2003 NSERC Prize Winners

The winners of the 2003 NSERC prizes were announced in March by Allan Rock, Minister of Industry and Minister responsible for NSERC, Rey Pagtakhan, Secretary of State (Science, Research and Development), and Tom Brzustowski, President of NSERC.

The NSERC E.W.R. Steacie Memorial Fellowships, Doctoral Prizes, and Howard Alper Postdoctoral Prize, which are among Canada's most important research prizes, will be presented at a ceremony later this year during which the winner of the Gerhard Herzberg Canada Gold Medal for Science and Engineering will also be honoured.

For additional information on the winners, visit www.nserc.ca, and on the prizes, visit www.nserc.ca/fact_e.ca.

2003 NSERC Steacie Fellows

Dr. Michel Gingras
University of Waterloo
Frustrated Magnets

Dr. Michel Gingras

Dr. Michel Gingras is at the forefront of research into frustrated magnetic systems and glasses, classes of materials in which the atoms in the solid state are randomly arranged.

These disordered systems are important in the study of high-temperature superconductivity, and in the creation of longer-life batteries and so-called ferromagnetic semiconductors, a class of materials in which the magnetic moments can be used to carry information in electronic devices.

The new Steacie Fellow will explore the role of quantum mechanics in these disordered systems.

Dr. Zongchao Jia
Queen's University
Protein X-ray Crystallography

Dr. Jia's lab is a leader in the use of x-ray crystallography to deduce protein structure.

His lab has led the way in the structural study of anti-freeze proteins, identifying the structures of four such proteins, including one in fish and the first ever in an insect.

Dr. Zongchao Jia

In 1999, Dr. Jia's lab won a heated international race to determine the structure of calpain, a calcium-regulated protein that plays a role in diseases from Alzheimer's to Muscular Dystrophy and in heart attacks.

As a Steacie Fellow, Dr. Jia will study phosphorylation proteins that are involved in cellular function, and phytase, an enzyme that liberates the nutrient phosphorus stored in plant seeds.

Dr. Gary Saunders

Dr. Victoria Kaspi

Dr. Victoria Kaspi
McGill University
Neutron Stars

Dr. Kaspi's research team is using the world's most advanced satellite-based x-ray telescopes, including NASA's $1-billion Chandra X-Ray Observatory, as well as the largest Earth-based radio telescopes to locate and study the behaviour of neutron stars.

It's research that provides a unique window on the physics of matter under extreme conditions. Neutron stars are the visible close cousins of black holes.

In the September 12, 2002, issue of *Nature*, her group reported the first observations of distinctive bursts of x-rays from so-called anomalous x-ray pulsars, thereby proving that these stellar remnants are a class of neutron stars called magnetars.

As a Steacie Fellow, Dr. Kaspi will be scanning the Milky Way for as yet undiscovered millisecond pulsars in order to determine their maximum spin speeds.

Dr. Gary Saunders
University of New Brunswick
Algal Systematics

Dr. Saunders' research of the past decade has pioneered the use of new genetic analyses to reinterpret the evolutionary history and familial relationships of red algae, and several other algal groups. The research has demonstrated that, contrary to previous thinking, some of the simplest red algae are the most recently evolved.

The economically important polysaccharides found in red algae are used to produce the emulsifiers and thickeners in products ranging from ice cream (carrageen) to cosmetics.

Dr. Saunders' lab will be looking for new genetic markers to further their ongoing gene-based reassessment of red algal systematics and link red algal genetics to these organisms' enormous range of reproductive strategies.

Dr. Molly Shoichet
University of Toronto
Tissue Engineering

Dr. Shoichet, an expert in the creation and modification of polymers, is a world leader in the application of tissue engineering to spinal cord regeneration.

Her lab has designed specialized tiny tubes that mimic the structure and feel of spinal cord tissue. Her experiments have also shown that spinal cord nerve cell regeneration is in part guided by specific concentration gradients of chemicals in the tissue.

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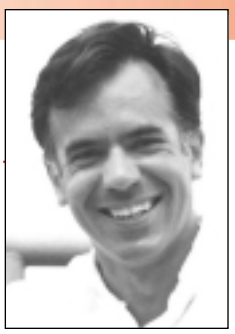

Dr. Kim Vicente

Yanka & Yolanda Van der Kolk, Toronto

Dr. Molly Shoichet

As a Steacie Fellow, Dr. Shoichet will continue her work to develop new biodegradable tissue bridges, and a less invasive way to deliver a sustained concentration gradient of neural growth factor using an injectable polymer.

Dr. Kim Vicente
University of Toronto
Cognitive Engineering

Dr. Vicente is a leading player in the rapidly growing field of cognitive engineering. In 1988, he coined the term ecological interface design (EID) to describe a new way of designing complex process control systems that takes into account the ways we think, perceive and behave.

His research group was the first to apply cognitive engineering principles to the redesign of a commercially available medical device, patient controlled analgesia (PCA).

With his Steacie Fellowship, Dr. Vicente will continue to explore improvements to the PCA design — a project that has become all the more important given reports of potential deaths related to the use of the device.

Recipient of the 2003 NSERC Howard Alper Postdoctoral Prize

Dr. Ryan Gregory
University of Guelph
Evolutionary Role of Genome Size

Dr. Gregory's Ph.D. work established him as a world leader in the study of the evolutionary significance of genome size diversity.

During doctoral work at the University of Guelph with Dr. Paul Hebert, Dr. Gregory drew together previously published research to compile the world's largest database of animal genome sizes. This online collection (www.genomesize.com) includes approximately 3,000 animal genomes and has become a critical resource for researchers worldwide, receiving 25–50 hits a day.

Using the database, Dr. Gregory did the first statistical analysis of large data sets of animal genome size.

At present, he's an NSERC postdoctoral fellow at the American Museum of Natural History's Comparative Genomics Institute.

2003 NSERC Doctoral Prize Winners

Dr. David Bryce
Dalhousie University
Solid-State NMR and Computational Chemistry

Dr. David Bryce's doctoral research used nuclear magnetic resonance (NMR) to characterize, for the first time, some of the 3-dimensional interactions specific to elements such as boron, chlorine and chromium.

These unique NMR data are important to materials scientists who are trying to understand the fundamental properties of molecules that contain these elements.

His innovative NMR work, with supervisor Dr. Roderick Wasylishen (now at the University of Alberta), was complicated by the fact that most of the nuclei Dr. Bryce was studying are "quadrupolar."

Dr. Bryce is presently continuing his work in developing new NMR techniques as an NSERC postdoctoral fellow at the U.S. National Institutes of Health Laboratory of Chemical Physics in Bethesda, Maryland.

Dr. Erik Demaine
University of Waterloo
Mathematics of Folding

Dr. Demaine is a prodigy in the mathematics of folding, and at 21 the youngest professor now at the Massachusetts Institute of Technology.

The University of Waterloo graduate's doctoral thesis with his supervisors Drs. Anna Lubiw and Ian Munro solved what's known as the Carpenter's Rule Problem. During his doctoral research he also created the proof for the Fold and Cut Problem.

Understanding the possibilities and limits of folding and unfolding in general is important to a wide range of applications, from sheet metal fabrication to airbag storage and bioinformatics, where the math is used to understand, and perhaps predict, how proteins fold. The Carpenter's Rule Problem also applies directly to the design of robotic arms used in industry.

Dr. Martin Dvorak
Simon Fraser University
Novel Heterojunction Bipolar Transistors

In 2001, as part of his doctoral research, Dr. Dvorak set a semiconductor speed record of 305 gigahertz, at the time the fastest bipolar transistor ever created in any semiconductor material.

Using an approach suggested by his supervisor, Dr. Colombo Bolognesi, Dr. Dvorak's speed record was based on using a semiconductor "sandwich," made up of layers of indium phosphide, gallium arsenide antimonide, and indium phosphide. These materials are particularly useful for specialized high-power and high-frequency applications where silicon-based transistors lose speed.

Dr. Dvorak is now working with California-based Agilent Technologies Inc. to commercialize similar technologies.

Dr. David Vocadlo
University of British Columbia
Catalytic Mechanisms of Glycosidases

Dr. David Vocadlo's doctoral work, with supervisor Dr. Stephen Withers, clarified the general catalytic mechanism for a key group of the enzymes called glycosidases. When we eat pasta or potatoes, certain glycosidases work on a carbohydrate such as starch by breaking the links between the many constituent sugar units that make it up, liberating them for use by our bodies.

His intensive research resulted in a 2001 *Nature* paper that revised the text book explanation for the functioning of hen egg white lysozyme, an iconic glycosidase.

Dr. Vocadlo's study of five specific glycosidases involved the use of mass spectrometry, chemical synthesis of alternative forms of carbohydrates, and X-ray crystallographic analysis (in collaboration with a British colleague) of intermediary enzyme reaction structures.

He is now a postdoctoral fellow at the University of California, Berkeley.