Then Now

Investments and Outcomes



Ontario Innovation Trust

Final Report 1999-2009

RESEARCH REVISITED

A look at projects we've profiled before—and how they're moving from idea to application.

"Where are they now?"

It's a staple question at the tabloids—but also at the Ontario Innovation Trust. And the answers come in the form of yearly reports to the Trust from supported researchers, describing progress and reporting milestones.

Over the last ten years, we've passed along some of that information in the form of profiles in our annual reports. But where are those projects now? What tangible results are they producing? What everyday applications are emerging?

From the 120 research efforts featured in previous annual reports, here are some updates.







OPEN SPACE: OPEN MIND

Empty lab space. That's all you could see behind Dr. Brenda Andrews in the Trust's first profile of the newly built Terrence Donnelly Centre for Cellular and Biomolecular Research. The piece appeared in the 2006 annual report.

Today the open concept labs are full—and bubbling with cross-disciplinary energy. Biologists and chemists from widely different backgrounds work shoulder to shoulder, and the mix is leavened with engineers and computational specialists. "When we're recruiting, we look for people who can take



BRENDA ANDREWS

BRENDA ANDREWS/UNIVERSITY OF TORONTO/$30,000,000



advantage of this kind of environment," explains Dr. Andrews, "people who know that in two years they'll probably be working on a different problem... It's a kind of 'why not?' environment."

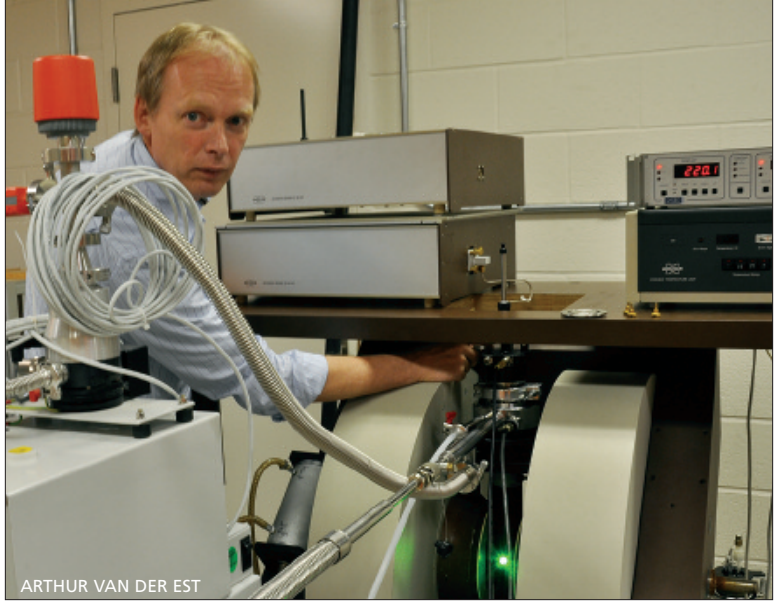
The open-ended ethos isn't for everyone. But the centre isn't looking for just anyone. "We try to put collections of people together who are interested broadly in biology, in collaborating with others, in exploring new technologies and in probing new questions."

And the strategy is working. Over four years, the centre has made 14 offers to leading scientists from around the world. An external review team recently described the results as unprecedented: 13 of the offers have been accepted.

GREEN SCIENCE AT BROCK: FROM ELECTRON SPIN TO ICE WINE

Every time we take a walk in the woods, we're surrounded by an energy system that could help save our species.

Photosynthesis is an incredibly effective technique for capturing, and storing energy. At the heart of the system are photosynthetic proteins


ARTHUR VAN DER EST

ARTHUR VAN DER EST/BROCK UNIVERSITY/$74,000

that grab photons from sunlight. The proteins store the absorbed energy by taking electrons from water and using them to convert CO_2 into substances such as sugars that cells can later use as fuel. If we could understand the principles behind these protein energy factories, we could potentially reverse engineer them to produce carbon-neutral fuels like hydrogen. The environmental implications are obvious.

The Trust's first annual report, in 2001, highlighted how Dr. van der Est at Brock University was probing photosynthetic proteins—and reported that the Trust would help provide him with the electron spin resonance spectrometer he needed to track how they work.

Almost a decade later much has changed. "We've discovered a lot about the structure and chemistry of these proteins," says Dr. van der Est. And the reverse engineering has begun; an early application is to create bio-hybrid solar cells that use the photosynthetic proteins to produce hydrogen. "People are already building prototypes of these kinds of cells based on the information we're providing."

While Dr. van der Est attempts to isolate the principles of photosynthesis—the blueprints of the energy factory, as it were—a colleague at Brock is tackling the frenetic, messy operations of the shop floor itself. "A protein is a wiggly, jiggly, dynamic thing," says Dr. Doug Bruce, who was profiled in the 2004/05 report. Dr. Bruce builds computer simulations that recreate the interactions of all 300,000 atoms in a complex of up to 30 photosynthetic proteins. Calculating each interaction once every femtosecond—a quadrillionth of a second—his software crunches huge amounts of data to replicate the actual mechanics of photosynthesis. Combined with Dr. van der Est's insights, the simulations provide even more hints about how humans may soon be able to mimic the process.


DOUG BRUCE

DOUGLAS BRUCE/BROCK UNIVERSITY/$1,387,700

The computation technology used by Dr. Bruce was provided with help from the Trust in 2004, as part of a suite of state-of-the-art biology tools for Brock. The equipment supports important fundamental research in areas like photosynthesis. But it's also being used for some intriguing applied science.

Dr. Tomas Hudlicky's specialty, for example, is "green chemistry"—introducing biological elements like enzymes into the manufacture of pharmaceuticals and other substances. The resulting processes use fewer toxic chemicals and are often quicker and cheaper. Since the 2004/05 profile, Dr. Hudlicky has developed greener and faster approaches to making the anti-viral drug Tamiflu, pain relief medications and a widely-used anti-tumour drug.

TOMAS HUDLICKY/BROCK UNIVERSITY/$184,991

Perhaps the most "applied" use of the infrastructure, however, is the research being conducted by Brock's Cool Climate Oenology and Viticulture Institute. A micro-array reader, for example, is allowing scientists to scan the genetic structure of a wide variety of yeasts, looking for strains that are resistant to cold stress and therefore suitable for the production of ice wine. "We've already developed protocols for reducing stress that have been adopted by the wine industry," says the Institute's director, Dr. Deborah Inglis. And she expects that the research will soon lead to a new yeast that will make a distinctively Canadian product more distinctive than ever.


DEBORAH INGLIS

LINE-UPS, SCRUMS AND CLUSTERS: HIGH PERFORMANCE COMPUTING

Think your new dual quad-core PC is wicked fast? Consider, then, what it would be like to throw not four, but 3,072 processors at your next computing task.

That's the kind of horsepower available in the DeathStar-like ranks of humming cabinets that fill a basement room at the University of Waterloo. This is Whale, the largest of 21 computing "clusters" that make up SHARCNet—the Shared Hierarchical Academic Research Network. The network—mentioned in the Trust's first annual report—serves over 1,600 researchers at 17 locations across the province, with a total of over 10,000 processors. The first round of Trust funding, in 2000, helped build essentially identical clusters at six locations, with the idea that researchers could spread the processing load across multiple clusters. But high performance computing was a young discipline, and it turned out that clusters designed to handle specific kinds of problems would be more useful. A second round of Trust funding in 2004 helped expand and retool the network. "We concentrated on establishing clusters with specific architectures to handle different types of load," explains Dr. Hugh Couchman, SHARCNet's scientific director.



HUGH COUCHMAN

HUGH COUCHMAN/THE UNIVERSITY OF WESTERN ONTARIO/$9,524,720

Whale is a "high throughput cluster," meaning that its processors are wired together to handle huge line-ups of relatively simple computations—the kind of computation required for analyzing images. But while these calculations could only pass through your new dual quad-core in ranks of eight, Whale can manage 3,072 at a time.

SHARCNet also has "capability clusters," like "Requin," the 1,536-processor installation at McMaster. The goal here is not to process large numbers of individual calculations in sequence, but to allow many bits of data to interact simultaneously—less like a line-up and more like a scrum in a rugby match. This type of computation is used in building weather models.

Whatever the type of cluster needed, demand for high performance computing is rising—and the range of its applications widening. "Recently," says Dr. Couchman, "we've been reaching out to the digital humanities…A researcher at Brock is using SHARCNet to visualize historical cities, for example. As an astronomer, I find that very interesting because it involves a different level of complexity—human complexity."

KEN EDGECOMBE/QUEEN'S UNIVERSITY/$5,189,000

"AND FROM KINGSTON, WEIGHING IN AT 4,200 PROCESSORS…"

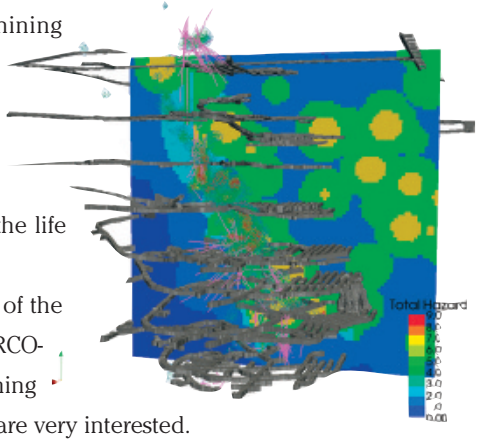
SHARCNet isn't the only high-performance computing network the Trust has supported. The Queen's University-based High Performance Computing Virtual Laboratory—HPCVL—provides a similar resource to institutions in eastern Ontario.

Profiled in depth in the 2004/05 Report, HPCVL is also broadening its horizons—particularly in the area of bioinformatics. In the spring of 2009, it signed an agreement to provide resources for the Ontario Cancer Biomarker Network.

A NEW DIMENSION OF EXPOSURE

Visualization in just three dimensions is so…yesterday.

When it was profiled in the Trust's 2003/04 report, the Mining Innovation, Rehabilitation and Applied Research Corporation (MIRARCO) had developed groundbreaking technology that allowed mining engineers to visualize areas of stress underground in 3-D, and plan tunnel locations accordingly.



Since then MIRARCO has added another dimension: time. Now the system can expose how underground conditions may change over the life of the mine.

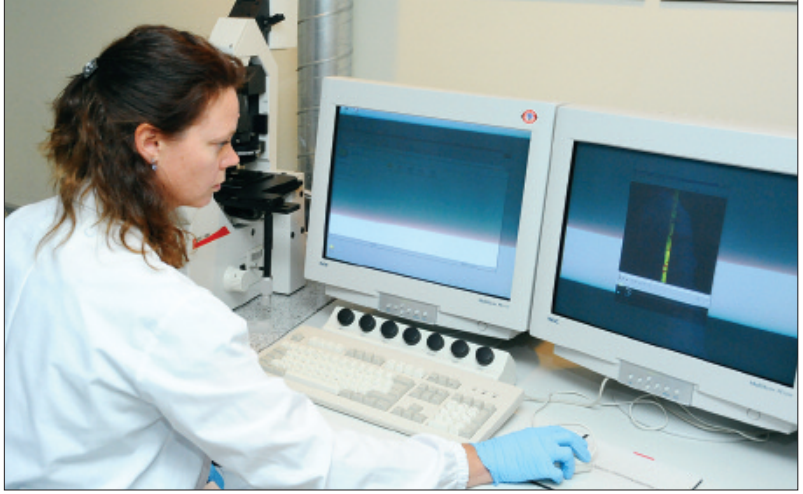
The evolving technology is catching the eye of the mining industry around the world. The latest MIRARCO-built centre has just opened in China, and mining companies in the U.S., Australia, Brazil and Chile are very interested.

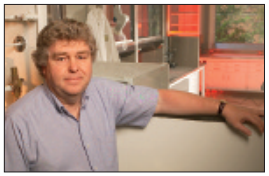
"We're a small company in a small town," says Vice President Andrew Dasys; the venture is based in Sudbury and owned by Laurentian University. "But because of OIT and CFI investment, we've got global exposure."



ENGINEERS IN CHINA USE MIRARCO VISUALIZATION TECHNOLOGY TO PLAN MINE EXPANSION

MIRARCO/LAURENTIAN UNIVERSITY/$1,920,000

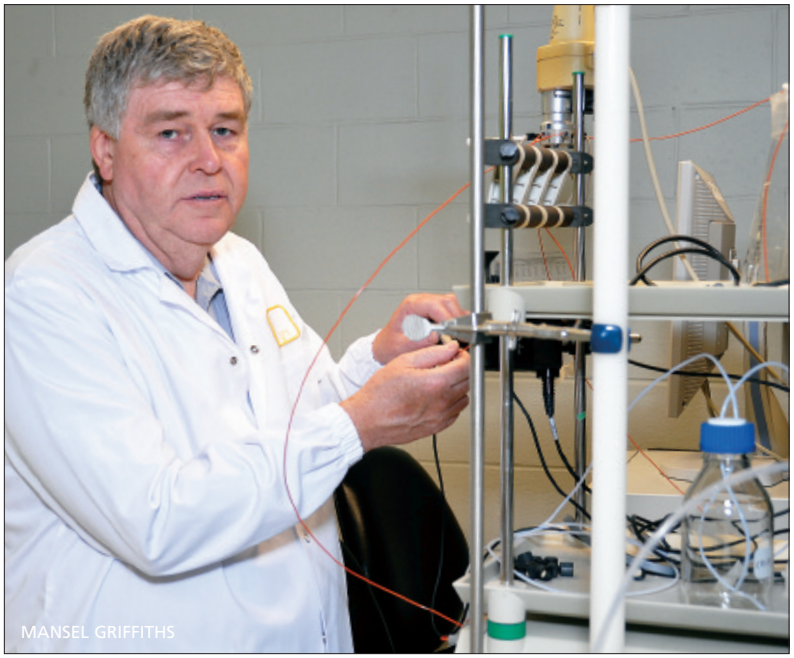




GOOD ON PAPER

It took a little lighting magic to bring to life a partially-completed containment lab in the 2001/03 annual report. (See the image on the left.)

Today, however, the lab is fully operational—thanks in part to Trust funding—and the Canadian Institute for Food Safety is full of scientists pursuing a wide range of research under the leadership of its director, Dr. Mansel Griffiths.



MANSEL GRIFFITHS

One example: a wrapping paper for meat and other products that uses harmless biological agents to destroy *e coli*. The paper was in the early stages of development when the last report went to press. Today, the Institute is in a partnership with several major Canadian paper companies to bring the product to market—likely within three years.

MANSEL GRIFFITHS/UNIVERSITY OF GUELPH/$4,623,166

THE ROOFTOP GETS CLOSER

"From desktop to rooftop." That's how Dr. Siva Sivoththaman describes the comprehensive research-to-hardware approach at Waterloo University's Centre for Advanced Photovoltaic Devices and Systems. The Trust approved funding for the Centre in 2004.

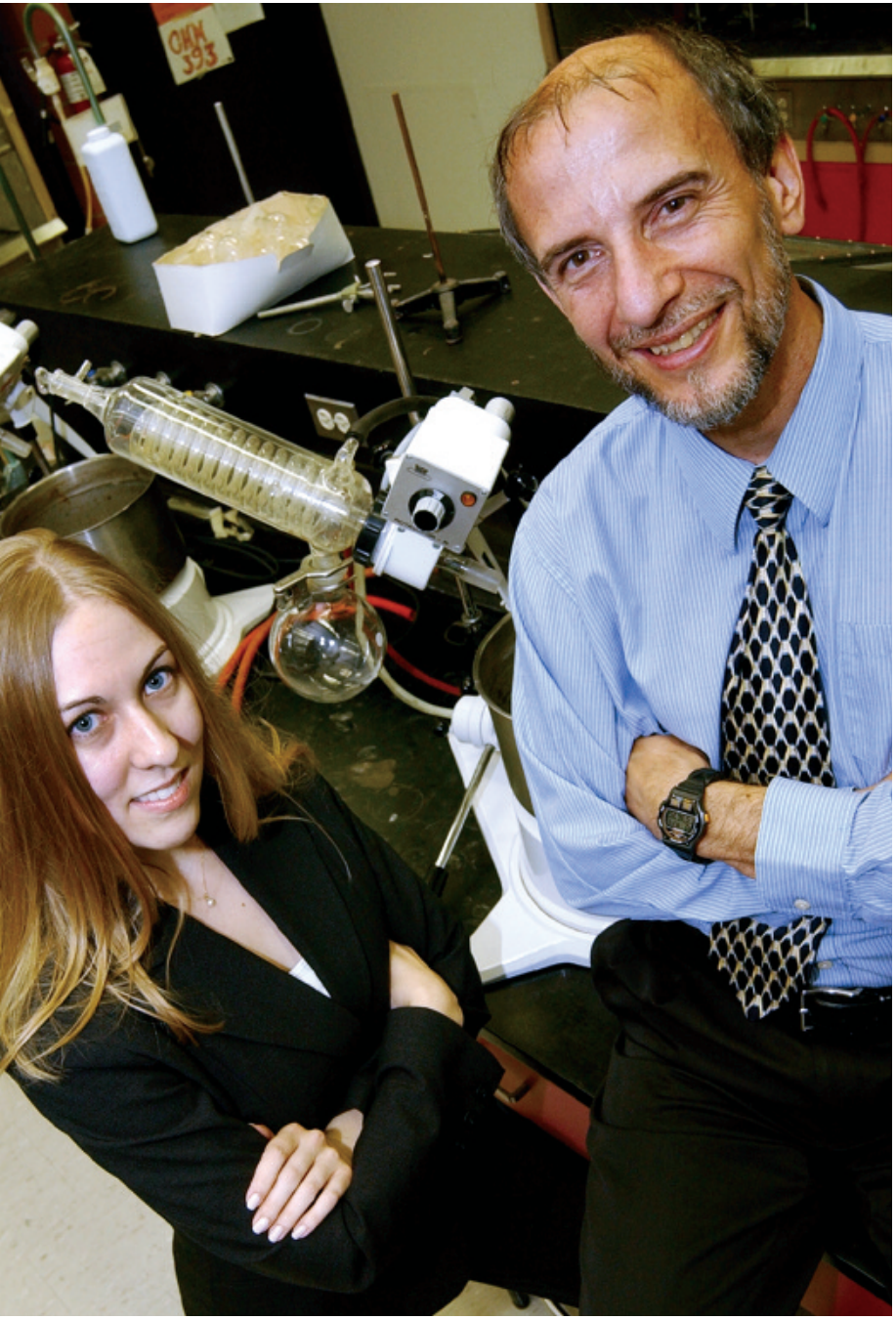
The new facility, completed in 2008, will enable Dr. Sivoththaman and his colleagues to continue their quest to reduce the cost-per-kilowatt of solar, making it more competitive with other sources.

The road to practical roof-top power is being paved in part by the Centre's unique capability for prototyping and testing new technologies. "It's one thing to produce a single cell that works in the lab," explains Dr. Sivoththaman. "But it's something else entirely to assemble a large number of cells in a module, put several modules in an array, and then see how the whole thing works in the real world."



SIVA SIVOTHTHAMAN

SIVA SIVOTHTHAMAN/UNIVERSITY OF WATERLOO/$3,069,911



ULRICH KRULL WITH FORMER STUDENT LISA STUDNICKI. HER STARTUP, GL CHEMTEC IS WORKING WITH KRULL TO DEVELOP NEW TECHNOLOGY FOR BIOSENSORS.

WORLD CLASS SCIENCE. WORLD CLASS CITY.

Can an investment in research have a city-sized impact? The answer from Dr. Ulrich Krull is an emphatic yes.

Back in 2000, Dr. Krull helped secure a relatively modest—but very significant—grant of $2.3 million from the Trust towards a new Centre for Applied Biosciences and Biotechnology at the University of Toronto's Mississauga campus, where he is now V.P. of Research.

The Trust's 2001/03 report highlights the promise of work at the Centre on the detection of pathogens through the use of engineered nano-particles called "quantum dots." But a larger story was unfolding in the background. Dr. Krull and his colleagues were forging a partnership with the City of Mississauga, working with Mayor Hazel McCallion to create the Healthy City Network. The Network brought together all of the key institutions and agencies responsible for the quality of life in the city, with a view towards making Mississauga a model of urban life in a new century. The University was to serve as the partnership's research arm.



ULRICH KRULL/UNIVERSITY OF TORONTO/$2,358,983

The city's unique strategy garnered global notice, and at a ceremony in London, England in 2006, Mayor McCallion accepted the Gold Medal in the Healthy City category from the World Leadership Foundation. The Mississauga submission won out over entries from hundreds of cities around the world—and the scientific credibility of the Centre played a significant role. "I'm not exaggerating," says Dr. Krull, "when I say that the medal was a direct result of the OIT funding for world class research at the university."

There have been other results as well. The Centre is now on the cutting edge of using quantum dot technology for diagnosis and therapy. An

interdisciplinary team of engineers, chemists and biologists is pioneering a new way to peer into cells—harmonic spectroscopy—that allows them to observe processes in more detail and for longer periods of time. The new technology uses a combination of infrared laser light and quantum dots engineered to respond to that light—and it's already proven its potential to reveal the presence of pathogens at a very early stage. "The next step," says Dr. Krull, "is to put a therapeutic bomb on the surface of those quantum structures, a substance that would be released to kill only diseased cells."

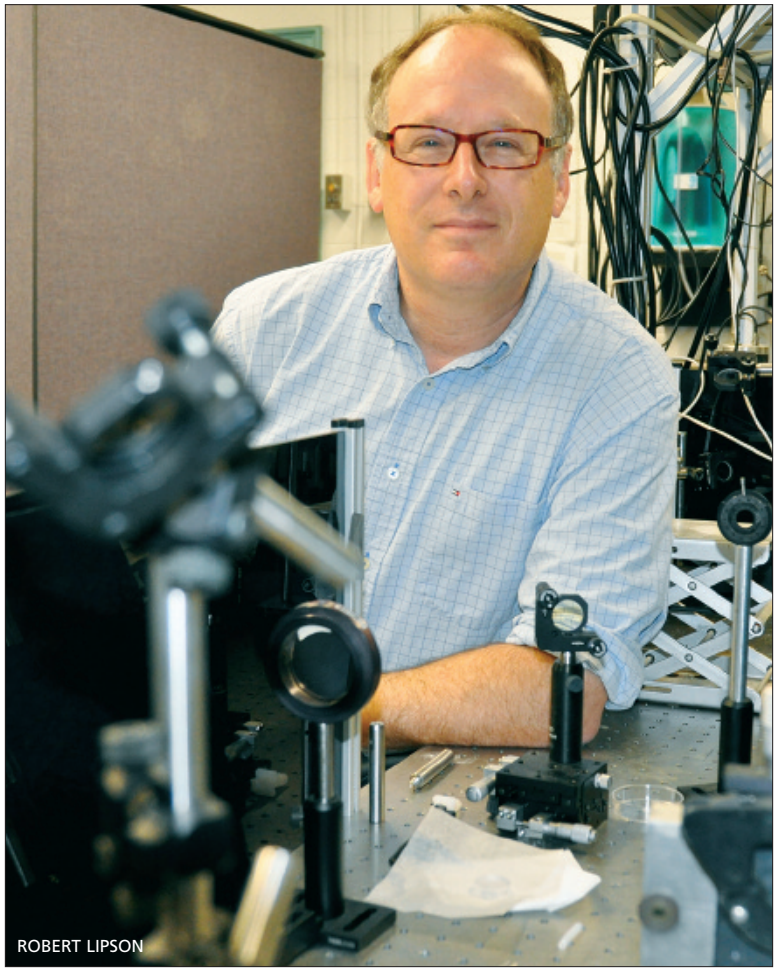
Clinical application of the technique is still years away, but it could help revolutionize the diagnosis and treatment for many types of cancer. And here once again, Dr. Krull credits the Trust's early support. "Obviously, there have been lots of investments since 2000," he says, "but it was the OIT that triggered it. If it hadn't been for them, we wouldn't be here."

"IMAGINATIONS JUST TOOK OFF"

"Build it, and they will come," chuckles Dr. Robert Lipson, director of the Western Institute for Nanomaterials Science and Professor of Chemistry. He quotes the W.P. Kinsella novel *Shoeless Joe* to illustrate the magnetic effect the Trust-funded Western Nanofabrication Facility has had on researchers at the University of Western Ontario. "When they saw what could be done here, their imaginations just took off," says Dr. Lipson.

"They" represent a surprisingly large cross-section of scientists from a variety of academic disciplines. When the project was first profiled in the Trust's 2001/03 report, the assumption was that the equipment in the Nanofab would primarily be used in the quest to make computer chips ever smaller. But the facilities have also been used by biologists and engineers to explore the hot new field of nano-scale biosensors. Chemists have developed new polymers, materials scientists new lubricants, applied mathematicians new materials simulations, and earth scientists new geological nano-probes.

The interaction of all these scientists using the Nanofab has sparked some serious cross-disciplinary insights—perhaps one of the facility's most important contributions. "The value of the investment," suggests Dr. Lipson, "has been that we couldn't just sit in our own labs. The Western Nanofab has brought people together—and that's opening lots of new windows and doors."



ROBERT LIPSON

ROBERT LIPSON/THE UNIVERSITY OF WESTERN ONTARIO/$3,047,720



KERRY JOHNSTON/HUMBER COLLEGE/$698,900



FROM RENDERING TO REALITY

Sometimes an architect's rendering can look better than the finished building. Not so with the Humber College Urban Ecology Centre.

The concept drawing for this glass jewel looked stunning in a 2005/06 feature on facilities for research. And the reality is more so.

The building incorporates leading edge technologies: high performance windows and an integrated building systems monitoring and control system. Sustainability was also a key consideration in construction. A rainwater harvesting system and green roof support storm water management, and the structure's design, orientation and glazing contribute to passive cooling and passive solar heating. These are some of the features that have earned the building a Gold certification under the Leadership in Energy and Environmental Design (LEED) program.

While serving as a learning centre for children across Toronto, the facility is also helping Humber College students develop research skills as they monitor and maintain the Centre's systems.


TONY PAWSON

PHOTO: MOUNT SINAI HOSPITAL

SIGNAL HONOURS

When he was profiled in the Trust's 2003/04 report, Dr. Tony Pawson was already one of Canada's most honoured scientists. His work has led to revolutionary new insights into how cells communicate with one another to sustain all kinds of processes in our bodies—and how the breakdown of that signaling function can lead to illness.

In the years since the Trust report, the honours have continued to flow in. In 2005, he was awarded the prestigious international Wolf Prize in Medicine, the first Canadian recipient. In 2006, he was named a Companion of Honour, and in 2008 he received the Kyoto Prize, "Japan's Nobel."

The honours reflect the new molecular territory Dr. Pawson has continued to explore. A combination of proteomic and in vivo experiments in his lab has led to a new understanding of cell signaling in the kidney. And his work has also shed new light on tyrosine kinases, a class of signaling proteins which, when they malfunction, are implicated in a wide range of cancers.

The signal insights continue. And so do the signal honours.

ANTHONY PAWSON/UNIVERSITY OF TORONTO/$7,224,335

STEM CELL THERAPY IN THE PRESENT TENSE

"Stem cell research is going to transform the practice of medicine," says Ottawa researcher Dr. Michael Rudnicki, speaking from his office at the Sprott Centre for Stem Cell Research at the Ottawa Hospital Research Institute. "Without question."

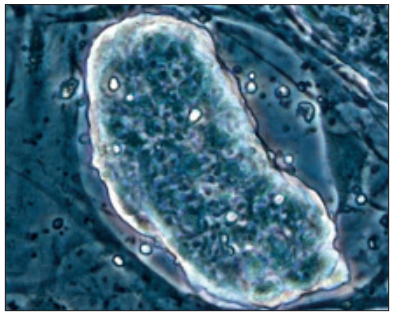

MICHAEL RUDNICKI

MICHAEL RUDNICKI/UNIVERSITY OF OTTAWA/$125,000

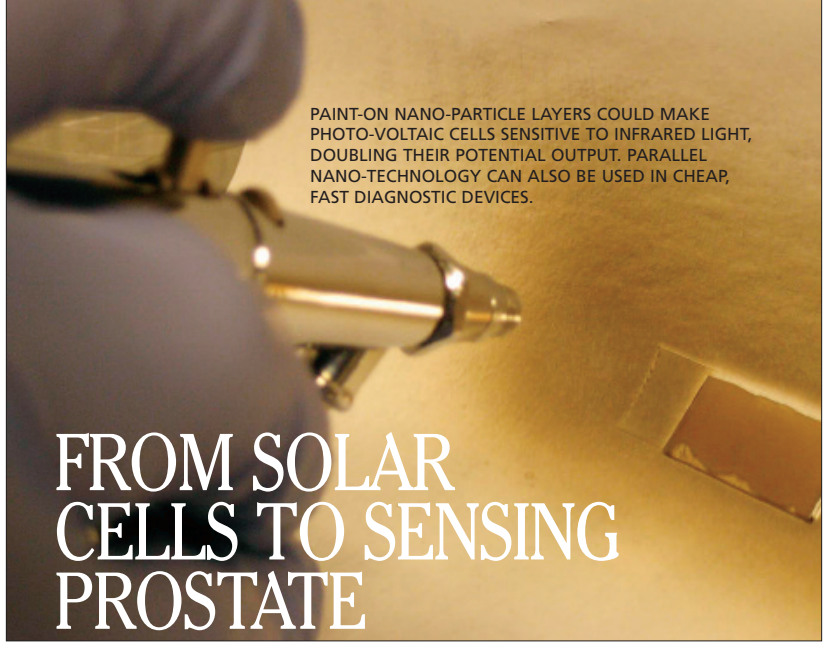
It's the kind of future-tense statement Dr. Rudnicki has been making since his research was described in the first Trust report eight years ago. But as he gives examples of the research scientists are doing now at the University of Ottawa-affiliated Sprott Centre—where he is director—the present tense is sounding a lot closer.

"Harry Atkins has been looking at purified blood stem cells to cure diseases like MS and Crohns disease," says Dr. Rudnicki. "When he publishes his paper later this year, I expect that his procedures will be widely adopted almost immediately." Other research projects in the final stages of clinical trial include the growing of new corneas for transplantation, and the regeneration of healthy tissue in patients with heart damage.

"All of this would have taken longer and been far more difficult," says Dr. Rudnicki, "without resources provided by the Canada Foundation for Innovation and the Ontario Innovation Trust."



JUST AS A SINGLE STEM IN A PLANT CAN PRODUCE MANY OTHER PARTS—BRANCHES, LEAVES, BLOSSOMS—SO STEM CELLS HAVE THE POTENTIAL TO PRODUCE OTHER CELLS WITH A VARIETY OF FUNCTIONS. STEM CELL THERAPY INVOLVES IMPLANTING THESE VERSATILE CELLS INTO THE DAMAGED TISSUE OF, FOR EXAMPLE, A HEART, WHERE THEY THEN REPRODUCE AS HEALTHY HEART MUSCLE CELLS.



PAINT-ON NANO-PARTICLE LAYERS COULD MAKE PHOTO-VOLTAIC CELLS SENSITIVE TO INFRARED LIGHT, DOUBLING THEIR POTENTIAL OUTPUT. PARALLEL NANO-TECHNOLOGY CAN ALSO BE USED IN CHEAP, FAST DIAGNOSTIC DEVICES.

FROM SOLAR CELLS TO SENSING PROSTATE

Dr. Ted Sargent has done very little work since he was last profiled in one of the Trust's early annual reports. Lots of very little work.

His specialty is custom fabricating particles and structures only a few millionths of a meter across. Because of their almost unimaginably small size, they behave according to the laws of quantum physics, not the regular action-reaction laws of our everyday experience. And that can give them surprising and powerful properties within a surprising range of applications.

Take photovoltaic cells. The conventional kind only react to visible light. But a layer of Dr. Sargent's "quantum dots" painted onto an electronic chip allows the device to harvest the sun's infrared light as well—doubling the electrical output. The new panels could be available at your local home improvement store in five years.

Dr. Sargent's lab has also collaborated with U of T colleague Shana Kelley in the development of a microchip that uses nanostructured gold wires as sensors for living molecules that may indicate the presence of disease. The two scientists have built a prototype device that can use a tiny urine sample to detect the presence, type and severity of prostate cancer—in just 30 minutes. A commercial version may be only a few years away.

TED SARGENT/UNIVERSITY OF TORONTO/$536,000

YOUR ATTENTION, PLEASE



JOHN TSOTSOS

How do our brains make sense of the flood of information coming from our eyes? The answer is a lot more complicated than you might think.

Dr. John Tsotsos of York University, uses the example of digital imagery to illustrate the magnitude of the problem. In a digital photo, any pixel can in theory be related significantly to any other pixel. But the total number of such potential relationships in any image is 2 to the power of the number of pixels. In a 3 megapixel photo that means $2^{3,000,000}$ possible combinations—an astronomically large number. To compound the problem, some scientists estimate that our eyes produce images at a resolution of almost 120 megapixels.

"Our brains aren't large enough to consider all the possibilities," Dr. Tsotsos explains. "So we have to choose what information to attend to. And that's what interests me—how the brain makes those choices."

Dr. Tsotsos found some important clues to the problem in an arcane branch of computer science known as computational complexity theory. And in 1990, he described a model for the process that has since become the dominant view in the field. "The paper was widely ridiculed by brain scientists at the time," he remembers, "But all the predictions I made there have since been verified."

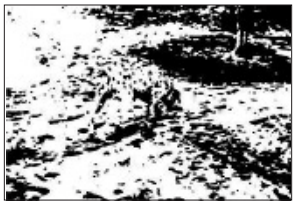
One of the tangible results of his research has been the PlayBot. First conceived by Dr. Tsotsos in the early 1990s, it finally reached the prototype stage with help from a 2003 investment from the Trust.

JOHN TSOTSOS/YORK UNIVERSITY/$214,904



Using cameras and sophisticated visual processing software, the robotic wheelchair can negotiate cluttered rooms as well as find, open and pass through doors. And its simple but subtle interface allows the occupant to manipulate and interact with a variety of objects. First envisioned by Dr. Tsotsos as a way to return mobility and play to the lives of severely disabled children, the device could also be invaluable for seniors. "Imagine a simpler version in an old folks residence," he suggests. "It could have four buttons: take me to the dining room, to my best friend's room, to the lounge, to my own room. Those four functions alone would tremendously increase independence and quality of life for the residents and lift a huge burden from care givers."

So far, however, no company has had the vision to take the product to market. So Dr. Tsotsos is continuing his ground-breaking work on visual attention—and hoping that someone will pay a little commercial attention to a device that could transform life for young and old alike.



THIS IMAGE, ORIGINALLY CREATED BY BRITISH SCIENTIST RICHARD GREGORY, IS OFTEN USED TO ILLUSTRATE THE PROBLEM OF VISUAL ATTENTION. BECAUSE THERE AREN'T MANY VISUAL CLUES TO HELP THE BRAIN CHOOSE WHAT'S "IMPORTANT" IN THE IMAGE, IT CAN TAKE A LONG TIME TO DECODE IT. IN FACT, SOME PEOPLE NEVER SEE THE CENTRAL SUBJECT: A DALMATIAN DOG SNIFFING THE GROUND.



MORE BURNING QUESTIONS

Fire is spreading at the University of Waterloo—and that's a good thing.

Programs at the university's Fire Research Lab have expanded remarkably since it was profiled in the 2001/03 report. The most significant development: a new Masters of Engineering in Fire Safety. Introduced in 2007, the program already has 10 full-time students.



The course offerings for the degree provide a glimpse of the lab's broad capabilities: from risk analysis through fire dynamics and advanced design. Graduate students at the lab are looking at advanced problems like how fire affects the structure of steel frame buildings—more significant than ever since the events of 9/11. Using software developed at the lab, they can model such fires—and then test them on actual steel structures in the facility's cavernous burn room.

The program, offered through the Department of Mechanical and Mechatronics Engineering is unique in that it goes beyond the usual civil engineering focus on fire protection to issues like smoke movement and materials testing. And the lab makes it all possible. "We couldn't offer anything close to this program," says director, Dr. Elizabeth Weckman, "without the investment the OIT made."

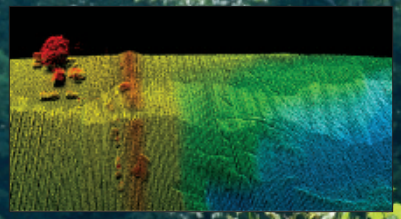


Expanding capabilities have also led to increased demand for faculty to share their insights with professionals across the country, from engineers to firefighters. And the facility has become a hub for training emergency responders.

But perhaps the most surprising application comes from outside the fire prevention and suppression community. Lured by the lab's huge fans—installed to simulate wind effects on fire—engineers from Canada and the United States are using the facility to test new wind-power turbine designs.

ELIZABETH WECKMAN/UNIVERSITY OF WATERLOO/$2,135,415





VEHICLES TO VINES

"I was watching a traffic simulation when I had the idea," says Dr. Mike Duncan of Niagara College. The software he was using—profiled in the 2004/05 annual report—had been developed with help from the Trust. "Traffic in the simulation was congested, and the cars weren't moving, even though their positions were being updated ten times a second from a database. I thought: 'They're just like plants.'" And a light went on.

Sparked by that out-of-left-field thought, Dr. Duncan and his colleagues at Niagara College have created new visualization software…for farmers. The system combines data from remote sensors and from databases on weather and soil to give farmers a moment-by-moment and even plant-by-plant picture of how their crops are doing. "They'll be able to look at a computer-generated map that says "Pick Here Now," says Dr. Duncan.

The system is still in development, but grape farmers in the Niagara Region are already expressing interest.

MIKE DUNCAN

MICHAEL DUNCAN/NIAGARA COLLEGE/$343,635



MARTI JURMAIN

FOUNDATION FOR A DECADE

"Because we're a community college, we're not in the business of seeking international research faculty or publishing. But the Ontario Innovation Trust looked at the quality of project and the capacity of the research team…They actually worked with people to help develop good proposals, and gave them good feedback. What the OIT provided was the start for two areas of expertise—visualization and photonics—and we've built on that for a decade."

Marti Jurmain
Director, Research and Innovation Division
Niagara College



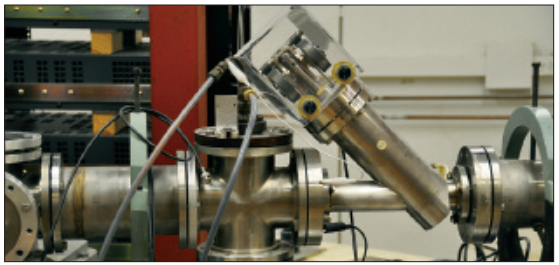
DOUG BOREHAM

DOUGLAS BOREHAM/MCMASTER UNIVERSITY/$323,582

MICRO BEAM. BIG IMPLICATIONS.

Can exposure to radiation actually reduce the risk of cancer?

This was the idea Dr. Doug Boreham was exploring when the Trust's 2001/2003 report profiled his research. His research, along with the work of others, indicates that individuals exposed to low doses of diagnostic radiation may experience lower-than-average rates of cancer.



Six years later, Dr. Boreham finally has an instrument that may help explain why.

The new biological microbeam line in his McMaster University lab allows him to fire high-speed particles at single cells—in fact, at individual components within a cell—to simulate exposure to radiation. By looking at the resulting changes in the cell's structure and DNA, he's hopeful he can identify the mechanisms and processes that make low-dose radiation a potential weapon against cancer.

FOOT 2.0

When Queen's University researchers tested their revolutionary prosthetic foot in Thailand, it was a winner. Thais injured by landmines in former war zones found the new foot comfortable, durable and affordable. First described in the Trust's 2003/04 report, it is now a foot of choice in many regions.



Research is continuously improving the design to meet the needs of people with disabilities worldwide. In 2005, a new idea emerged while testing in another country where landmines are a legacy of past conflict: El Salvador. Here, Model 1 … well, stumbled. While test areas in Thailand were flat farmlands, El Salvador was mountainous—and a more flexible foot would perform better on steeply-sloped paths.

The development team—Dr. Bryant (Queen's), Rob Gabourie (Niagara Prosthetics and Orthotics), Dupont Canada, and prothetists at El Salvador's Universidad Don Bosco, amongst others—went to work. "We begged and borrowed from every technology," says Dr. Bryant, "from cars to farm equipment." The result is the Niagara Foot™—Model 2.

A new DuPont material makes the foot as durable as the original, but more flexible. Perhaps equally significant, the foot's "keel"—its plastic core—is easily shaped to adapt to local conditions. And local molding companies can create covers for the device. These attributes could help foster an indigenous prosthetics capacity in countries where the foot is used.

In Central America, the Queen's-Universidad Don Bosco partnership is expanding expertise in prosthetics and orthotics " … to help develop a centre of excellence," explains Dr. Bryant, "and perhaps make connections with Africa in a 'south-south' partnership that would see us out of the picture."

It's a big and inspiring dream. And in the meantime, with Models 1 and 2 now in the field (and hills), work continues … on Niagara Foot™ Model 3.

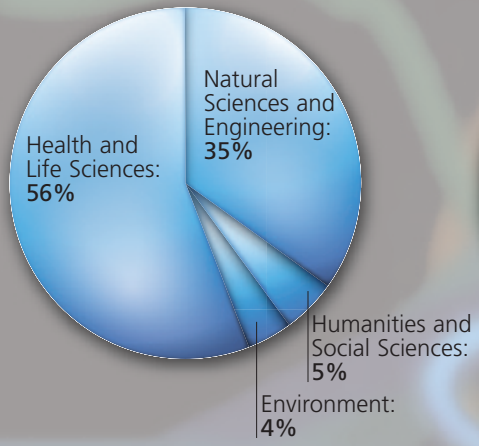
TIMOTHY BRYANT/QUEEN'S UNIVERSITY/$1,682,000

INNOVATION IMPACTS

A numerical look at ten years of Trust investment—and some of the impacts.

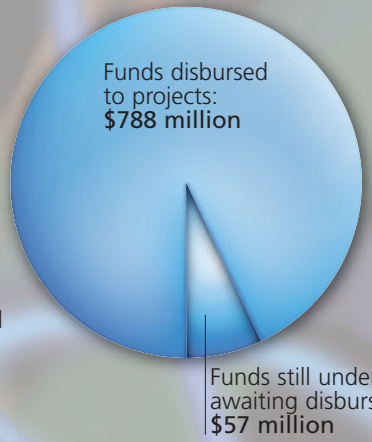
Investments by discipline:
Trust funding has been distributed among a variety of disciplines and institutions in Ontario.

Over half of the Trust's investment in research has gone to projects in Health and Life Sciences.

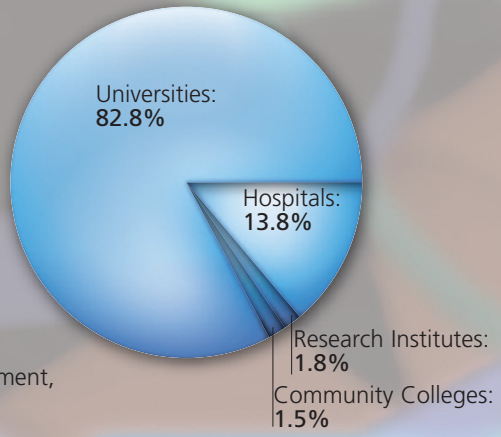


Status of disbursements:
The Trust disburses funds according to a schedule of construction and installation milestones set out in its contracts with researchers and their institutions.

To date, 93.25 per cent of the Trust's funds have been disbursed.

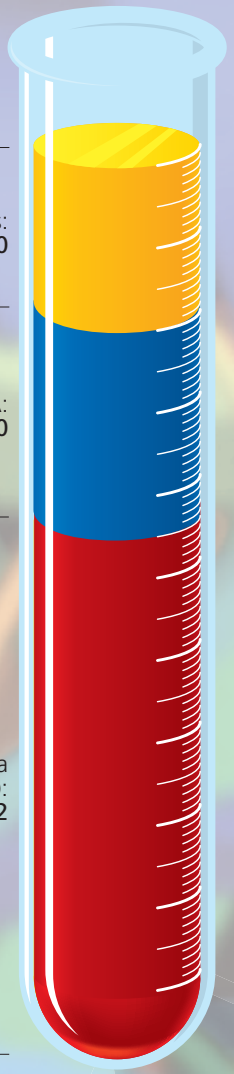


Investments by institution type:
Universities have received the majority of the Trust's investments.



Infrastructure can have an international draw
Cutting edge infrastructure is often important in attracting the best researchers.

Almost half of the researchers recruited for supported projects came from outside Canada.

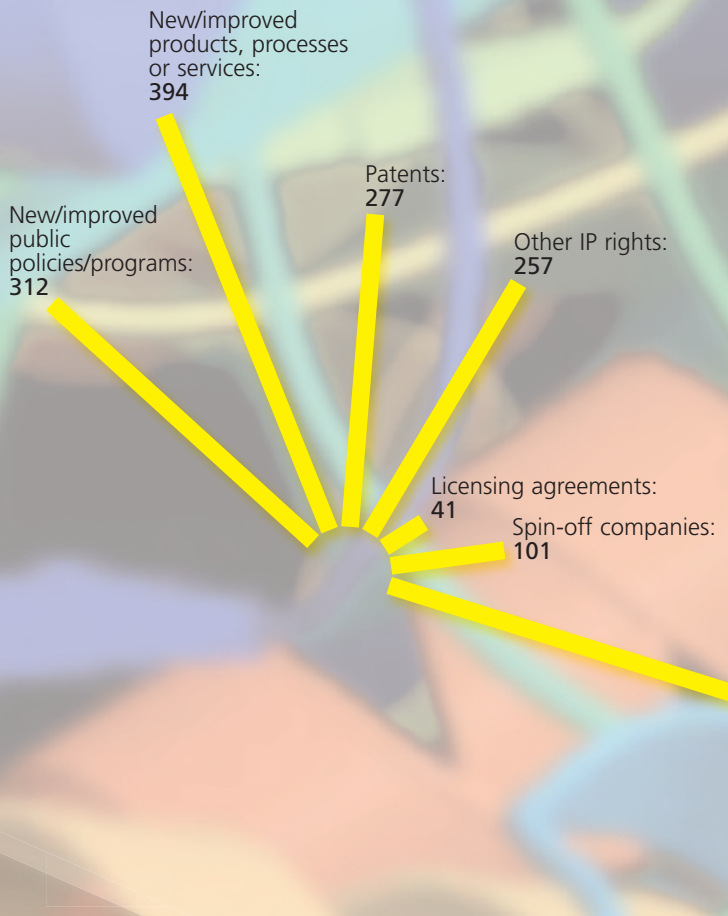


Quality infrastructure helps attract quality people:
In about a third of Trust-supported projects, the quality of infrastructure was reported as an important factor in recruiting personnel.



Number of projects generating spin-off benefit

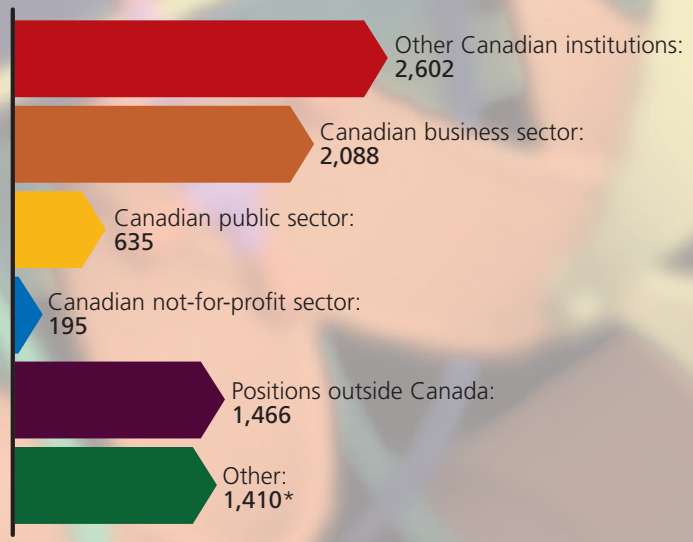
Trust-supported research has generated significant spin-off benefits for the province of Ontario.



Destinations of post-doctoral fellows/grad students leaving projects

Trust-funded research provides a springboard for tomorrow's scientists into both the public and private sectors.

About one-quarter of the post-doctoral fellows and graduate students who left supported projects to pursue research elsewhere went to other Canadian institutions. A further quarter went to work for private companies.



*Responses too broad to quantify – eg: currently seeking employment, entered a new/different discipline, not known.

Total researchers using Trust-funded infrastructure

A key goal in the Trust funding has been to encourage collaboration around advanced infrastructure, both inside institutions and beyond.

Trust-funded infrastructure was used by an average of about 17 researchers per project within the institution and about 8 researchers beyond the institution.



SOURCES: BUDGET FIGURES ARE FROM THE TRUST'S BOOKS. OTHER STATISTICS HAVE BEEN GATHERED FROM PROGRESS REPORTS FILED WITH THE CANADA FOUNDATION FOR INNOVATION AND THE ONTARIO INNOVATION TRUST BY THE PRINCIPAL INVESTIGATORS OF EACH FUNDED PROJECT, AND ACCESSED THROUGH THE INNOVATION INSTITUTE OF ONTARIO'S FACTORIAL INFORMATION MANAGEMENT SYSTEM. NUMBERS ARE BASED ON INFORMATION AVAILABLE AS OF MARCH 31, 2009.

PALEOPUZZLE

Here's a tip: don't tell Henrik Poinar any Jurassic Park jokes. He's heard them all. Some of Dr. Poinar's most recent research aims to reconstruct the DNA of the wooly mammoth.

It's not as easy as science fiction might suggest. Even though the McMaster paleogeneticist has access to frozen mammoth remains—as opposed to petrified dinosaur bones—the samples are still highly degraded. The fragments of DNA that remain are small and random, and the samples are often contaminated by soil, bacteria and human handling. Imagine assembling a linear jigsaw puzzle with about a billion pieces. Sure, you have a few hundred-piece chunks to get you started. And you can use other completed puzzles as clues, like the genome of the modern elephant. But there are lots of pieces in the box from other puzzles. And every time you touch a piece you risk changing its shape and colour.

Dr. Poinar, however, is using new techniques to screen for contamination, and to check rapidly for millions of potential "fits" in the DNA puzzle. As a result, he and other researchers are now confident of about 70 percent of the mammoth genome.

So What?

Paleogenetic techniques refined by such projects are also being used in Dr. Poinar's lab to trace the evolution of HIV and other human diseases. (And we all loved Jurassic Park.)

CURIOUSER INDEX:

HENRIK POINAR/MCMASTER UNIVERSITY/$120,000

HENRIK POINAR

CURIOUS & CURIOUSER

The light at the end of the "rabbit hole" of basic research is the promise of tomorrow's treatments and technologies.

"Curiouser and curiouser!" So exclaims Alice as she confronts yet another bizarre phenomenon in Wonderland.

A dispassionate observer might be tempted to say the same thing on entering the apparent rabbit hole of "curiosity-driven" research at Ontario universities. After all: imaginary numbers? String theory? The food habits of fruit flies?

Curiosity-driven enquiry—also known as basic or fundamental research—focuses on understanding principles and processes, as opposed to harnessing their practical applications. And it can lead into realms as bizarre—and full of wonder—as anything from the fertile imagination of Lewis Carroll: invisible matter, frozen mammoths, colliding stars.

Its practitioners willingly admit that their work is unlikely to have any immediate impact, commercial or otherwise. And in a reflection of that reality, the Ontario Innovation Trust has invested only a small percentage of its resources in this sector. But why pour any money at all into what can so easily be seen as the rabbit hole into Wonderland? In a time when Ontario desperately needs to develop new technologies that lead to new jobs, better health care and a greener environment—why support curiosity-driven research?

We turned the question back on a handful of scientists themselves—researchers whose Trust-supported work is "curious" in every sense of the word. The answers they provided were thought-provoking and compelling.

Some started at a philosophical level. To be human is to be curious. Just ask Alice—or mathematician **Dierdre Haskell**. "One of the things that distinguishes us from animals," she says, "is that we support the search for things that don't just contribute to our material prosperity, but also to our cultural and intellectual well being."

For some scientists, the act of adding to human understanding is justification enough for what they do. By way of illustration, Dr. Haskell points to the British mathematician, G. H. Hardy, author of the 1940 classic

YOUNG BRAINS FOR A BIG BANG

It takes a brain at the peak of its youthful powers to engage the abstract ideas of theoretical physics. That's why Neil Turok, the director of the Perimeter Institute, is attempting to lure the best young physicists in the world to Waterloo. What they get in return is an environment where nothing distracts them from asking if, for example, 11 dimensions are sufficient to explain the origin and structure of the universe. (And you were getting along fine with three…)

The Institute has also recruited senior faculty members from both of the two main competing schools of thought in theoretical physics—string theory and quantum gravity. It's an unusual approach. Most physics faculties and institutes become bastions for one particular perspective. The mixed environment at the Perimeter Institute helps keep young minds sharp.

"They don't ask for much," says Dr. Turok of the young scholars drawn to the Institute. "Blackboards, food, coffee and an inspiring environment. And in exchange, we ask them to think day and night about the hardest questions in physics… The spirit here is very entrepreneurial. We're investing in people's minds."

So What?

That's just what they said about Einstein.

CURIOUSER INDEX:



NEIL TUROK/PERIMETER INSTITUTE FOR THEORETICAL PHYSICS/$5,624,892

A Mathematician's Apology. For Hardy, discovery had its own aesthetic rewards; practical application somehow devalued it. "I have never done anything 'useful,'" he writes with no trace of regret and a hint of pride. "No discovery of mine has made, or is likely to make, directly or indirectly, for good or ill, the least difference to the amenity of the world."

None of the researchers we spoke to had Hardy's apparent aversion to application. But there was a strong sense that the journey is as satisfying as the destination. (Ironically, his work later ended up having significant applications in cryptography.) Even given the burdens of administration, supervision and teaching they carry, several spoke about the pleasure their work brings them. "It's a passion that's not linked necessarily with particular downstream applications," explains **Henrik Poinar**, a specialist in paleogenetics. This may not sound much like passion—until he adds: "I mean, I sometimes can't believe that I actually get paid to come here and dream about different experiments I can do on the impact of climate on wooly mammoth diversity across the last glacial maximum. Is that cool or what?"

The poster boy of passionate curiosity is, of course, Albert Einstein. As a patent clerk, motivated purely by a need to understand how the world worked, he produced insights so fundamental that they've helped shape physics for over a century. And his work—then very theoretical—turned out to have enormous tangible applications in fields as diverse as nuclear energy and electronic navigation.

What kind of price do you put on the potential for results like that? Mike Lazaridis knows. The Canadian entrepreneur—and vocal advocate of fundamental research—has donated a total of $150 million to establish the Perimeter Institute For Theoretical Physics in Waterloo. The Institute scours the world for talented young physicists, then brings them together and gives them carte blanche to pursue whatever interests them, while exposing them to some of the most influential theorists in the field. **Neil Turok**, the Institute's director, explains the goal: "We want to get young people into advanced

PATTERN COGNITION

McMaster mathematician Dierdre Haskell is at least three degrees of separation away from the next great widget. "My work is probably going to be looked at by other mathematicians, and their work might be looked at by more applied mathematicians and their work might be looked at by physicists and biologists."

So what is it she does? For a start, Haskell explains that mathematics is about recognizing and understanding patterns. We observe the same pattern of behaviour, for example, in waves on the ocean and sound in the air. Math is the expression and study of such patterns in abstract form, as equations. But Haskell's work in the field of mathematical logic goes deeper. "I don't study the patterns," she explains. "I study the idea of patterns."

From here, the ideas get very complex very quickly. Mathematical logicians bandy about concepts like "o-minimality" and "imaginaries." It's enough to say that this kind of research is perhaps the most fundamental of all. The work of people like Dierdre Haskell underlies and verifies the mathematics that every other kind of research—basic or applied—is built on.

So What?

You never see the foundations of a skyscraper. But they have to be there.

CURIOUSER INDEX:



DIERDRE HASKELL/MCMASTER UNIVERSITY/$97,162

STAR STRUCK

"I'm a theoretical astronomer," says McMaster's Alison Sills. "I don't use a telescope; I use a computer."

Dr. Sills' specialty is clusters of from two to thousands of stars—and especially clusters whose stars behave unusually. "They're too blue or too bright or too strange in some way," she explains. To try to understand these aberrations, Sills models the systems on high-performance computers that can track the movement of 100,000 elements over periods as long as 15 billion years, simulating conditions that might have caused a given cluster to look or move the way it does.

Sills has a particular interest in stellar collisions. These colossal events take place over a matter of hours when members of a binary system get too close. Such collisions are surprisingly frequent, and the results are usually understood. "Except when they're not," says Sills. "And that's when I get interested."

So What?

Grad students and post-docs trained in the rigorous problem-solving of disciplines like astrophysics can bring those skills to the public and private sector. (And besides, wouldn't you want to know what happens when two stars collide?)

CURIOUSER INDEX:



ALISON SILLS/MCMASTER UNIVERSITY/$174,442

ALISON SILLS

research as quickly as possible, with a firm focus on generating breakthroughs." And that's "breakthroughs" spelled with a capital B.

Will the Perimeter Institute produce the next Einstein—and another century of undreamed-of applications? "We don't know," Dr. Turok readily admits. "It's a very big experiment." But he's betting his career—and Mike Lazaridis is betting his fortune—that it might.

Einsteins, however, are few and far between. Pressed further to make a case for pursuing curiosity into the rabbit hole, some of our scientists pointed to practical valuables that can be picked up along the way. One of those researchers is **Anthony Noble**, an astrophysicist who's investigating "dark matter."

No one has even been able to directly measure dark matter, let alone see it. And even if Dr. Noble manages to do so, the stuff isn't something a start-up company can market from a garage. And yet this research is already spinning off very tangible applications. "We had to work with industry to produce the new technologies we needed for our underground sensors," he explains. "And in the process they picked up many of those technologies—including a water purification system now being used in developing countries around the world." He goes on to cite a classic spin-off of exotic research: the development of the powerful electromagnets used in particle accelerator research—about as "curious" as science can get—yielded enabling technologies for an alphabet soup of diagnostic scanning devices—CAT, PET, MRI—fundamental to modern medicine.

This is, some may say, an expensive way to enjoy spin-off benefits. Why not let other countries look for, say, dark matter; then Canadians can raid the research and build the purification plants. Dr. Noble points out, however, that it doesn't work that way. Very few intellectual scraps fall from the table of basic research. The scientists who actually do the work—as well as their close collaborators—are the ones who file for the patents on the spin-offs.

There's another very tangible benefit for societies that foster basic research. "I spend a lot of my grant money on people—on grad students and

INVISIBLE. BUT OUT THERE.

Remember those scenes from "invisible man" movies where you can't see anyone in the room, but there's a suspicious dent in the sofa? Here's an astronomical equivalent: we can only directly detect about 20 percent of the matter in our universe, but we know the rest is there because of its effects. One clue: spinning galaxies hold onto stars much more powerfully than they should, given the mass we can calculate from optical and radio measurements. What accounts for the mystery mass that produces extra galactic grip?

The answer is "dark matter." And Queen's astrophysicist Anthony Noble is trying to observe it. The problem is the blizzard of other particles that envelops us every day, masking any dark matter that might be present. That's why Dr. Noble has built a detector two kilometers underground in a mine near Sudbury; the overlaying rock filters out most of the interference.

The detector uses a form of fluorine, which has properties that should make it flash when struck by a dark matter particle. If the detector is successful, what we can learn from it may help us understand the origins, make-up and ultimate fate of our universe.

So What?

High-tech experiments like these often generate valuable spin-off technologies in areas like medical scanning. And we can stop worrying about all that missing matter.

CURIOUSER INDEX:



ANTHONY NOBLE/QUEEN'S UNIVERSITY/$125,000

WHO'S LAUGHING NOW?

Marla Sokolowski remembers, as a child, watching seagulls fight over food scraps in a parking lot. Why, she wondered, were some more aggressive than others?

Exploring food behaviours in animals has since defined her academic career. She began by identifying a "rover/sitter" gene in fruit flies that helped determine foraging patterns—a gene she later discovered has a parallel in humans.

The gene may be related to a number of human food disorders—and teasing out the genetic connection may help lead to drug treatments for conditions like anorexia and obesity. Dr. Sokolowski is also exploring a potential link to Seasonal Affective Disorder—a condition where the onset of winter triggers symptoms like depression, overeating and fatigue. And now psychologists and sociologists are looking at her research for possible keys to other behaviours like population mobility and workplace dynamics.

"From fruit flies to humans," she chuckles, reviewing the surprising arc of her research. Then, describing a talk she gave recently to a lay audience, she neatly captures how people have responded to her work. "There was a lot of laughing about my flies," she says, "but at the end, people were pretty excited."

So What?

Big and immediate health implications. And who better to unlock the secrets of seasonal affective disorder…than a Canadian?

CURIOUSER INDEX:



MARLA SOKOLOWSKI/UNIVERSITY OF TORONTO/$125,000

MARLA SOKOLOWSKI

post doctoral fellows," says astronomer **Alison Sills**. "They won't all go off and become astronomers. But there's a decent chance that many will get into applied science or even business." And when they do, she suggests, they bring a very useful mindset to their work. "They know how to frame problems. And getting the problem right is often the hardest thing." Dierdre Haskell puts it in slightly different terms: "We train students that the truth is important, fundamental. So wherever you end up working, that's going to be what they're looking for."

Spin-offs are important. But the question remains: what about ultimate results? Does this kind of fundamental research ever lead to direct payoffs? Is there any kind of straight line between an investment in someone's curiosity and a payoff in health or prosperity? Sometimes, yes. Take the case of biologist **Marla Sokolowski**.

Dr. Sokolowski began her academic career looking into a subject that might kindly be described as "academic": the foraging habits of fruit flies. In her Ph.D, she identified two basic behaviour patterns: "rover" flies restlessly searched for new food sources, while "sitters" tended to stay put and eat.

The results might sound like fodder for a stand-up routine on myopic science…were it not for where they led. Dr Sokolowski went on to isolate and identify the fruit fly gene that determined the behaviour. And then she began looking for—and finding—evidence of the same gene in other insects, in mammals and ultimately in humans.

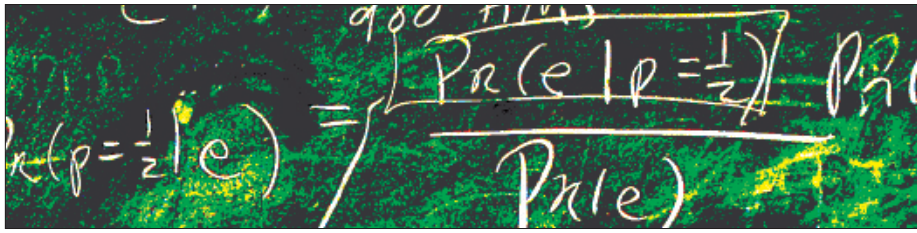
Today, she's on the cutting edge of research that's tying the rover/sitter gene in humans to disorders like anorexia and obesity, and even to ADHD—attention-deficit hyperactivity disorder. Understanding how the gene can be turned on and off by drugs and by environmental factors may lead to effective treatments for these and other human afflictions. Asked about the importance of supporting curiosity-driven research, she can answer with particular authority: "It's absolutely critical."

Dr. Sokolowski is the first to admit that her story isn't typical. "Many researchers don't live to see the wonderful outcomes of their work…Often, basic research has to build up a huge knowledge base before anyone can get to the stage where you're contributing to human health." But her accomplishments help to reinforce the assertion that, in the end, sooner or later, directly or indirectly, curiosity does make contributions. In the case of a Henrik Poinar or a Marla Sokolowski, it may happen sooner and the results may be direct and tangible. On the other end of the spectrum, it may well be that no one alive to read this report will see everyday applications of current work at the Perimeter Institute. But the history of science makes it clear: there will be results. Someone will eventually shout "Eureka!"

For this reason, we choke off the "rabbit hole" of curiosity-driven research at our peril. "Yes, we have to deal with immediate problems in the world," says Perimeter's Neil Turok. "But the amount of investment you need in basic science to make a big difference in the future is very small." He laughs somewhat ruefully. "I mean, Einstein cost nothing."

For that small investment, we fuel the flame of human curiosity, we reap the benefits of spin-off technology, we train new generations of fine minds and we set the stage for astonishing breakthroughs. In fact, fundamental research represents one end of a continuous pipeline that leads, at the other end, to applied technology. Keep ideas flowing from the source, and the harvest of applications will be continuous and abundant. Let the stream dry up, and future technology will wither.

We're not talking, then, about a rabbit hole at all. We're talking about a portal to tomorrow. And that light at the end of the tunnel is the glimmer of a better life for us and generations after.



MESSAGE FROM THE CHAIR

A FOUR PART PRESCRIPTION FOR THE FUTURE OF RESEARCH

What a remarkable decade it's been since the Ontario Innovation Trust opened its doors in 1999. Ten years later, as we issue our final annual report in this form, we celebrate what can be accomplished when partners—Ontario's research community, the business community, the governments of Ontario and Canada, and the Trust—work together.



I confess, however, that I have little patience with dwelling on the past. Yes, our collective investments have paid great dividends. But what comes next? What can we do now, as a province, to ensure that the accomplishments of the next 10 years are even more remarkable?

Here's my prescription.

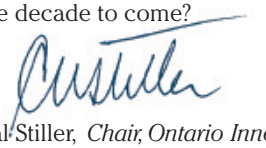
Dream unreservedly. There is no reason Ontario can't be in the very top ranks of the world's idea-driven economies. Any failure to achieve that goal will be fundamentally a failure of attitude and imagination. Enough with stereotypical Canadian modesty, in the lab, in the caucus room and in the board room. We can lead and we will.

Appraise honestly. This is the hardnosed, clear-eyed complement to dreaming. Where are we now in the world's idea-driven pecking order? What are our current strengths—and weaknesses—in research? How effective have we been in translating ideas into patents, applications, wealth and health?

Focus strategically. Here we marry dreaming and evaluation. Which of the pressing challenges that face our world, our country and our province are we best-equipped to tackle? Let's be clear: there will be hard choices to make here; we can't do everything. But if we choose our challenges well, the things we do will be astounding.

Act decisively. Tough calls on focus will demand bold action. We'll need courageous new commitments to spending from enterprise as well as government. We'll need creative new channels to get those funds to where they'll be most effective. And we'll need to find new ways to clear the blockages in the vital pipeline that joins fundamental research, applied research and the marketplace.

Can we do all this? As I read about a decade of research, represented by the examples on these pages, I have no doubt we can. After all: vision, honesty, focus and bold action have characterized these ten years of accomplishment. Why should we expect any less of the decade to come?



Cal Stiller, *Chair, Ontario Innovation Trust*

THE BOARD

The Board of Directors of the Ontario Innovation Trust

The Trust is governed by a volunteer Board of seven Directors appointed for a fixed term. Two Board members are appointed by the universities of Ontario, one by Ontario's hospitals, one by Ontario's community colleges, and three by the Ontario Government, through Orders-in-Council.

BOARD MEMBER	TERM OF SERVICE	APPOINTED BY
Calvin Stiller *Chair*	1999 – present	Universities
Ian D. Clark	2007 – present	Universities
Bette Stephenson	1999 – present	Hospitals
Rick Miner	2002 – present	Community Colleges
Phil Howell	2005 – present	Province of Ontario
Janet Mason	2005 – present	Province of Ontario
George Ross	2006 – present	Province of Ontario

GREATER THAN ITS PARTS: THE FUNDING MOSAIC

The funding of advanced research in Ontario involves a complex mosaic of grants, awards, endowments and gifts in kind from a variety of sources.

As it marks a decade of engagement, the Trust acknowledges this productive mosaic of partnership. We are particularly grateful for our close relationship to the Canada Foundation for Innovation, upon whose resources we have often relied in evaluating and monitoring investments in infrastructure. Provincial funding bodies have also offered valuable collaboration, most recently the Ministry of Research and Innovation, as have universities, hospitals, institutes and colleges.

The Trust also pays tribute to the many businesses that have become active partners in research, whether through funding or the provision of services or equipment. And finally, we acknowledge the vision of individual donors.

Together, we have each contributed to the funding mosaic, and the result is more than the sum of its parts—a co-ordinated effort to put Ontario firmly among the leaders in global science.

Canada Foundation for Innovation
Fondation canadienne pour l'innovation

Canada Foundation for Innovation
www.innovation.ca

Ontario

Ministry of Research and Innovation
www.mri.gov.on.ca

On the next pages...

THE RESEARCHERS



FACE OF DISCOVERY *Pages 26 and 27*
Female, male. Younger, older. From the more than 1200 projects we've supported, here is what the face of curiosity looks like.



ROLL CALL: A DECADE OF INNOVATION *Pages 28 and 29*
All the researchers the Trust has supported, alphabetically, by institution.



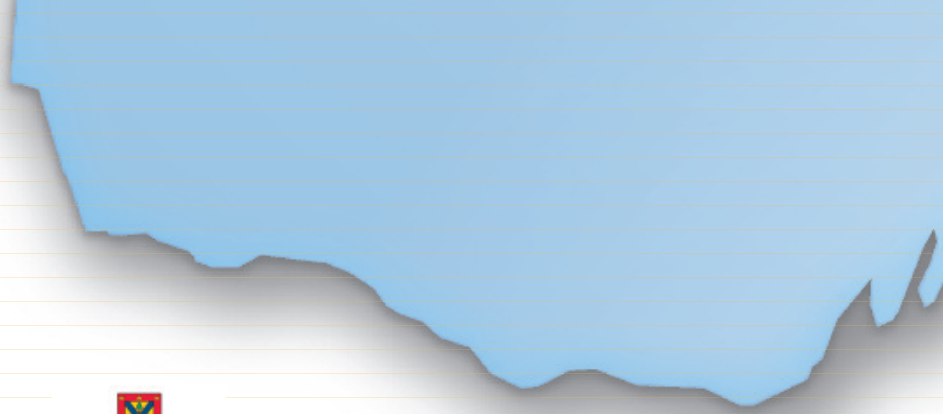


Algonquin College: Barbara J. Foulds, Jack Treuhaft, Baycrest Centre for Geriatric Care: Donald T. Stuss, **Brock University:** Karen Arnell, Douglas Bruce, Alfredo Capret James McNulty, Danielle Parks, Melanie Pilkington, Brian Roy, Sidney Segalowitz, Adonis Skandalis, Jeff Stuart, Phillip Sullivan, Glenn Tattersall, Terrance Wade, Carle Fahrig, Kathleen Gilmour, Pavan Gunupudi, George Hadjisophocleous, Feridun Hamdullahpur, Yasser Hassan, Shawn Hayley, Chris Herdman, Xiao Huang, Michael Je Pappas, Ruth Phillips, Michael Pisaric, Michael Poulter, Joanna Pozzulo, Sharon Regan, John Rogers, David Rogers, Abhijit Sarkar, Thomas Sherratt, Andrew Simons, D **Centennial College of Technology and Applied Arts:** Lynda Atack, **Conestoga College:** Leonid Sloutsky, Jal C. Wadia, **Confederation College:** David J. Archibald, **Fans** Jeffrey Banks, Lione Catalan, Aicheng Chen, Qing-Lai Dang, Wa Gao, Allan Gilbert, Scott Hamilton, Peter Hollings, Peter Lee, Kam Tin Leung, Carney Matheson, S **University:** Akram Alfantazi, Madhur Anand, Greg Baiden, Celine Boudreau-Lariviere, Francois Caron, Diana Coholic, Paul Dunn, Jacques Farine, Sylvain Grenier, J **Research Institute:** Frank S. Prato, **London Health Sciences Centre:** Richard Novick, Geoffrey L. Hammond, **Loyalist College:** Kari L. Kramp, **MaRS Discovery District:** Joh Paul Berti, Douglas Boreham, Gianluigi Botton, Michael Boyle, Jonathan Branson, John D. Brennan, Eric Brown, Aubrey Cannon, Alan Chen, Chih-Hung Chen, David Mohamed A. Elbestawi, Digby Elliott, Ian Fearon, Warren Foster, Cecile Fradin, Jack Gauldie, Raja Ghosh, G. Brian Golding, Gillian Goward, Nicholas J. Griffin, Dan Takashi Imai, Gordon A. 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Stewart Aitchison, Christine Allen, Benjamin Alman, Carl Amrhein, Michele Anderson, Adam K Anderson, Peter Andolfatto, Maydianne Andrade Belanger, Carl Bereiter, Johannes Van Biesebroeck, Angelos Bilas, Robert Birgeneau, Russel Bishop, Charles Boone, James Booth, Shelley R. Boyd, Brian Branfireun, Clare Warren Chan, Belinda Chang, Tom Chau, Vijay Chauhan, Robert Chen, Peter Cheung, Chung-Wai Chow, Dinesh Christendat, David Clarke, John R. Coleman, Paul C Drucker, James Drummond, Daniel Dumont, Daniel Durocher, Aled Edwards, Tamer E. El-Diraby, George Eleftheriades, Ahmed El-Sohemy, Suzanne Erb, Greg Evans, N. Simon Graham, Peter R. Grant, Omer Gulder, Jeffrey Henderson, Peter Herman, Scott P Heximer, Geoffrey Hinton, Walid A. Houry, Timothy R. Hughes, Mitsuhiko Iku Shitij Kapur, Rupert Kaul, Lewis E. Kay, Robert S. Kerbel, Marten Van Kerkwijk, Nazir Kherani, Lakshmi Kotra, Ulrich Krull, Roy Kwon, Eyal De Lara, Kang Lee, Chi-Guhn L Lu, Wei-Yang Lu, Stephen Lye, Mikhail Lyubich, Fabio Macciardi, Scott MacDougall-Shackleton, Tak Mak, Morris Manolson, Joaquim Martins, Andrew Mason, Willian Stephen Morris, Martin Moskovits, Javad Mostaghimi, Karen Mundy, Farid Najm, Calvin Netterfield, Dominic Ng, Heyu Ni, Matthias Niemeier, Pamela Ohashi, Mic Ue-Li Pen, T Picton, Regis Pomes, Milos Popovic, Martin Post, Robert Prosser, Li Qian, Martin Ralph, Jonathan Rast, Cheryl Regehr, Lloyd D. Reid, Stephen Reid, John Katreena Scott, Michael Sefton, Daniel Sellen, Ze ev Seltzer, Barry J. Sessle, Jumi Shin, Molly S. Shoichet, Myrna Simpson, Peter Singer, Peter Smith, Brian Cantwell Sm Louis Taillefer, James Thompson, Joseph H. Thywissen, Denny Trinh, Vincent Tropepe, Jack V Tu, D. Tyers, Jack Uetrecht, Shahrokh Valaee, Hubert VanTol, Homayoun John Y. T. Wei, Cari Whyne, Andrew Wilde, Shane Williamson, Brian C. Wilson, Rudolf Winklbauer, Mitchell A. Winnik, Minna Woo, Ulrich Wortmann, Ning Yan, C Mei Zhen, Min Zhuo, **University of Waterloo:** Mark Aagaard, Vladimir Bantseev, Gladimir Baranoski, James Barker, Sanjeev Bedi, Peter Bernath, James Black, David Emelko, Anthony Endres, Robert Feick, Eric Fillion, James A. Forrest, James Geelen, Alan George, Michel Gingras, Farid Golnaraghi, Robert Gorbet, Tadeusz Gorecki, Christopher Hudson, Elizabeth L. Irving, Mohamed Kamel, Achim Kempf, Holger Kleinke, Jan Kycia, Raymond Laflamme, Kam Tong Leung, Ming Li, Shoufa Lin, Keser W. E. Rush, Joseph Sanderson, Jacob Sivak, Ranjini Sivakumar, Siva Sivoththaman, Joan Soares, Khaled Soudki, Cameron L. Stewart, Arne Storjohann, Ken Seng Tan, **Western Ontario:** Samuel Asokanthan, Donglin Bai, Michael Bancroft, Michael Bartlett, Amerjeet Bassi, Michael A. Bauer, Roderic Beaujot, Frank Beier, Daniele Belang Patricia Corcoran, Hugh Couchman, Irena Creed, Carole Creuzenet, Jody Culham, John Denstedt, Zhifeng Ding, S. Jeffrey Dixon, Sudhir D'Souza, Cynthia Dunning, Huang, Norman P. A. Huner, Jeffrey Hutter, Donald Jamieson, John Jardine, Thomas Jenkyn, Lila Kari, Gerald M. Kidder, Penelope King, Robert Klassen, Lars Kone Madrenas, John McCormick, Grant McFadden, N. McIntyre, Ravi Menon, Ian Mitchell, Silvia Mittler, Mehrdad Moallem, Bruce Morton, Dwight Moulin, George Nakhla, Rajan, Bryan Richardson, Sohrab Rohani, Peter Rupert, Eric Savory, Oleg Semenikhin, Tsun-Kong Sham, Gary Shaw, Brian Shilton, Kevin Shoemaker, David W. Shoes W.K. Wan, Christine White, James Wisner, Robert A. Young, Liana Zanette, Jingxu (Jesse) Zhu, Abid Zine-Eddine, **University of Windsor:** Adnan Ali, Sirinart Ananvorani Haffner, Daniel D. Heath, Dennis Higgs, Hongfa Hu, Suzan Ilcan, Wladyslaw Kedzierski, Jerald Lalman, Robert Letcher, Stephen Loeb, Charles Macdonald, Eleanor M Tam, Panayiotis Vacratsis, Sherah Vanlaerhoven, Jichang Wang, Iris Xiaohong Xu, Jianwen Yang, Ming Zheng, **Wilfrid Laurier University:** Maher Ahmed, James Blackbur Lucila Lee, John Lit, Linda Parker, Stephen Perry, Richard Playle, Philips Servos, Robin Slawson, Arthur Szabo, Lisa Teather, Peter Tidus, Robin Waugh, Anne Wilson, B Tara Haas, Laurence Harris, Eric Hessels, David Hood, Katalin Hudak, Robert Huggins, Christopher Innes, Engin F. Isin, Jennifer Jenson, Philip Johnson, Joel Katz, Ronald Pearlman, Brendan Quine, Michael Riddell, Catriona Sandilands, Lauren E. Sergio, Gordon Shepherd, Richard Staines, Bridget Stutchbury, Gary Sw

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Prepas, Heidi Schraft, Roger Strasser, Abdelhamid Tayebi, **Lambton College of Applied Arts & Technology:** Kim Choo, **Laurentian** ohn Gunn, Peter Kaiser, Aseem Kumar, Bruno Lafrance, Abdelwahab Omri, Amadeo Parissenti, Helen Shang, Graeme Spiers, Ramesh Subramanian, **Lawson Health** n Evans, **McMaster University:** Alex Adronov, Christopher Anand, David Andrews, Muhammad Altaf Arain, Paul Ayers, Sigal Balshine, Christian Baron, Patrick Bennett, Chettle, Samir Chidiac, Ron Childs, William D. Coleman, Paulin Coulibaly, Walter Craig, Lisa Crossley, Kari Dalnoki-Veress, M. Jamal Deen, Sarah Dickson, David Earn, en Grocke, Yiping Guo, Peijun Guo, Yaser Haddara, Mohamed Hamed, Deirdre Haskell, Catherine P. M. Hayward, Paul Higgs, Adam P. Hitchcock, Suleiman Igdoura, eiman, Andrew Knights, Philip Koshy, Peter Kruse, John N. Lavis, Yingfu Li, Patricia Liaw, Graeme Luke, Zhi-Quan Luo, Joy MacDermid, Andrew Macpherson, Joseph elinovsky, Robert H. Pelton, Anthony Petric, Stuart Phillips, Hendrik Poinar, Nikolas Provatas, Ronald Racine, Eduard Reinhardt, Geoffrey Rockwell, Peter Rosenbaum, th, Erik Sorensen, Janet Starkes, Jonathon Stone, Hongjin Sun, Henry Szechtman, Damu Tang, Tamas Terlaky, Michael Thompson, Bernardo Trigatti, Ray Truant, Tracy s, Timothy Whelan, David S. Wilkinson, Kon Max Wong, Christopher M. Wood, Xiaolin Wu, Zhou Xing, Jianping Xu, Chang-ping Xu, Igor Zhitomirsky, Shiping Zhu, ana, **Niagara College:** Ahsan Zaheer Chowdary, Michael Duncan, Marti Jurmain, Olga Piedrahita, **Nipissing University:** Gregory Pyle, **Perimeter Institute for Theoretical** ippindale, Susan Cole, Andrew Craig, Anne Croy, Peter L. Davies, Troy Day, Bradley Diak, Mark Diederichs, Aristides Docoslis, Michael Dorris, Randy Ellis, Amir Z. Fam, di-Zaad, Hossam Hassanein, Jeanette Holden, Robin Hutchinson, Praveen Jain, Philip G. Jessop, Li Jun Ji, Zongchao Jia, Ingrid Johnstrude, Rober Knobel, Marianna Kon- er Loock, Stephen Lougheed, Colin MacDougall, Roderick J. Macleod, Neil Magoski, Linda McLean, Luis Melo, Janet Menard, Matthew Mendeszohn, Douglas Mewhort, h Pater, William Paterson, Andrew Pollard, Sharon Regan, Kevin Robbie, Jim Roche, Mark Ropeleski, Gregory Ross, F. Kerry Rowe, Mark Sabbagh, Laurent Seroude, Yuxiang Wang, Christopher Ward, Louise Winn, Chi-Hsiang Yeh, Gennady Zak, **Robarts Research Institute:** Mickie Bhatia, Robert Hegele, Terence Peters, David White, mleh, Alagan Anpalagan, Daolun Chen, Mario Estable, Zouheir Fawaz, Ling Guan, Aziz Guergachi, Kenneth Jones, Michael Kolios, MohamedLachemi, Jonathan Li, ookstock, Bin Wu, FengFeng Xi, Xiao-Ping Zhang, **Sault College:** Robert Currell, Harvey Robbins, Subhash Verma, Valerie Walker, **Seneca College:** Katharine Janzen, **ming College:** Peter Spasov, Mark Williamson, St. Joseph's Hospital: John Bienenstock, Paul O'Byrne, **St. Michael's Hospital:** Arthur Slutsky, Duncan Stewart, **Sunnybrook** avid Malkin, Daniela Rotin, Stephen W. Scherer, Lap-Chee Tsui, **Trent University:** William Atkinson, James Conolly, Peter Dillon, Eric Helleiner, Chris Metcalfe, Dennis el Benchimol, Alejandro (Alex) R. Jadad, David Jaffray, Gary A. 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Scaiano, Susannah Scott, Lowell Winger, Ronald Worton, Mustapha Cherif Eddine Yagoub, Jianping Yao, Xiaohui Zha, **University of Toronto:** Parham Aarabi, Jonathan Abbatt, Baher Abdulhai, e, Brenda Andrews, Michael Archer, Cheryl Arrowsmith, Nasser Ashgriz, Isabelle Aubert, Julie Audet, Ravin Balakrishnan, Virginijus Barzda, David Bazett-Jones, Pierre Brett, Julie Brill, Robert Bristow, Mireille Broucke, Ian Brown, Patricia Brubaker, John Brumell, Benoit Bruneau, Raymond Carlberg, Anthony Carusone, John Caspersen, Cooper, Sean Cutler, Dennis Cvitkovitch, Christopher Damaren, Stephen W. Davies, Sandy Der, Al-Amin Dhirani, John Dick, Susan Done, Gregory P. Downey, Daniel J. Eyles, Ramin Farnood, Taylor Feild, Zhong-Ping Feng, Susanne Ferber, Geoffrey Fernie, Lori Frappier, Paul Gauvreau, Michael Georges, Michael Glogauer, John Glover, ura, Keith Ireton, Hans-Arno Jacobsen, Greg Jamieson, Jennifer Jenkins, David JA Jenkins, Dylan Jones, Sheena Josselyn, Stephen Julian, Michael Julius, David Kaplan, ee, Howard Leong-Poi, Deborah Leslie, Pascal Van Lieshout, Teng Joon Lim, Howard Lipshitz, Jun Liu, David Livingstone, Hor-Kwong Lo, Wen-Yi Wendy Lou, Zheng-Hong n Evans McIlroy, Roderick R. McInnes, John McLaughlin, JoAnne McLaurin, R.J. Dwayne Miller, Charles Mims, Jerry Mitrovica, Jeremy Mogridge, Jean-Marc Moncalvo, hael Ohh, Beverley Orser, Lucy Osbourne, Emil Pai, Christopher J. Paige, Marius Parashivoiu, Chul B. Park, Esteban Parra, Lacra Pavel, Tony Pawson, Richard Peltier, Roder, Eve De Rosa, Janet Rossant, Locke Rowe, Dean Rowe-Magnus, Peter Roy, Mohini Sain, Edward Sargent, Konstantinos Sarris, Bruce Schneider, Gregory Scholes, ith, Marla B. 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INNOVATION PROVINCE-WIDE

An institution-by-institution overview of Trust-supported research in Ontario



Ontario Innovation Trust Investments 1999 – 2009

CITY	INSTITUTION	NUMBER OF OTHER FUNDING PARTNERS	NUMBER OF PROJECTS	TOTAL PROJECT COST	OIT FUNDING
Barrie	Georgian College	5	1	$1,161,469	$464,588
Belleville	Loyalist College	2	1	$459,300	$183,720
Guelph	University of Guelph	150	93	$147,433,518	$53,687,338
Hamilton	McMaster University	200	138	$189,477,974	$64,138,427
Hamilton	Mohawk College	5	2	$429,248	$171,345
Hamilton	St. Joseph's Hospital	2	2	$28,156,836	$11,262,736
Kingston	Queen's University	117	101	$230,801,690	$66,804,893
Kingston	Royal Military College of Canada	11	6	$5,689,479	$1,702,272
Kitchener	Conestoga College	10	2	$2,612,504	$920,648
London	Fanshawe College	8	1	$619,360	$243,230
London	Lawson Health Research Institute	3	1	$9,247,734	$2,864,000
London	London Health Sciences Centre	3	1	$7,992,143	$2,818,062
London	London Regional Cancer Centre	2	1	$820,000	$211,500
London	Robarts Research Institute (The University of Western Ontario)	3	4	$26,085,008	$8,624,260
London	The University of Western Ontario	170	117	$281,010,649	$91,724,815
North Bay	Nipissing University	1	1	$418,203	$166,646
Oakville	Sheridan College	5	4	$4,617,016	$1,694,992
Ottawa	Algonquin College	5	3	$2,881,392	$1,045,482
Ottawa	Carleton University	113	50	$121,290,826	$37,608,466
Ottawa	University of Ottawa	154	98	$212,166,283	$73,058,559
Peterborough	Sir Sanford Fleming College	5	2	$2,651,218	$1,060,487

CITY	INSTITUTION	NUMBER OF OTHER FUNDING PARTNERS	NUMBER OF PROJECTS	TOTAL PROJECT COST	OIT FUNDING
Peterborough	Trent University	17	17	$20,088,473	$5,573,252
Sarnia	Lambton College	5	1	$1,806,964	$722,786
Sault Ste. Marie	Sault College	22	4	$4,659,459	$1,827,851
St. Catharines	Brock University	33	23	$17,615,815	$5,396,828
St. Catharines	Niagara College	11	6	$4,542,752	$1,675,253
Sudbury	Laurentian University	35	19	$9,341,663	$3,483,959
Thunder Bay	Confederation College	8	1	$692,000	$276,800
Thunder Bay	Lakehead University	28	20	$12,564,055	$3,869,347
Toronto	Baycrest Centre for Geriatric Care / Rotman Research Institute	2	2	$32,189,517	$11,152,000
Toronto	Centennial College	4	1	$707,700	$284,930
Toronto	MaRS Discovery District	23	1	$25,000,000	$10,000,000
Toronto	Humber College	19	1	$1,747,900	$698,900
Toronto	Mount Sinai Hospital	25	8	$93,129,740	$35,246,997
Toronto	Ryerson University	37	25	$8,787,544	$3,433,018
Toronto	Seneca College	11	4	$3,627,587	$1,243,774
Toronto	St. Michael's Hospital	7	2	$8,878,207	$3,520,595
Toronto	Sunnybrook Health Sciences Centre	17	4	$42,308,229	$16,561,292
Toronto	The Hospital for Sick Children	3	5	$31,636,872	$10,522,437
Toronto	University Health Network	7	8	$77,976,648	$25,144,995
Toronto	University of Toronto	251	263	$546,919,868	$206,498,126
Toronto	York University	107	51	$40,673,835	$15,210,768
Waterloo	Perimeter Institute for Theoretical Physics	3	1	$21,788,010	$5,624,892
Waterloo	University of Waterloo	165	88	$125,433,053	$45,594,725
Waterloo	Wilfrid Laurier University	21	26	$16,572,452	$6,574,321
Windsor	University of Windsor	39	43	$22,826,581	$8,040,750
			1,253	**$2,447,536,774**	**$848,635,062**

SUMMARIZED FINANCIAL STATEMENTS



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Auditors' Report

To the Directors of
Ontario Innovation Trust

The accompanying summarized balance sheet and summarized statements of operations and capital and changes in capital are derived from the complete financial statements of Ontario Innovation Trust as at March 31, 2009 and for the year then ended. In our auditors' report on the complete financial statements dated June 18, 2009, we expressed an unqualified opinion. 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
June 18, 2009

Year ended March 31, 2009

Summarized Balance Sheet as at March 31

	2009	2008
ASSETS		
Cash, accounts receivable and prepaid expenses	$ 444,156	$ 156,957
Investments	64,097,277	82,249,145
Equipment	9,160	35,891
	$ 64,550,593	$ 82,441,993
LIABILITIES AND CAPITAL		
Accounts payable and accrued liabilities	$ 787,077	$ 320,977
Due to Innovation Institute of Ontario (note 1)	136,042	129,082
	923,119	450,059
Capital		
Invested in equipment	9,160	35,891
Restricted for approved grants (internally restricted)	53,594,214	66,620,973
Unrestricted	10,024,100	15,335,070
	63,627,474	81,991,934
	$ 64,550,593	$ 82,441,993

Summarized Statement of Operations and Changes in Capital
Year Ended March 31

	2009	2008
Revenue		
Investment income	$ 2,525,965	$ 4,408,152
Expenses		
Consulting and management services	604,485	657,660
Service fees paid to Innovation Institute of Ontario	565,950	568,406
Salaries and benefits	422,453	380,080
Office and general	103,708	84,370
Investment and custody services	79,383	97,180
Amortization	33,443	77,778
Travel	11,264	11,130
	1,820,686	1,876,604
Excess of revenue over expenditures before undernoted items	705,279	2,531,548
Eligible project disbursements	17,027,803	24,280,612
Final projects (note 2)	2,041,936	-
	(18,364,460)	(21,749,064)
Capital, beginning of year		
As previously stated	81,991,934	104,137,305
Change in accounting policy	-	(396,307)
As restated	81,991,934	103,740,998
Capital, end of year	$ 63,627,474	$ 81,991,934

Summarized Statement of Changes in Capital
Year Ended March 31

	2009				2008
	Invested in property and equipment	Restricted for Approved Grants (Internally Restricted)	Unrestricted	Total	Total
Capital, beginning of year	$ 35,891	$ 66,620,973	$ 15,335,070	$ 81,991,934	$ 103,740,998
Deficiency of revenue over expenditures	(33,443)	(17,027,803)	(1,303,214)	(18,364,460)	(21,749,064)
Purchase of property and equipment	6,712	-	(6,712)	-	-
Transfer (note 2)	-	4,001,044	(4,001,044)	-	-
Capital, end of year	$ 9,160	$ 53,594,214	$ 10,024,100	$ 63,627,474	$ 81,991,934

Summarized Notes to Financial Statements – Year Ended March 31, 2009

1. Purpose and creation

Ontario Innovation Trust (the "Trust"), an inter-vivos trust, was created on March 31, 1999. The Trust was sponsored by the Government of Ontario, Ministry of Energy, Science and Technology. However, as part of the terms of the Trust agreement, the Government of Ontario is precluded from amending the agreement or exercising control over the Trust. The object of the Trust is to grant funding for qualifying projects that increase the capacity to conduct important, high quality research in Ontario. Eligible recipients are Ontario hospitals, universities, community colleges, and non-profit organizations that carry on (or in the opinion of the Board of Directors (the "Board") are capable of carrying on) research.

As at March 31, 2004, management determined that the sponsor did not intend to provide future funds. Since then, new projects have been approved to the extent that they can be funded by residual unrestricted capital.

By virtue of the Trust agreement, the Trust was to cease to exist by its tenth anniversary, March 31, 2009. However, in order to facilitate an orderly wind-up, during the year the Board approved amendments to the Trust agreement, extending the termination date to March 31, 2011. No further viable activity is to be completed subsequent to March 31, 2009 and subsequent activities of the Board are limited to fiduciary responsibilities.

Management and the Board are currently assessing issues related to an orderly discontinuance of operations, including monitoring of conditions attached to project disbursements and the distribution of residual capital.

The Trust retains sufficient operating funds for the period in which it is responsible for overseeing the projects in progress.

Notwithstanding the expected discontinuance of operations after March 31, 2011, the Trust has continued to use generally accepted accounting principles applicable to a going concern. Management believes that the asset carrying values are realizable. Costs associated with the wind-down of the Trust will be recognized at March 31, 2011.

2. Final Projects

During the year, $5,500,000 was approved for commitment to various final projects. This amount was funded by $1,498,956 of capital previously restricted for approved projects, which were finalized at less than the approved amount, and a transfer of $4,001,044 from unrestricted capital.

Compensation Disclosure

In accordance with the Public Sector Salaries Disclosure Act, all salaries in excess of $100,000 are reported to the Province of Ontario and are as follows:

	2009	2008
David Bogart	$ 156,250	$ 150,000

Included with consulting and management services expenses are payments in the amount of $174,812 (2008 – $172,990) made on a purchase of services basis to Knox Innovations for the services of Kenneth W. Knox as President and CEO of the Trust.

ABOUT THIS REPORT

This final report covers the financial position of the Ontario Innovation Trust up to March 31, 2009, with a sampling of its activities for the entire period of its operation.

The Ontario Innovation Trust was created by the Government of Ontario to invest in research equipment and facilities at Ontario's universities, colleges, research hospitals and other non-profit research institutions. The Trust is governed by an independent Board of Directors, according to the terms of a Trust agreement established by the Ontario government. A small professional staff administers the program.

HIGHLIGHTS AT A GLANCE

Ontario Innovation Trust Investment	$848.6 million
Investment from other sources	$1,598.9 million
Total Value of Infrastructure Investment	$2.45 billion
Number of Projects funded by the Ontario Innovation Trust	1,253
Private and Public Sector Partners involved	1,000+
Universities involved	18
Community Colleges involved	15
Research Hospitals and Health Science Research Institutions involved	11
Other Research Institutions involved	2

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