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# MoGeNews

Issue 2 - July 2014

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**Message from the Chair**



## **Partnering for success: 1969 - 2014**

On the 45th anniversary of the founding of the Department, which is also the 25th anniversary of the establishment of its graduate program, it is worth looking at where we are now, and how we got here. Whereas, in 1969 the Department had 10 faculty members housed solely in the newly constructed Medical Sciences Building (MSB), it now comprises over ten times as many faculty members, half on campus and half in hospital-based research institutes. This growth reflects the success of the Department in establishing and maintaining key partnerships both on and off campus.

The Department's first off-campus partnership, with the Research Institute of the Hospital for Sick Children (SickKids), began in the mid-1970s, when a cohort of human geneticists joined the Department. Many breakthroughs have been made by our SickKids-based faculty members: in human genetics and genomics, developmental biology and stem cells, and cancer research. By early next year our SickKids contingent will comprise over 30 professorial faculty members in our Ph.D. Program in Molecular Genetics and 40 professors, lecturers and instructors in our Genetic Counseling Masters Program. Our new faculty are highlighted below in this issue.

In the mid-1980s, with the founding of the research institute at Mount Sinai Hospital, now known as the Lunenfeld Tanenbaum Research Institute (LTRI), a second off-campus node of the Department was established. Our Mt. Sinai faculty members, currently numbering 15, have made many key advances over the years in cellular signaling networks and systems biology, mouse developmental biology and genetics, proteomics and structural biology.

Another important partnership, this time on campus, has been with the Banting and Best Department of Medical Research (BBDMR) and, since 2005, with the Donnelly Centre for Cellular and Biomolecular Research (DC). The DC is Canada's flagship venue for integrative and systems biology, and is a world leader in these fields. Currently, about two-thirds of the DC faculty members (25) hold either their primary appointment or their graduate school appointment in the Department of Molecular Genetics. Apart from numerous research collaborations that link our faculty members in the DC with those at the Department's other nodes, we have recently initiated a close educational

collaboration with the DC in establishing a Quantitative Biology track for Ph.D. students. Click [here](#) for more details.

The core MSB-based faculty contingent initially was composed largely of a collection of prokaryotic geneticists who made major contributions to understanding bacterial and phage genetics, and contributed to the recombinant DNA/genetic engineering revolution in the 1970s and 1980s. Currently our almost 30 core faculty members bring enormous depth and diversity in fundamental molecular, cellular, developmental and structural biology. The core is also a vibrant venue for research on molecular microbiology and viral, bacterial and fungal pathogens. This field of research within the Department is highlighted in this issue below. The Department also offers an undergraduate specialist B.Sc. degree and a major in microbiology, and we will soon be introducing an online course on ‘Medical Microbiology’, which was developed in collaboration with Public Health Ontario.

By restricting our on- and off-campus faculty appointments primarily to the four geographic nodes described above, the Department has been able to maintain a critical mass of faculty and students at each location, thus fostering a sense of community and ‘belonging’. This structure has also fostered research collaborations among labs with complementary expertise, a key feature of much of modern cutting-edge research. The ongoing success of the Department – and of its partners – will continue to depend on the excellence of our faculty, staff and trainees, and our collegiality, all of which have been hallmarks of our partnerships since their inception.

Sincerely,

Howard Lipshitz

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**Alumna Spotlight**

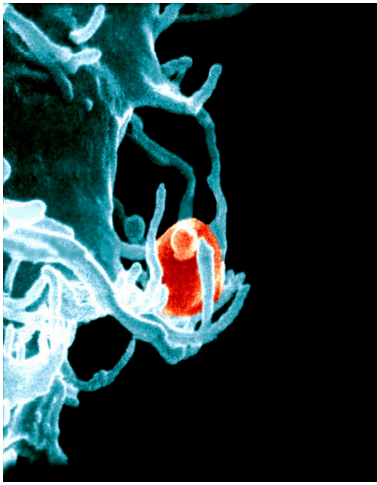


Professor Pamela Stanley, Horace W. Goldsmith Foundation Chair and Professor of Cell Biology at Albert Einstein College of Medicine, discusses her career trajectory from growing up in Australia to performing postdoctoral research with Dr. Lou Siminovitch in the then Department of Medical Genetics, to launching an independent career at Einstein. Pamela provides career advice to young scientists and discusses exciting discoveries such as new paradigms of how sugars can affect cell signaling, and how this could ultimately enable development of new strategies to treat human

diseases. Click [here](#) for access to the full interview.

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## **Spotlight on MoGen Research Field - Molecular Microbiology & Infectious Disease**



*Courtesy of Scott Gray-Owen. Neisseria gonorrhoeae (orange) being cradled by protrusions from a human endocervical epithelial cell.*

MoGen research in the area of Molecular Microbiology and Infectious Disease tackles fundamental questions as to the molecular mechanisms that bacteria, fungi, and viruses employ to achieve their biotic prowess. We aim to understand how pathogens manipulate the host to replicate and cause disease, and how the host recognizes, captures, and destroys invading pathogens. We also study basic cellular processes such as genome replication, regulation of gene expression, and responses to stress and environmental cues. This understanding will be critical in enabling us to address global challenges including the development of new strategies to cripple HIV, prevent and treat tuberculosis, halt the spread of sexually transmitted disease, and conquer Legionnaire's Disease, invasive fungal infections, and microbial drug resistance.

Research in microbiology and infectious disease is undergoing a renaissance over the past decade. Microbes exist in overwhelming numbers and unparalleled diversity, and we now appreciate their profound impact on the planet and on human health and disease. The human body contains over 10 times more microbial cells than human cells, with members of the human microbiome being implicated in a multitude of conditions including obesity, diabetes, rheumatoid arthritis, muscular dystrophy, multiple sclerosis, and cancer. Some microbes are pathogens and can cause life-threatening infectious disease. These pathogens pose one of the greatest threats to human health worldwide, at least in part because they rapidly evolve resistance to the drugs we use to kill them. We are now in jeopardy of entering a post-antibiotic era, in which common infections that were once treatable will become lethal due to widespread multi-drug resistance.

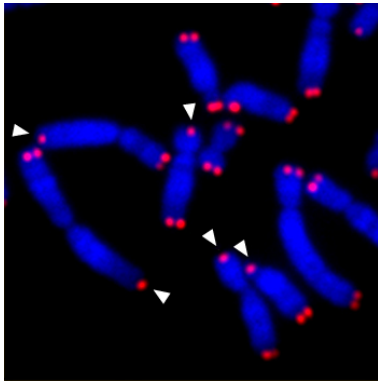
Our diverse labs form an innovative, interdisciplinary, and collaborative community at the forefront of science in Canada and internationally. We integrate diverse disciplines such as biochemistry, molecular biology, genetics, microbiology, immunology, epidemiology, and evolutionary biology, using state-of-the-art genomic and proteomic approaches coupled with advanced imaging technologies. We benefit greatly from extensive collaborative

interactions with the five other MoGen research fields including Cellular and Molecular Structure and Function, Computational and Systems Biology, Functional Genomics and Proteomics, Genetic Models of Development and Disease, as well as Molecular Medicine and Human Genetics.

We invite you to click [here](#) for a closer look at some of the exciting research in Molecular Microbiology & Infectious Disease in MoGen.

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## Research Highlights

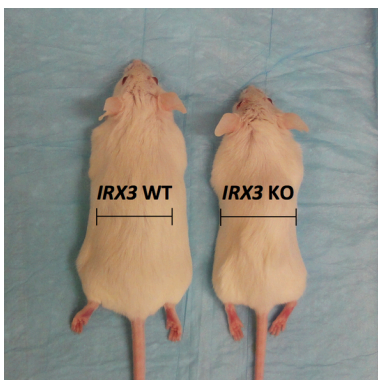


*Image credit:  
Alexandre Orthwein.*

**Researchers solve a longstanding mystery in cell division -- cells do not repair damage to DNA during mitosis because telomeres could fuse together with catastrophic consequences.** (Science 2014, DOI:

10.1126/science.1248024). MoGen team lead by

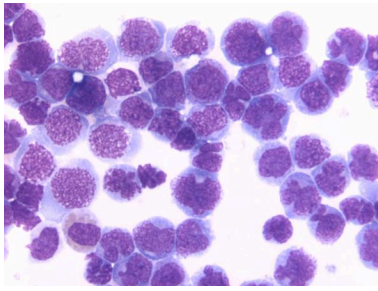
Daniel Durocher discovered that at the moment of cell division cells lose the ability to distinguish between damaged DNA strands and telomeres. They found that reactivation of DNA double-strand break repair machinery that is normally shut down during cell division leads to fusion of telomeres, as shown. Click [here](#) for more details.



**Discovery of an "obesity gene" that encodes a master energy regulator in the brain, contributing to obesity and likely diabetes.** (Nature 2014, 507: 371-5). An international team co-

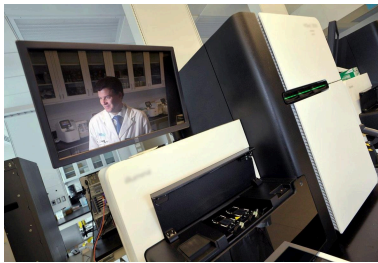
led by MoGen scientist Chi Chung Hui found that obesity-associated genetic variants control weight gain by tuning the expression levels of the gene IRX3. IRX3 in turn controls a group of neurons in the brain that regulate energy expenditure. Mice

lacking IRX3 showed reduced weight gain and more efficient glucose processing compared to control mice, providing a foundation for developing new therapeutic approaches for obesity and diabetes. Click [here](#) for more details.



**Study discovers a pre-leukemic stem cell that may be the first step in initiating disease and also the culprit that evades therapy and triggers relapse in patients with acute myeloid leukemia.** (Nature 2014, 506: 328-33).

MoGen team led by John Dick lays the groundwork to detect and target pre-leukemic stem cells in the bone marrow that give rise to an aggressive blood cancer. Mutation in the gene DNMT3a cause the pre-leukemic stem cells to proliferate abnormally, creating a reservoir of cells that is resistant to chemotherapy and can lead to relapse. Click [here](#) for more details.



**Researchers make great strides towards cracking the autism code.** (Nature Genetics 2014, Epub ahead of print). An international team lead by Stephen Scherer discovered a unifying set of characteristics in DNA that define a genetic formula to calculate which mutations have the highest

probability of causing autism. The key to solving the enigmatic code was in recognizing exons of genes that are highly conserved in human evolution and highly expressed during early brain development. Click [here](#) for more details.

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## Faculty Highlights & Awards



Professor John Dick has been elected as a Fellow to the Royal Society (London). He transformed the study of human hematopoiesis and leukemogenesis, with his development of methodologies for transplanting human bone marrow into immune-deficient mice. He has identified long-term repopulating human hematopoietic stem cells and generated mouse models of leukaemia. His studies showing that a specific subset of leukemic cells can recapitulate tumour growth are foundational for current work on cancer stem cells and applications

to cancer therapy.



Professor Charlie Boone is awarded the Edward Novitski Prize by the Genetics Society of America. This award recognizes an extraordinary level of creativity and intellectual ingenuity in solving significant problems in genetics research. Click [here](#) for more details.

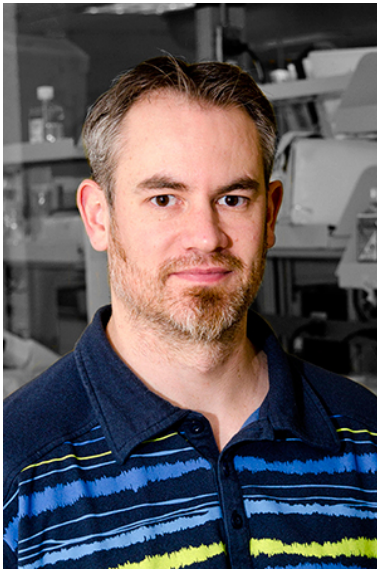


Professor Igor Stagljar has been named a Corresponding Member of the Croatian Academy of Sciences and Arts. He uses a combination of molecular, cellular, chemical genomic and proteomic approaches to study the function of yeast and human membrane proteins, as well as bacterial proteins involved in pathogenicity.



Professor Janet Rossant has been awarded a 2014 honorary Doctor of Laws from the University of Windsor.





Professor Bret Pearson was awarded the 2013 Early Career Award in Cancer from the CIHR Institute of Cancer Research. This award was established to recognize the excellence of research being conducted in Canada by a new investigator in the field of cancer. Dr. Pearson's project entitled "Understanding the mechanism of stem cell lineage development and tumour suppression using freshwater planarians" received the highest ranking (by percent rank) in the 2013 Spring Operating Grant competition.



Professor Martha Brown receives a 2014 Award for Excellence in Undergraduate Teaching in the Life Sciences from the Faculty of Medicine. Click [here](#) for more details.



Professor Julie Claycomb is awarded an international team grant from the Human Frontier Science Program Organization. The team will explore the roles of small RNA pathways related to RNA interference as a means of extracellular communication between parasitic nematodes and their mammalian hosts. Click [here](#) for more details.



Professor Alan Davidson is interviewed on Quirks and Quarks on the March 15th episode, "Beyond Antibiotics." Click [here](#) for more details and for a link to the episode.



Professor Jun Liu interviewed by Liam Mitchell to discuss fighting a global war against super-bugs and understanding the World Health Organization report "Antimicrobial resistance: global report on surveillance 2014". Click [here](#) for more details.

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## Welcome to Our New Professors

We are delighted to welcome five new professors to the department of Molecular Genetics since July 2013.



Professor Ronald Cohn joined The Hospital for Sick Children as the Chief of the Division of Clinical and Metabolic Genetics, Co-Director of the Centre for Genetic Medicine and Senior Scientist in September 2012. He also became the Inaugural Women's Auxiliary Chair in Clinical and Metabolic Genetics in April of 2013, as well as joining the department of Molecular Genetics as an Associate Professor in July of 2013. For a brief biography and statement of research interests click [here](#).



Professor James Dowling is a clinician scientist at the Hospital for Sick Children who is focused on gene discovery and therapy development for childhood muscle diseases. He was appointed to the department of Molecular Genetics as an Assistant Professor in September of 2013. Click [here](#) for more biographical details and information on clinical activities and research interests.



Ran Kafri was appointed to the department of Molecular Genetics as an Assistant Professor in November 2013. Prior to this appointment, he was a Postdoctoral Research Fellow at the Department of Systems Biology, Harvard Medical School hosted jointly by the laboratories of Marc W. Kirschner and Galit Lahav. His research focuses broadly on cell growth and proliferation, signal transduction, and genetic redundancy.



Monica Justice is the Head and a Senior Scientist in the Genetics & Genome Biology program at The Hospital for Sick Children and a pioneer in the field of mouse mutagenesis. She was recruited from Baylor College of Medicine, Houston, Texas, where she was a Professor in the Department of Molecular and Human Genetics and Director of the Mouse Embryonic Stem Cell Core and the BaSH Consortium for the Production and Broad-based Phenotyping of Knockout Mice. She was appointed to Molecular Genetics as a Professor in April 2014.

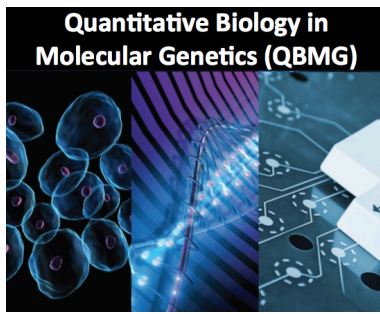
Click [here](#) for a brief biography and statement of research interests.



Julie Lefebvre is a Scientist in the Neurosciences and Mental Health Program at The Hospital for Sick Children, and was appointed to the department Molecular Genetics as of July 1, 2014. Prior to this appointment, she pursued her postdoctoral training in the laboratory of Dr. Joshua Sanes at Harvard University. She studies how nerve cells establish highly specific patterns of connections in the developing nervous system and links defects in these processes to neurodevelopmental disorders and brain diseases. For a brief biography and statement of research interests click [here](#).

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## Graduate Student Highlights & Awards



The Department of Molecular Genetics is initiating a new Quantitative Biology Track within its graduate studies program with a May 1st, 2014 application deadline for admission of the first cohort of students in September. Click [here](#) for more details.



Molecular Genetics alumna Dr. Antonija Kreso was featured in the Toronto Star for her graduate work with Dr. John Dick on the characteristics of colon cancer cells. Click [here](#) for a link to the Toronto Star "People to Watch" feature and for a link to the January 3rd interview on Canada AM. Dr. Kreso also receives the CIHR Lap-Chee Tsui Publication Award. Click [here](#) for more details.



Molecular Genetics student Joseph Bondy-Denomy was finalist and runner-up for the Three Minute Thesis competition, in which doctoral students have three minutes or less to present their doctoral research to a panel of non-specialist judges. Joe's talk was about *Harnessing Viruses as the Next Generation Antibiotic*.



Former Molecular Genetics student Dr. Kelvin Law participates in the most interdisciplinary team competing for the Hult Prize. Bill Clinton's Hult social venture prize is the world's largest student competition. Click [here](#) for more details.

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## Undergraduate Student Highlights



Our summer undergraduate research program is thriving, with 70 students being trained in Molecular Genetics labs. In late July, we will welcome an additional 14 undergraduates from China as part of our international summer student research program. In addition to pursuing research projects, the students are participating in a seminar

series, and will present their research at a poster session towards the end of the summer. Interspersed social events, such as a picnic and World Cup kickoff/ice cream party provide opportunities to relax and create friendships with new colleagues!

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## International Partnerships



Molecular Genetics partnerships with China featured in the Norman Bethune Celebration. The University of Toronto's Faculty of Medicine celebrated the legacy of one of its most famous graduates — Dr. Norman Bethune — 75 years after the death of the renowned humanitarian. Click [here](#) for the video.

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## Message from the Associate Chair, Infrastructure, Communications, and Alumni Relations



We hope that you enjoyed the second issue of **MoGeNews**. In order to effectively capture highlights from our MoGen community members, we need to hear from you. In particular, we strive to build a stronger community that connects our alumni with current Molecular Genetics faculty and trainees. Please take a moment to update us on exciting career developments, discoveries or achievements.

Please send any updates or suggestions to Leah Cowen at [leah.cowen@utoronto.ca](mailto:leah.cowen@utoronto.ca).

I look forward to hearing from you!

Sincerely,

Leah Cowen

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