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inSCights

FACULTY OF SCIENCE, McMASTER UNIVERSITY


photo credit: Ron Scheffler

Dr. John Valliant and Research Associate Dr. Pat Causey use remote manipulators during the production of a new molecular imaging probe derived from medical isotopes produced at the McMaster Nuclear Reactor.

photo credit: simonwilson.ca

The Faculty of Science has had a great deal of positive feedback from our inaugural issue of inScights. It has been a pleasure to see the research, teaching, operational and educational efforts of faculty, staff and students recognized and applauded. It is the collective effort of this team of people that has put the Faculty of Science at McMaster at the forefront of research and educational excellence both nationally and internationally.

Shortly we will celebrate our newest Science graduates at Spring Convocation, and we wish them all the best in their future endeavors. Investments in educational excellence are a Faculty priority. In this issue you'll learn more about iSci, a new flagship undergraduate program. In the coming months we will also highlight our efforts in graduate education, a key priority for us. We are immensely proud of these initiatives, and know that we are and will continue to grow as leaders in science education.

Enjoy this issue and regards.

John P. Capone, Ph.D.
Dean, Faculty of Science

McMaster University SCIENCE

Centre for Probe Development and Commercialization

Dr. John Valliant Chemistry and Medical Physics & Applied Radiation Sciences, and Institute of Applied Radiation Sciences


photo credit: simonwilson.ca

In February, Industry Minister Jim Prentice announced funding ($14.9M) for the Centre for Probe Development and Commercialization (CPDC), from the Centres of Excellence for Commercialization and Research – Networks of Centres of Excellence. With an additional 10M in partnership support coming from Cancer Care Ontario, GE Healthcare, The Ontario Institute for Cancer Research, the McMaster Nuclear Reactor, Pfizer Inc. and VWR Inc. The CPDC is poised to become the conduit through which scientific research in the field of molecular imaging probes transition from discovery to commercialization.

Molecular imaging probes in conjunction with medical imaging scanners can be used to observe specific biochemical processes non-invasively. Advances in this technology and the evolution of these probes assist clinicians in promoting earlier and more accurate diagnosis of major diseases, like cancer, and in designing new therapies.

The Scientific Director of the CPDC is Dr. John Valliant, presently the Acting Director of the McMaster Institute of Applied Radiation Sciences and a faculty member in the Departments of Chemistry and Medical Physics & Applied Radiation Sciences.

"My own research program spans a number of fields however the current focus involves the development of new methods for the preparation and discovery of molecular radioimaging and radiotherapy agents" explained Valliant. Crucially, however, Valliant's vision extends to all imaging modalities and to all corners of the Province.

The CPDC will be an avenue through which researchers can move their discoveries to clinical trials and/or commercialization, which can be a difficult and costly process.

"The Centre will have a tangible and significant economic and clinical impact," says Valliant, adding it's the first in the country, perhaps the world, to address every component of probe development."

The CPDC will create a focus for this sector within Ontario and Canada. The host community will gain from the creation of high tech jobs. The CPDC will also ensure that the innovations of top Canadian researchers get to clinical trials, from which patients will benefit. Ultimately, researchers will be able to see that their creativity is truly making a difference.

www.chemistry.mcmaster.ca/faculty/valliant/home.htm

Research Profiles

photo credit: Glenn Lowson

Dr. Allison Sekuler

Psychology, Neuroscience & Behaviour

Dr. Allison Sekuler is the Associate Vice-President of Research at McMaster University, a Canada Research Chair in Cognitive Neuroscience, and a Professor of Psychology, Neuroscience & Behaviour.

As co-director with Patrick Bennett of the Vision and Cognitive Neuroscience lab at McMaster, Sekuler is an active part of the research team. One of the avenues of research Sekuler, her students and collaborators pursue in the lab is to examine the effects of aging on vision and neural processing.

"We have discovered that the brain shows a significant amount of plasticity over the lifetime of an individual. Older and younger subjects can perform equally well on some simple visual tasks, but they may use very different parts of their brains to reach that level of performance." Sekuler continued, "We use a combination of behavioural and neuroimaging methods to understand the limits and functional consequences of this sort of compensatory reorganization, so that we can have a full understanding of how healthy aging works."

www.psychology.mcmaster.ca/sekuler/

Dr. Mike Waddington

School of Geography & Earth Sciences

Dr. Mike Waddington is an Associate Professor in the School of Geography & Earth Sciences. One of his areas of research is wildfire in boreal forests and peatlands. In collaboration with researchers at the Canadian Forestry Service, Michigan State University, and the University of Toronto, Waddington has initiated the PeatFire project.

Peatland ecosystems store a large portion of the world's soil carbon. They have a delicate water balance and are especially sensitive to change. Climate change over the last 40 years has impacted the moisture balance of peatlands, causing a drying of the peat and an increased burn area. Peat fires contribute a large source of carbon to the atmosphere and the negative health impacts from resulting poor air quality are a large concern.

"Our research on peatland vulnerability and the ecological consequences to wildfire is critical to both the peat resource and fire management communities." Waddington continues, "We are developing new quantitative fire danger and smouldering potential models for peatland fires that will guide environmental, health and fire management policies".

www.science.mcmaster.ca/%7Ewadding/index.htm

Dr. Narayanaswamy Balakrishnan

Mathematics & Statistics

Dr. N. Balakrishnan is a Professor of Statistics at McMaster University. His research interests include order statistics, outliers, univariate and multivariate distribution theory, statistical inference, records, multivariate analysis, design of experiments, reliability, survival analysis, and industrial statistics.

"For example, order statistics arise naturally in many problems such as life testing and reliability experiments, outlier detection and robust inference," explained Dr. Balakrishnan. "My work in this area covers both theoretical problems – like bounds, approximations, dependence properties, recurrence relations, and characterizations – as well as applied aspects – like inference, censoring methodology, acceptance sampling, tolerance limits, and prediction."

Dr. Balakrishnan says that statistical distributions play an important role in many applied problems and form the foundation for model building and parametric statistical inference. His contributions to this area have been through proposing new distributions, developing novel inferential techniques for these distributions, and demonstrating their use while analyzing data obtained from different applied fields.

www.math.mcmaster.ca/bala/bala.html

Research Profiles

Dr. Sergey Mashchenko

Physics & Astronomy

Dr. Sergey Mashchenko is a theoretical astrophysicist in the Department of Physics & Astronomy. His research focuses on interstellar medium physics and the origin of dwarf galaxies.

Mashchenko is the lead investigator in the study "Stellar Feedback in Dwarf Galaxy Formation" recently published in Science. He and his team have used supercomputer simulations to reveal the violent and critical relationship between interstellar gas and dark matter during the formation of galaxies.

"Supernova explosions push the gas clouds back and forth in the centre of the galaxy," says Mashchenko. "Our high-resolution model did extremely accurate simulations, showing that this 'sloshing' effect – similar to water in a bathtub— kicks most of the dark matter out of the centre of the galaxy."

This research will have an impact on the way scientists view the role of interstellar gas on galaxy formation and it will also shed light on the mysterious dark matter.

www.physics.mcmaster.ca/%7Esyam/index.html

Dr. Patricia Chow-Fraser

Biology

Dr. Patricia Chow-Fraser is a professor in the Biology Department, whose research focuses on the anthropogenic impacts on the functional ecology of freshwater ecosystems.

She has created a check list of indicators based on the status of various organisms and different environmental characteristics, in an effort to determine the quality of the Great Lake wetlands throughout the U.S.A. and Canada. Using a GIS database she and her team have mapped the Great Lakes shoreline to determine the impact of land use and development on shoreline wetland quality.

"An example of our findings is the link between habitat loss and the disappearance of the juvenile musky in Southern Georgian Bay. We must ensure that this and other wetlands do not succumb to the same development pressure that has already impaired most of the wetlands along Lakes Erie and Ontario, and for which we now pay hefty sums to restore." stated Chow-Fraser.

www.science.mcmaster.ca/Biology/faculty/chowfras/chowfras.htm

Award Profile Dr. Paul Ayers Chemistry

Dr. Paul Ayers is an Associate Professor in the Department of Chemistry and a Canada Research Chair in Theoretical Chemistry and Chemical Biology. He was recently awarded a prestigious Sloan Research Fellowship (2008-2010). Established in 1955, these awards support early career scientists who demonstrate outstanding promise.

Ayers' research focuses on developing new mathematical and computational methods for describing and predicting chemical reactions. This requires an understanding of how chemical bonds fracture and form, which in turn requires the understanding of how the electrons that bind atoms into molecules rearrange during chemical reactions.

"My research program requires the use of quantum mechanics to model the changes in electronic structure that accompany chemical reactions." explained Ayers. "But we also want to understand what is happening at a qualitative level. The most unconventional facet of my research is its emphasis on developing new qualitative tools for understanding why chemical reactions happen."

The Faculty of Science is extremely proud of Dr. Ayer's achievements to date and congratulate him on being named a Sloan Fellow.

www.chemistry.mcmaster.ca/faculty/ayers/

Education Profile iSci www.science.mcmaster.ca/~isci/

In September 2009 the Faculty of Science will welcome the first 60 students into the flagship Honours B.Sc. Integrated Science (iSci) Program. Within the first year, students will be engaged in research and obtain an integrated background in Physics, Mathematics, Chemistry, Biology, Biochemistry, Psychology, Earth Science and Computer Science.

The program is designed to produce students that will be able to understand how scientific thought is created and communicated. Students will be taught by interdisciplinary teams of instructors in laboratory and field settings as well as in lectures, workshops, and tutorials. Much of the program content will be taught as thematic modules such as 'Deflecting an Asteroid', or 'Averting a Pandemic' this approach will allow students to understand the connections between various scientific disciplines and the relevance of science to modern society.

"The goal of this program is to produce broadly educated individuals who will have an exceptional level of scientific literacy and will be able to contribute to any modern field of science and beyond. As we continue to work towards launching iSci, we will keep the community posted." stated John Capone, Dean, Faculty of Science.

NMR's 50th Anniversary at McMaster

Chemical research at McMaster University has been using Nuclear Magnetic Resonance (NMR) since 1958. In 1986, the facility was formalized and today it houses 7 instruments.

This year we celebrate this milestone with activities, including a one-day symposium in May. This symposium will include oral presentations, a poster session and a banquet.

For further information about the history of NMR at McMaster go to http://nmr50.mcmaster.ca/

If you have story ideas, please contact the Faculty of Science at (905) 525-9140 ext. 22616