



Lady Davis Institute Research Newsletter



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Technological “game-changer” targets cancer cells with precision

Novel nanorobotic agents capable of navigating the 100,000 kilometres of blood vessels that criss-cross the human body to deliver a drug with precision directly to active cancer cells promise to be, in the words of **Dr. Gerald Batist**, Director of the Segal Cancer Centre, “an absolute game-changer. The holy grail of cancer research is the discovery of a technology that can precisely target cancer while sparing healthy tissue.”

Nanorobotics could be the system that investigators have been searching for because it can deliver a toxic molecule directly to the most resistant cells at the centre of a tumor and destroy them. This breakthrough was the subject of a paper in [Nature Nanotechnology](#).

The technology was developed by engineers at the Polytechnique Montréal, led by Dr. Sylvain Martel, who are collaborating with Drs. Batist and **Te Vuong** at the Jewish General Hospital to propel the clinical aspect of the research. In a pre-clinical trial, nanorobotic agents were successfully administered into colorectal tumors in an animal model.

Legions of these agents are released amidst millions of self-propelled bacteria and loaded with drugs that find the most direct path between the injection point and the target site. Once inside the tumor, they can detect oxygen-depleted areas (known as hypoxic zones), which are its most active region, and deliver the drug. Hypoxic zones are created by the substantial consumption of oxygen that is characteristic of rapidly proliferative tumor cells. These zones are resistant to most treatments, including radiotherapy.

“Chemotherapy, which is so toxic for the entire human body, could make use of these natural nanorobots to move drugs directly to the targeted area, eliminating the harmful side effects while also boosting its therapeutic effectiveness,” said Dr. Martel.

The Nanorobotics Laboratory at the Polytechnique recently received \$4.6 million in funding, including contributions from the Canada Foundation for Innovation and the government Quebec, making it a “Canada First” site to bring nanorobotics to cancer therapy.

Launch of largest Canadian clinical study on dementia

The Canadian Consortium on Neurodegeneration in Aging (CCNA) is launching its signature clinical study, the [Comprehensive Assessment of Neurodegeneration and Dementia \(COMPASS-ND\)](#). Over the next two years, the study will enroll 1600 participants, between the ages of 50 and 90, with memory problems at 30 sites across Canada. The goal is to learn about who is at risk of developing dementia, how early it can be detected and what tests are most effective at detecting it.

The \$8.4 million study is funded by the \$31.5 million grant awarded for the creation of the CCNA in 2014 by the Government of Canada through the Canadian Institutes of Health Research and 14 partner organizations from the public and private sectors.

The goal of COMPASS-ND is to study dementia in all its forms, including cases where there are multiple pathologies involved, such as Alzheimer’s disease and cerebrovascular disease, referred to as “mixed” dementia. This broad approach is being taken in order to investigate what these dementias have in common, as well as what differentiates them. Doing so will help in diagnosing, understanding, and working to prevent the onset of dementia in all its forms. In the case of mixed dementia, study results will help CCNA researchers examine the impacts of different pathologies alone and in combination, and their implications for disease course and treatment.

“Our aim is to capture a detailed picture of Canadians living with, or at risk for, dementia by ‘phenotyping’ individuals, or collecting information across different dementias and focus areas, such as genetics and brain imaging. We believe this approach will help us to better understand the similarities and differences across all forms of dementia, which will lead to improvements in diagnosis and treatment,” says **Dr. Howard Chertkow**, Scientific Director of the CCNA.

Segal Cancer Centre joins the “Cancer Moonshot”

On September 21, 2016 the Segal Cancer Centre, on behalf of McGill University, joined with the United States National Cancer Institute of the National Institutes of Health in an unprecedented international collaboration to further America’s [“Cancer Moonshot.”](#) an initiative toward which the White House pledged \$1 billion in new funding to accomplish a decade’s worth of progress in five years.

Along with the University of Victoria and the UVic-Genome BC Proteomics Centre, the Segal Cancer Centre will develop proteogenomic technologies to identify proteins that are activated by genetic mutations in cancerous tumors and to translate its findings into effective clinical care.

“Proteogenomics allows us to penetrate to the very core of the mutation that causes a cancer to form and identify the actual proteins that stimulate its growth and spread,” explains **Dr. Gerald Batist**, Director of the Segal Cancer Centre.

A decade of genomic study has concluded that it is critical to dig down to the deeper level of proteomic activity, given that proteins are the substance that therapeutic molecules target. In other words, a genetic mutation must express an identifiable protein to be targeted by a drug designed to prevent the replication of malignant cells.

The Cancer Moonshot is no less ambitious than to eliminate cancer as we know it. President Barack Obama drew an analogy between cancer research and America’s success in harnessing the financial and intellectual resources necessary to land humans on the moon.

The Jewish General Hospital and McGill University emerged as a leader in clinical proteomics with the arrival of **Dr. Christoph Borchers** at the LDI as Segal Family Chair in Molecular Biology. Dr. Borchers, who is also Director of the Proteomics Centre, is instrumental in advancing proteomics analysis.

“Another element to this research is the promise of immunotherapies, which activate the proteins that control the immune system in an effort to enlist them to direct the body’s own natural defense mechanisms to destroy cancer cells,” said Dr. Batist. “As we get better at identifying proteomic biomarkers, we’ll be able to deploy precision medicines best suited to treat a particular patient’s cancer.”

“Genomics has led to improved success rates in cancer therapies, however the signature of proteogenomics, the combination of proteomics and genomics, has an even greater potential to better predict the efficiency of cancer treatments than each ‘omics’ discipline by itself.” - **Dr. Christoph Borchers**, Segal Family Chair in Molecular Oncology, McGill University

Dr. Brent Richards was awarded the 2016 André Dupont Young Researcher Award from the Club de recherche cliniques du Québec, and was invested in the College of New Scholars, Artists, and Scientists of the Royal Society of Canada. The RSC’s College of New Scholars, Artists and Scientists aims to gather the best of the emerging generation of leaders in scholarship, science and art in Canada. Together, College members apply interdisciplinary approaches to addressing issues of particular concern to new scholars. Dr. Richards researches the genetic determinants of common, aging-related endocrine diseases, and ways in which these findings can be applied to improving clinical care.

New Montreal Alzheimer’s Research for a Cure to support **Andréa LeBlanc**

Montreal Alzheimer Research for a Cure (MARC) is a unique online fundraising program designed to engage younger donors to support Montreal-based research into the early detection and treatment of Alzheimer’s disease and related dementia. **Dr. Andréa LeBlanc** of the LDI, whose research aims to provide a valid therapeutic target for treatments designed to stop Alzheimer’s disease before it causes irreversible damage, will be one of the beneficiaries of [MARC](#).

MARC is spearheaded by Dorothy Reitman, whose late husband, Cyril, died in 2014 after living with Alzheimer’s disease for a number of years.

“MARC speaks directly to younger people who may have no existing connection to the disease, but who stand a one in five chance of developing a form of dementia, which can start as early as in their 30s,” said Ms. Reitman. “We are asking them to make an investment in their own future, and that of their families.”



Dr. Koren Mann, Head of Molecular and Regenerative Medicine, addresses the axis' first Scientific Retreat. The day provided opportunities for principal investigators and trainees in this new axis to learn about one another's research interests and to discuss potential collaborations.

Obituary: Dr. Norman Kalant

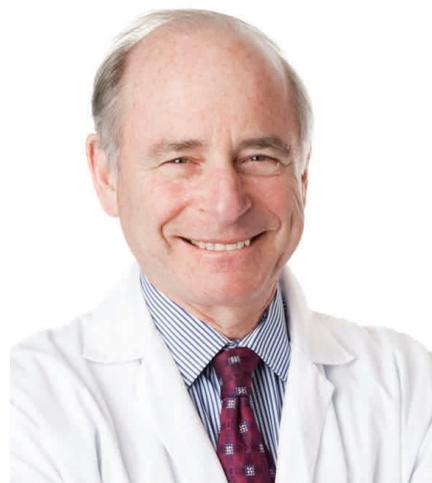
The Lady Davis Institute was sad to learn of the passing of its inaugural director, Dr. Norman Kalant. He led the Institute from 1969 until 1991. He earned his medical degree from the University of Toronto, and a PhD in Experimental Medicine from McGill University. Following post-doctoral work at Tufts University in Boston, he joined the Jewish General Hospital in 1955 as a researcher in the Department of Medicine. His primary research interest was diabetes. Dr. Mark Wainberg, himself a former director of the LDI, praised him on the occasion of his retirement "for taking the time to mentor every junior scientist who walked through our doors. And I don't just mean he gave them a friendly pat on the back. He took a true interest in their work."

Ernesto Schiffrin wins prestigious UBC award

Dr. Ernesto Schiffrin has been awarded the Margolese National Heart Disorders Prize by the University of British Columbia Faculty of Medicine. The prize is valued at \$50,000, making it among the most lucrative honours given by a Canadian university.

Dr. Schiffrin is credited with discovering the remodeling mechanisms of small resistance arteries and the effects of anti-hypertensive therapy on vascular remodeling in humans. He was the first to demonstrate the role of endothelin in high blood pressure, specifically in salt-sensitive and severe hypertension and vascular disease, which has led to recent studies of endothelin antagonists in resistant hypertension. He clarified the pathophysiological role of angiotensin II and aldosterone on damage to blood vessels, elucidated the vasoprotective actions of peroxisome proliferator-activated receptors, and revealed the role of inflammation and T-regulatory lymphocytes in vascular remodeling in high blood pressure. His identification of the differential effects of anti-hypertensive drugs on vascular structure led to clinical trials that replicated those findings in humans. Dr.

Schiffrin is currently exploring connections between the immune system and cardiovascular disease, and is considered a leading expert on innate immunity in the pathophysiology of hypertension.



Dr. Fackson Mwale has been promoted to Professor (Research) in the Faculty of Medicine at McGill University. Dr. Mwale is head of the Orthopedics Research Lab at the LDI. He is well-known for his identification of the Link-N peptide as a mediator in the repair of intervertebral disc degeneration.

Spotlight on Fellows

Maud Marques – Cancer Axis

Dr. Maud Marques began her scientific career at the University of Toulouse, France before pursuing her doctorate in molecular biology in 2005 at the University of Sherbrooke. Her research focused on the cross-talk between two different receptors involved in binding pollutants and how they may affect breast cancer. She began her post-doctoral fellowship at the LDI in 2013 in Dr. Michael Witcher's cancer lab, with a cross-appointment to work on biostatistics with Dr. Claudia Kleinmen and the Q-CROC (Quebec- Clinical Research Organization in Cancer) group.

"The LDI offered me a good opportunity to combine my research and interest in bio-informatics," Dr. Marques said. "I like that there is a lot of collaboration between the PIs here, they're really open and make themselves accessible to all of us, and that the trainees are really motivated to succeed."

As a biologist and bio-informatician, she has the dual capacity to design experiments that will generate new data, as well as to exploit existing databases. "Bio-informatics is the future of research. Going forward, it will be essential that we develop tools which can dig deeper into all the data that is at our disposal."

She is currently concentrating on two projects. In the Witcher lab, she is working on in vitro and in vivo experiments to develop an inhibitor against a protein that they have identified as a potential therapeutic target in breast cancer. For Q- CROC she is searching for biomarkers of drug resistance in patients with metastatic colorectal cancer.

"I really enjoy science for the sake of science. I'm very happy when my research helps people," she said, "but as a fundamental researcher, I am trying to understand how processes work. There are so many unanswered questions to explore."



Dr. Vicky Tagalakis has been appointed McGill University Director for the Division of General Internal Medicine (GIM). An Associate Professor in the Division of General Internal Medicine within the Department of Medicine, Dr. Tagalakis is strongly committed to medical education and has been recognized for accomplishments achieved during her 12 year tenure as General Internal Medicine Residency Program Director leadership. Dr. Tagalakis will promote the development of academic activities within GIM across all McGill sites.

Cancer and Work is a new, interactive web site to help cancer survivors return to the workplace.

The co-principal investigator is **Dr. Christine Maheu**, an associate member of the Segal Cancer Centre. The site offers practical information from Canadian experts, including health care professionals, vocational rehabilitation counselors, occupational therapists, physiotherapists, lawyers, insurance representatives, and fellow cancer survivors.

Dr. Susan Kahn has been elected a Fellow of the Canadian Academy of Health Sciences (CAHS). Her internationally recognized research focuses on prevention and treatment of venous thromboembolism. She is a Tier 1 Canada Research Chair and was a Chercheur National of the Fonds de recherche du Québec-Santé. She was recently awarded a prestigious 7-year CIHR Foundation grant, and a 5-year CIHR grant to lead a national venous thrombosis research network. She has published more than 200 papers in peer-reviewed journals. Fellowship in the Academy is considered one of the highest honours for members of the Canadian health sciences community.



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