

# IQ

INNOVATION QUEST

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McMaster University's Research Newsmagazine



## Home and away

IN THIS ISSUE: McMaster's research on the global stage



## Welcome

Welcome to 2012 and welcome back to IQ. This year, McMaster turns 125 and what an incredible decade-and-a-quarter it's been. Over those years, we've earned a solid reputation as a global leader in both teaching and research. We've moved cities, grown in size and stature, and taken our rightful place as one of Canada's leading research-intensive universities.

Our campus has grown in step with our status and we're now home to more than 70 research centres and institutes and some of the world's most state-of-the-art laboratories. Our faculty – numbering some 1,300 – brought in more than \$395 million in research income over the last academic year. And, they are engaged in research that not only spans the disciplines but, in many cases, spans the globe.

In the pages that follow, you'll get a glimpse into the kinds of work in which they're involved. From Brazil to China to India to Asia to Britain to the USA, McMaster's research is having a global impact. Indeed, our researchers are making a difference both home and away. ■



### Mo Elbestawi

Vice-President, Research & International Affairs

■ On the cover: Canada Research Chair in Ethnic Diversity and Cardiovascular Disease, Dr. Sonia Anand, who also holds the Michael G. DeGroot Heart and Stroke Chair in Population Health and Epidemiology and the Eli Lilly Canada-May Cohen Chair in Women's Health.

## INQUIRE

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**Editor** Lori Dillon

**Contributors** Danelle D'Alvise, Suzanne Morrison

**Design** Nadia DiTraglia

**Photography** Ron Scheffler

Please forward inquiries to:

IQ

Office of the Vice-President (Research & International Affairs)  
Gilmour Hall 208, McMaster University, 1280 Main Street West  
Hamilton ON CANADA L8S 4L8

(905) 525-9140 ext. 27002 | [iq@mcmaster.ca](mailto:iq@mcmaster.ca) | [mcmaster.ca/research](http://mcmaster.ca/research)

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Celebrating 125 years

# McMaster welcomes the world to Hamilton R&D Forum



■ Pictured above: (from left to right) The Honourable Kevin Lynch, McMaster alumnus and vice-chair of BMO Financial Group, Subhasis Chaudhuri, dean of international relations, Indian Institute of Technology (Bombay), Arun Chockalingham, director of global health, National Institutes of Health, William Kupferschmidt, vice-president and GM of R&D, Atomic Energy of Canada Limited, Michael Bowman, chair and president Delaware Technology Park, and Wenjun Zhang, vice-president, Shanghai Jiao Tong University, kick off the two-day forum with the opening session, "Collaboration in International R&D: The Big Picture." Photo: Ron Scheffler.

**For two days last September**, high-profile decisions-makers from around the world came to Hamilton to discuss international collaboration in research and development.

In total, some 200 delegates from 11 countries, including Canada, the US, China, India, France, Germany, Austria, Brazil, Britain, Chile and Saudi Arabia responded to McMaster's invitation to collectively address the role of university research in a globalized economy.

The International Forum on R&D: The Role of Research Intensive Universities was held September 11 & 12 at Liuna Station. The forum – the first event of its kind to be organized by a Canadian university – brought together academic, business and government leaders to discuss the impact and potential of research partnerships in a global context.

Co-chaired by Mo Elbestawi, vice-president of research and international affairs, and Luke Chan, associate vice-president of international affairs, the forum's objectives were to explore the role of universities and other stakeholders in governments, businesses and NGOs in the context of R&D; to

stimulate the creation of new R&D clusters; to identify best practices for fostering R&D in a global economy; and to influence public policy.

"Research universities must position themselves to seize the opportunities and respond to the challenges related to internationalization and globalization," says Elbestawi. They must increase their market share of international R&D projects, to promote economic development and to help their countries meet their human resource needs in a knowledge-based society."

■ Former Prime Minister, The Right Honourable Paul Martin (middle) – flanked by Patrick Deane, McMaster's president and vice-chancellor (left) and Lynton 'Red' Wilson, McMaster's chancellor-- makes his point during an engaging discussion about Canada's role in global R&D activities. Some 200 guests, representing nearly a dozen countries, attended the two-day Forum. Photo: Ron Scheffler.

Putting research to work to benefit economic and social well-being, has been the foundation of McMaster's research enterprise. According to Elbestawi, locally, provincially and even nationally, McMaster has had success, but the opportunities are limitless with a globalized economy.

"We have successes we can point to domestically, but there are many more opportunities available to us – both in terms of marketing our R&D internationally and in using our knowledge to help solve global issues which affect us all." ■



# IQ research feature — Research without borders



■ McMaster's Chris Wood and Adalto Bianchini of the Federal University of Rio Grande in southern Brazil, are working together to battle the increasing pollution in that country's coastal areas. Photo: Tony Foughse.

**McMaster has a long tradition** of research collaborations that span the globe. The world's rivers, lakes and estuaries have become our living laboratories and the health concerns of developing countries have become challenges met with the creation and application of our research knowledge.

In 2009, two of McMaster's Canada Research Chairs, Chris Wood and John Lavis, were selected to undertake research projects partnered with counterparts in developing countries to tackle the issues of remediating and managing polluted ecosystems and turning health research into policies that will improve lives the world over. Their expertise was recognized by the International Research Chairs Initiative (IRCI), a leading-edge program that is sponsored by Canada's International Development Research Centre (IDRC) in collaboration with the Canada Research Chairs Program.

Biologist Chris Wood, Canada Research Chair in Environment and Health, is paired with Adalto Bianchini of Brazil to battle the increasing pollution in that country's coastal areas. Wood and Bianchini have focussed on two bodies of water that are severely threatened by

both population and industrial growth – the Patos Lagoon and Amazon estuaries. They have been assessing the extent of the pollution, the major causes, and the best strategy to manage and remediate these environments. From what they've learned at the Brazil site, they will determine what is transferable to the Hamilton Harbour cleanup in terms of both monitoring techniques and getting the 'buy-in' of stakeholders.

"it took years to degrade these environments in both Brazil and Hamilton and we have only five years to work on management and remediation strategies, the key here is student training and capacity building."

– Chris Wood

Bianchini, the Industrial Research Chair in Environmental Health and Management, first worked with Woods

in 2000 when he spent a 13-month sabbatical visit in Wood's McMaster lab. Their project utilizes their respective research strengths in biomarker analyses, toxicology and metal contamination, a collaboration that Woods acknowledges is unique, "both in terms of hard science and environmental management and in the complementarities of our expertise".

The International Research Chairs Initiative also provides university students with unique training and fieldwork opportunities under the mentorship of the chairholders. Over the five years, eight Brazilian trainees will visit McMaster for up to 12 months and five Canadian trainees will visit the Federal University of Rio Grande in southern Brazil for up to six months. This intense, ongoing exchange of Highly Qualified Personnel (HQP) significantly increases the research capability of the group and enriches the project's academic collaboration for research and education.

The team will receive up to \$1 million over five years to address the key development challenge of advancing alternative approaches to guide industrial regulation, settlement and urban policies. While it's a relatively short time frame, given the extent of their research program, Wood notes that "it took years to degrade these environments in both Brazil and Hamilton and we have only five years to work on management and remediation strategies, the key here is student training and capacity building. These HQP can continue the process long after the program is over."

Education and capacity building is also at the core of the partnership between McMaster University and Makerere University. Dr. John Lavis, a professor in the department of clinical epidemiology & biostatistics, was the Canada Research Chair in Knowledge Transfer and Exchange when he partnered with Dr. Nelson Sewankambo, the Principal

# Researchers partner to tackle international issues

of the College of Health Sciences at Makerere University for a 41-country study of knowledge-translation platforms in low-and-middle-income countries.

Their project – also funded for \$1 million over five years – includes a student exchange that has featured a number of short two-to-five day courses in Africa for students involved in the partnership. Research meetings have also provided the opportunity to build relationships with members of the team from the ten participating African countries, and laid the groundwork for their field experience in these countries.

As the IDRC Research Chair in Evidence-Informed Health Policies and Systems, Sewankambo's research collaboration with Lavis will tackle the challenge of how to turn health research into policy by evaluating the knowledge-translation (KT) platforms that have been launched by the World Health Organization (WHO) in 10 African countries. Sewankambo is recognized as a global leader in the fight against HIV/AIDS in Africa and was one of the first scientists to publish data on AIDS in Africa. He is well acquainted with McMaster, having completed his MSc in clinical epidemiology here in 1989, returning to receive an honorary doctorate of laws from the University in 2007.

Translating health research into action can mean the difference between good or bad health, but in Africa, the situation becomes particularly dire where 'health' often becomes an issue of life or death. Child survival rates, women continuing to die during pregnancy and child birth, deaths from AIDS continuing to rise – these and other health issues have very real barriers to overcome. While the conversion of research knowledge to policy has bolstered the effectiveness of health systems in countries such as Canada, the policymakers and stakeholders in the developing world may not value research evidence, or



■ McMaster's John Lavis and Nelson Sewankambo of Makerere University in Africa, are building education and capacity with their 41-country study of knowledge-translation platforms in low- and middle-income countries. Photo: Tony Fouhse.

find it relevant to the issues they face in their country or simply find the statistics, reports and data too difficult to use.

The WHO knowledge transfer platforms are experimenting with efforts to address these challenges. The objective of Lavis' research program is to evaluate the WHO-sponsored platforms to facilitate knowledge translation for the improved health in each of the 10 countries.

“once in a lifetime opportunity to learn in real time how to support evidence-informed health policies and systems.”

– John Lavis

“Whether it's addressing the adherence to tuberculosis medications in Cameroon or the implications of male circumcision in Kenya as an HIV prevention strategy, we hope to address the top concerns in each of the ten countries,” says Lavis, who, up until this IRCI award has

worked with turning research evidence into national policymaking for a single country at a time.

Lavis describes the International Chairs as an initiative that has provided him with a “once in a lifetime opportunity to learn in real time how to support evidence-informed health policies and systems,” and notes that the IRCI will be a catalyst for innovation through the next generation of scholars that will benefit from the research partnership. Students from Canada will have the opportunity to do their field work in Africa, while students from Africa will be trained in their second year at McMaster.

A total of eight research collaborations were funded by the International Research Chairs Initiative (IRCI) after a rigorous selection process that saw 104 teams from across Canada submit proposals. McMaster was the only university to be funded for two projects.

“The partnership between IDRC and the Canada Research Chairs Program is a distinctly Canadian international initiative that brings the power of science and technology to bear on problems in the developing world, while creating unique research opportunities for Canadians,” said IDRC president David Malone. ■

# IQ research feature — a head “START”



■ Canada Research Chair in Ethnic Diversity and Cardiovascular Disease, Dr. Sonia Anand

**Type 2 diabetes affects** 80 million people in India. In Canada, diabetes and early heart disease are found among increasing numbers of South Asians who have migrated here.

Why South Asians originally from India, Pakistan, Sri Lanka and Bangladesh face this increased risk is a mystery being investigated by Dr. Sonia Anand, professor of medicine and epidemiology in the Michael G. DeGroote School of Medicine at McMaster University and Canada Research Chair in Ethnic Diversity and Cardiovascular Disease.

Anand and her colleague, cardiologist Dr. Milan Gupta, are working with collaborators in Canada and the St. John Research Institute in Bangalore, India in a novel research study which is



Milan Gupta

designed to determine how maternal health behaviours, genetic and other in utero exposures in South Asians may contribute later in life to the development of Type 2 diabetes and heart disease.

The START (SouTh Asian birth cohoRT) study is funded by the Canadian Institute of Health Research (CIHR), the India Council of Medical Research and the Heart and Stroke Foundation of Ontario.

The study involves two birth cohorts - South Asians in Southern Ontario and another in urban and rural India. (Dr. Anand has applied for funding

to create an additional cohort among Aboriginal mothers and newborns from the Six Nations reserve in Ontario).

For three years, 1,000 pregnant women of South Asian origin, 18-40 years of age, in Ontario will be followed, along with their newborns. During their pregnancy, the mothers will undergo extensive assessments, ranging from having their blood sugar tested, height and weight recorded to having their diets and physical activity evaluated. As soon as they deliver their baby, the infant will undergo extensive screening. Cord blood will be collected to test blood sugar, insulin and genetic factors, along with birth weight and fat.

Researchers, mothers and their babies will meet once a year. In between, they will be in contact by telephone or computer.

“The study is designed to find out why central adiposity and diabetes are so prevalent among the South Asian population,” said Anand. “If we can identify factors in utero, or during the early years, we will be in a better position to prevent diabetes in individuals as they age.”

Anand holds the Eli Lilly Canada-May Cohen Chair in Women’s Health and the Heart and Stroke Foundation of Ontario-Michael G. DeGroote Chair in Population Health Research. She is a joint member of the department of clinical epidemiology and biostatistics where she directs the population genomics program and is a scientist at the Population Health Research Institute (PHRI).

As a research scientist, her focus is on understanding the environmental and genetic causes of early cardiovascular risk factors, including type 2 diabetes and cardiovascular disease among high risk, diverse ethnic groups.

In a study published last year in the medical journal PLoS ONE, Anand and her McMaster collaborators found that some ethnic groups are more likely to be adding dangerous fat onto their internal organs

# on solving some medical mysteries

like their liver when they gain weight, while others just add it to their waistline.

In particular, said Anand, South Asians are more likely to add the type of organ-hugging fat that can lead to diabetes and coronary artery disease, as they have less space to store fat below the skin than white Caucasians and that the excess fat, therefore, overflows to ectopic compartments, in the abdomen and liver where it may affect function.

“If we can identify factors in utero, or during the early years, we will be in a better position to prevent diabetes in individuals as they age”

– Sonia Anand

More recently, in collaboration with researchers at McGill University, her research conducted at the PHRI received international attention with a study published in the journal *PLoS Medicine* which showed a diet high in fruits and vegetables appears to lessen the genetic risk of the 9p21 gene on heart disease.

The research, which represents one of the largest gene-diet interaction studies ever conducted on cardiovascular disease, involved the analysis of more than 8,000 individuals from five ethnicities – European, South Asian, Chinese, Latin American and Arab – and the effect that their diets had on the 9p21 gene.

The results suggested that individuals with the high risk genotype who consumed a prudent diet, composed mainly of raw vegetables, fruits and berries, had a similar risk of heart attack to those with the low risk genotype.

“We observed that the effect of a high risk genotype can be mitigated

by consuming a diet high in fruits and vegetables,” said Anand, joint principal investigator of the study.

She added that this finding fits well with public health recommendations to eat five or more servings of fruits and vegetables a day. “Genetic information may be a motivation to help people take the public health recommendation seriously.”

Experts, such as Dr. William O’Neill, cardiology professor and executive dean of clinical affairs at the University of Miami’s Miller School of Medicine, suggested this research points the way toward the future in terms of understanding the genetics of heart disease.

With this unique finding, Anand is now conducting the population-based SAHARA (South Asian Heart Risk Assessment) study to determine if knowing about this gene motivates individuals at risk of a heart attack to change their habits.

The study, funded by the Heart and Stroke Foundation of Ontario is the first in Canada designed to help South Asians lower their risk of heart disease. It will screen 1,000 South Asians in the Greater Toronto area to determine their risk for heart disease and diabetes.

Using e-mail and other multimedia devices, such as smartphones and cell phones, researchers will test the effectiveness of culturally tailored multi-media based intervention that provides health messages and feedback to help participants reduce their risk factors over a six month period. An assessment after six months will reveal if there have been any changes in an individual’s heart disease risk profile.

Participants receive a personal heart disease risk report and, if randomly selected, the opportunity to participate in an online goals setting program. ■

## FACTS & FIGURES

### Population Health Research Institute

**Founded:**

1999 as a joint institute between Hamilton Health Sciences and McMaster University. It is now the largest and most cited academic cardiovascular research group in Canada.

**People:**

More than 250 researchers, physicians, scientists, epidemiologists, biostatisticians, rehabilitation experts, nutrition scientists, research coordinators, allied health professionals, and quality assurance personnel.

**Impact:**

PHRI has conducted more than 80 global trials and epidemiological studies in more than 1500 centres in 83 countries, involving over 750,000 patients.

**Reach:**

PHRI works with a global team of collaborators with researchers in North America, Africa, Asia Pacific, Europe, Middle East, Latin/South America.

**Publications:**

More than 1,300 publications in the last 10 years, in many prestigious medical journals such as *The New England Journal of Medicine*, *Lancet*, the *Journal of the American Medical Association*, *British Medical Journal*, *Circulation*, *Journal of the American College of Cardiology* and the *European Heart Journal*. Several of the discoveries made by scientists at the PHRI have influenced prevention and treatment practices worldwide.

**Citations:**

PHRI publications have been cited over 20,000 times in peer-reviewed literature.

# IQ faculty feature

## MARK LOEB Genetic detectives investigate dengue virus



**Dr. Mark Loeb** leads an international group of sleuths who are determined to find out why the dengue virus is so lethal for some people and has little, or no effect at all, on others.

Looking for clues to solve this puzzle, their genetic detective work is underway in universities around the world, extending from McMaster University in Canada to the United States, Nicaragua, Honduras, Mexico, Vietnam, Thailand, Sri Lanka, Columbia and Burma.

With Loeb at the helm, researchers are an extensive community of tightly-knit investigators who are in constant contact with each other. “The good thing about this is that everybody seems to know each other because they are all investigators in dengue so they share the same problems,” said Loeb, an internationally respected microbiologist.

This makes it easier for everyone, he said, because everyone always attends the same meetings. “We don’t have to arrange separate meeting for everybody because we just show up and everybody is there,” he said, adding this happened again recently when all the researchers showed up in Pennsylvania for the annual meeting of the American Society for Tropical Medicine.

Dengue virus is the source of a huge global health burden. Over two-fifths of the world’s population – 2.5 billion people – are at risk of dengue. Endemic in more than 110 countries, incidence of the virus has increased 30 fold in the last 50 years. Gradually, it’s creeping into North America.

Loeb’s dengue research is supported by \$10 million in funding from the National Institutes of Health (NIH)

in the United States. He is partnered with the International Vaccine Institute headquartered in Seoul, Korea, an organization exclusively devoted to vaccine research and development for people in developing countries, especially children, and the Dengue Vaccine Initiative (DVI), funded by the Bill and Melinda Gates Foundation.

Loeb’s genetic association study on the dengue virus is looking to discover genetic variations that expose individuals, especially children, to severe complications. He is gathering samples of blood and DNA from 8,000 individuals around the world. The genome of each sample will be looked at to find out which genetic variations are most important for exposure.

The hope is to find out what is going wrong with the immune system, a discovery that could lead to new drug and vaccine development. Sample collection and clinical information is ongoing with gene typing possibly starting by the end of 2012.

Loeb believes there must be some genetic predisposition in an individual’s genetic make-up that makes them more susceptible to severe complications.

A professor in the McMaster’s Department of Pathology and Molecular Medicine and Division Director of Infectious Diseases in the Department of Medicine, Loeb is the first holder of the Michael G. DeGroot Chair in Infectious Diseases.

As an infectious diseases physician and epidemiologist, Loeb has spent his career searching out the causes of infectious diseases and finding better ways to manage them. As well as dengue, his broad research interests focus on epidemiologic and genomic population-based studies of the West Nile Virus, influenza, antibiotics use and resistance, and understanding respiratory infections

in elderly nursing home residents.

Canadians For Health Research, a national not-for-profit organization, has called Loeb a “crusader” for his work in advancing Canadians understanding of health research and its impact on their lives.

When SARS (severe acute respiratory syndrome) broke out in 2003, Loeb became recognized internationally as a respected expert in infectious disease epidemiology. At that time, he became founding scientific director of the Canadian SARS Research Network and led the creation of a blood bank of specimens from people who contracted SARS. This global initiative allows researchers around the world to access specimens so that they can pursue their own study of the disease.

After the West Nile Virus emerged as a significant public health threat in 1999, Loeb led a major five-year study looking into why some people who contract the disease develop serious complications, while others seem to shrug it off.

Funded by a \$19 million grant from the U.S. National Institutes of Health, Loeb worked with researchers, doctors and public health officials during the case control study which involved patients from Ontario, Alberta, Saskatchewan and across the United States.

Loeb is wrapping up studies investigating the effects of the influenza vaccine on infection rates among children living in isolated Hutterite communities in Western Canada. Years of data analysis are ahead with the hope of discovering genetic variants which lead to a good, or poor, response to the vaccine. Loeb and his research team received \$1.6 million to carry out the research from the Rx&D Health Research Foundation (HRF), the Canadian Institutes of Health Research (CIHR) and the Canadian Food Inspection Agency (CFIA). ■

# IQ faculty feature

## CARMEL MOTHERSILL Research team sifts through data

**Kerala, situated in the lush tropical coastal region** of southern India, is truly paradise on earth and promoted as one of the must-see destinations of a lifetime by tourist advisories.

The region has another face, one that radiobiologist Carmel Mothersill is investigating: Black sand on Kerala's beaches contain radioactive minerals. They have the highest level of natural radioactivity in a densely populated area anywhere in the world.

Mothersill is concerned about the effect this may be having on families who live in scrap huts on the beaches. Most men spend their lives away on the sea fishing, leaving women to generate extra income by undertaking beach sand mining, sifting the sand looking for semi-precious stones. "Because the beaches are highly radioactive due to thorium in the sand, there is quite a concern about its health effects on these people," said Mothersill, professor of medical physics and applied radiation sciences and Canada Research Chair in Radiobiology.

As well, the Canadian power generation industry has a major interest in beach sand mining because of thorium which is extracted from Monazite in India's east and south coasts and is currently treated as tailings. The reason for their interest: the Canadian designed CANDU reactor can run on thorium, as well as uranium, but thorium has the advantage of not producing neutrons.

With funding from the Shastri Indo-Canadian Institute, Mothersill pulled together a team of researchers from Canada and India who are assessing environmental quality, ecosystem health, human health and social/psychological well-being in the Kerala beaches.

"Last year, we drew up a health questionnaire about their diets, smoking habits, health status, numbers in their family and where they live," said



■ Carmel Mothersill, right, and research collaborator Mary Mohan Kumar, scientific officer at the India Gandhi Centre for Atomic Research

Mothersill. The survey was distributed to residents through local churches.

In January, Mothersill returned to India to check up on the results of the survey, accompanied by her husband, Colin Seymour, a professor of medical physics and applied radiation science and NSERC Industrial Research Chair on the Effects of Ionizing Radiation on Non-Human Biota.

The current project is an extension of research the couple has been undertaking on the effects of low dose radiation since the late 1970s, first in Ireland, then in Canada after both were awarded research chairs.

A snapshot of the research partnership:

- First-hand information from workers engaged in beach sand mining about income, safety methods and health status are being obtained McMaster's John Eyles, professor of Geography and Earth Sciences, and Mary Mohan Kumar, scientific officer at the India Gandhi Centre for Atomic Research.
- Cancer incidence and other ailments in the region are being compared with low background areas using data from a cancer registry kept in Kanyakumari district.
- The impact of ionizing radiation on fish, amphibians and small rodents as well as the effect of beach sand mining on fertility and reproductive rates among various species are being investigated
- Human and aquatic biomarker assays

are being conducted at the Scott Christian College in Nagercoil.

- Two McMaster students are working on the alpha radiation research, while students from India have been invited to McMaster to train in sensitive biomonitoring assays.

By April, Mothersill will be co-ordinating collected data and writing a report on the project. "I hope it will show that there is no serious health impact of doing this kind of work. It will also become a baseline survey of radiation levels in plants and animals."

Ultimately, she hopes the project will result in useful data on the scientific, occupational and societal impact of beach sand mining.

Concerned about transparency, Mothersill plans to make sure all stakeholders are aware of the impact this mining has on all other groups while leaving trained local residents who will continue to monitor conditions using a surveillance system established during the project.

Ultimately, the plan is to leave in place a stakeholder-driven monitoring and surveillance system that can chart consequences and impacts. "We will set up a sustainable watch system with easy to use tools that can be used by local high school students to enhance local interest and capacity," she said. ■

# IQ faculty feature

## RAY LaPIERRE Nano structures offer enormous potential



Ray LaPierre

**As researchers,** their partnership extends from Canada to Argentina, Brazil and China. And it all began several years ago at McMaster University.

Their focus is nanowires, tiny hair-like structures which have enormous potential to harness energy from the sun that can be converted into low-cost solar electricity.

Ray LaPierre, associate professor of engineering physics, recalls how this broad international partnership began while he was a PhD student and he met then post-doctoral student, David Comedi. Comedi is now a professor of physics at Tucuman University in Argentina and after completing his studies he later returned to McMaster as a visiting scientist. "I was growing nanowires at that time and when he returned to Argentina we continued collaborating," LaPierre said.

Comedi was already collaborating with Yuri Pusep, professor of physics in the material sciences department at the University of Sao Paulo in Brazil. The three scientists started working together and applied to the Natural Sciences and Engineering Research Council of Canada (NSERC) for funding to study nanowires. "Our collaboration has been going on ever since," said LaPierre.

Canadian-born Jian-Jun He, professor of optical engineering at Zhejiang University in China, met LaPierre while visiting McMaster and joined the collaboration.

The international collaboration initially grew out of LaPierre's success in growing light-absorbing nanowires. His research primarily focuses in characterizing and understanding the mechanisms involved during the gold-catalyzed growth of III-V nanowire. The work is intended to expand the field.

Nanowire research can be traced back to the 1950s and has gained in importance in the last decade as scientists work to create solar electricity using nanowires.

LaPierre's research team has received significant funding from NSERC, the Ontario Centres of Excellence and Cleanfield Energy, an Ancaster developer of renewable energy technologies. The money is being used for an initiative that is aimed at creating high-efficiency solar cells that are flexible and easy to mass manufacture.

Nanowires made from silicon or more exotic compounds like gallium-arsenide are excellent at trapping light. When densely packed together, they offer more surface area than conventional cells for absorbing the sun's energy. The thinness of each nanowire also makes it easier to collect the electrons knocked loose by the sun's photons, allowing for greater

electrical output per square centimeter of a solar cell.

LaPierre said that using nanowires means using less material which reduces costs.

Nanowires are grown by planting tiny balls of gold or aluminum on a surface that is exposed to gallium and arsenide gases. The gas atoms are sucked up by the gold to form a layer. As each layer is added, the nanowire begins to sprout. The process is repeated until a desired length and thickness is reached.

LaPierre's team has been exploring different ways of growing nanowires on a variety of surfaces or "substrates" that include silicon, glass, flexible metal foils and high-tech fabric made of carbon nanotubes. They have also been looking at ways of harvesting nanowires that are grown and scraped from one material and later embedded in flexible plastics.

LaPierre's main interest is in fundamental materials and growing these material structures and "solar electricity is just one application that I'm interested in."

He doesn't believe solar energy is in competition with wind power or nuclear energy. "In my opinion, we need all these technologies because of population growth, the need to mitigate climate change, and the increased need for energy for developing nations." ■

## HENDRIK POINAR Black Death mystery solved



Hendrik Poinar

**The Black Death** swept across Europe in **1346** killing an estimated **30-50 million people** – an astounding **30-50%** of the population plagued by an unknown pathogen. Using the skeletal remains from a London graveyard, Hendrik Poinar and his collaborative **16-member research team** from **Germany, USA and Canada**, unlocked the mystery of the Black Death – the "grandfather" of today's modern plague strains. Some **7 centuries** after the devastation, they identified the bacteria responsible for the deadly pandemic and reassembled its entire genome – the **first** ancient pathogen genome to date. Their research grabbed the attention of **hundreds** of media outlets worldwide. ■

# IQ faculty feature

## GRAHAMSCOTT Research by water and air



Graham Scott

**Geese that can fly** at altitudes that would make humans ill and fish that can survive the wild fluctuations in temperature that sometimes plague our Great Lakes. How have

these creatures adapted – and flourished – while living in extreme environments?

Evolutionary biologist Graham Scott is fascinated by species whose physiological capabilities are seemingly pushed to their limits. The bar-headed goose is one such super bird – an elite marathoner in the skies whose migration route takes it over the Himalayas, cruising at heights between 5,000 to 6,000 metres, some soaring almost as high as airplanes at 9,000 metres.

Not only do these geese climb from sea level to elevations that might render

a human comatose, they do so quickly, crossing the Himalayas in a matter of seven to eight hours. Scott's research – in collaboration with scientists from the University of Birmingham's Centre for Cardiovascular Sciences in the U.K. – revealed how the geese cope with roughly 25% of the oxygen available at sea level and sustain their oxygen consumption to fuel their constantly flapping wings.

“Not surprisingly, bar-headed geese do have big lungs, but they also have flight muscle with more capillaries. Within these muscle cells they have more mitochondria – which process oxygen – that are nearer to the cell membrane, which means that oxygen exchange is more speedy and efficient,” explains Scott.

By discovering these unique physiological adaptations at the molecular level, Scott and his colleagues have

solved how and why the bar-headed goose is such an aerobic superstar. What they've learned can be used to develop new treatments for humans who have problems arising from oxygen limitations, such as heart attacks and strokes.

Scott's also investigating the fish that live and breed in Canada's aquatic habitats, providing valuable scientific information as to what happens within the lifetime of individual fish when water temperatures rise or fall suddenly, or when there is less oxygen for them to breathe.

“A richer appreciation of how species from different habitats and environments adapt mechanistically and physiologically to how their world – and ours – is changing, can eventually be used to inform policy makers on how to maintain a natural, healthy environment with global climate change.” ■

## MICHELEMORRONE An exchange of ideas



Michele Morrone

**Described as the gold standard** in academic exchange and a leader in public diplomacy, the Fulbright international program was first authorized by President Harry

Truman in honour of Senator J. William Fulbright, who hoped that the program would bring “a little more knowledge, a little more reason, and a little more compassion into world affairs.”

The Foundation for Educational Exchange – Fulbright Canada – was established in 1990 to enhance mutual understanding between the people of Canada and the United States, offering exchange programs for students, scholars and independent researchers, including the Fulbright Visiting Research Chair

program. McMaster boasts three Fulbright Visiting Research Chairs: Science & the Environment, Globalization & Cultural Studies, and Governance & Public Policy.

Last fall, Christopher Breu, an associate professor of English from Illinois State University, came to McMaster as the Fulbright Visiting Research Chair in Globalization and Cultural Studies. He worked with colleagues from McMaster's Institute on Globalization and the Human Condition, shared his own unique perspective on biopolitics and completed his book *The Insistence of the Material: Literature in the Age of Biopolitics*. He says his Canadian experience “helped to shape and inform” his book and “helped to give it more of a global perspective.”

January 2012 brings Michele Morrone to McMaster as the Fulbright Visiting Research Chair in Science and the Environment.

The Director of Environmental Studies at Ohio University will teach an undergraduate course in the health impact of global climate change, survey McMaster's undergraduates to measure their environmental literacy and implement workshops for faculty to discuss ways to integrate environmental sustainability in the curriculum in all disciplines.

The recently granted Chair in Governance and Public Policy will focus on public policy formation and implementation in a globalized world.

“These chairs attract individuals of achievement and potential who strengthen bi-national collaborative research and share issues of importance to both countries, enriching the higher global education and research landscape for our students and faculty,” says Mo Elbestawi, vice-president of research. ■



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