, direct		
Cosmology and Gravity	1,022,065	1,039,003
Earth System Evolution	786,377	651,983
Evolutionary Biology	-	(97,665)
Experience-based Brain and Biological Development	608,970	511,634
Genetic Networks	525,110	459,246
Institutions, Organizations and Growth	847,626	714,783
Integrated Microbial Biodiversity	551,338	549,815
Nanoelectronics	1,051,893	980,529
Neural Computation and Adaptive Perception	497,445	446,725
Quantum Information Processing	732,636	682,129
Quantum Materials	1,151,781	1,039,865
Social Interactions, Identity & Well-Being	684,579	504,926
Successful Societies	836,768	782,766
Junior Fellow Academy	304,525	-
	9,601,113	8,265,739
Active programs, support		
Program Development and Assessment	1,666,781	1,480,760
Program Reviews and Research Council	85,635	108,668
Knowledge Transfer	69,165	60,544
International Reach	47,709	17,542
Interdisciplinary Study	123,000	94,050
New Program Development	117,481	122,439
	2,109,771	1,884,003
Total program expenses	11,710,884	10,149,742
Advancement and communications	2,098,153	1,827,350
Governance and administration	690,365	628,048
25 th Anniversary	14,431	754,876
Other	10,194	36,116
Total expenses	14,524,027	13,396,132
Excess of income over expenses	\$ 856,610	\$ 6,872,298
Allocated to:		
Invested in equipment and leasehold improvements	\$ (115,108)	\$ (133,938)
Internally restricted for See Far Fund	24,100	5,053,100
Unrestricted	947,618	1,953,136
	\$ 856,610	\$ 6,872,298

See accompanying note

SUMMARIZED STATEMENT OF CHANGES IN NET ASSETS

Year ended June 30, 2009

	2009	2008
Balance, beginning of year	\$ 29,080,123	\$ 22,164,441
Excess of income over expenses	856,610	6,872,298
Endowment contribution	-	500,000
Unrealized gain on foreign currency	343,425	156,184
Unrealized loss on investments	(2,593,252)	(612,800)
Balance, end of year	<u>\$ 27,686,906</u>	<u>\$ 29,080,123</u>

See accompanying note

SUMMARIZED STATEMENT OF CASH FLOWS

Year ended June 30, 2009

	2009	2008
Operating activities		
Excess of income over expenses	\$ 856,610	\$ 6,872,298
Amortization of equipment and leasehold improvements	115,108	133,938
Changes in non-cash working capital	(3,036,841)	495,712
Cash flows from operating activities	(2,065,123)	7,501,948
Financing activities		
Endowment contribution and cash flow from financing activities	-	500,000
Investing activities		
Investments	(2,130,498)	(2,891,144)
Investment in equipment and leasehold improvements	(117,868)	(248,063)
Cash flows from investing activities	(2,248,366)	(3,139,207)
Net change in cash during the year	(4,313,489)	4,862,741
Cash and short-term deposits, beginning of year	8,507,437	3,644,696
Cash and short-term deposits, end of year	\$ 4,193,948	\$ 8,507,437

See accompanying note

NOTES TO SUMMARIZED FINANCIAL STATEMENTS

Year ended June 30, 2009

1. Nature of Operations and Basis of Financial Statements

The Canadian Institute for Advanced Research - L'Institut Canadien de Recherches Avancées (the "Institute") is incorporated under the Canada Corporations Act as a not-for-profit organization and is a registered charity under the Income Tax Act (Canada). The primary objective of the Institute is to bring leading researchers together to work on major collaborative advanced research projects that address scientific, economic and social questions that are of importance to the future of Canada and the world. The Institute funds multi-year projects that bridge institutional, regional, cultural and national boundaries. The funding provided by the Institute contributes to research support and salaries of program members.

In common with other not-for-profit organizations, the Institute is economically dependent on the continued financial support of federal and provincial governments and the private sector to meet its ongoing commitments.

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