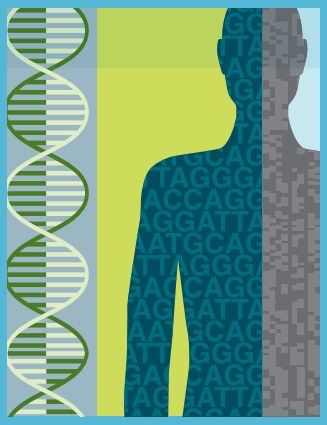
Ontario Institute for Cancer Research

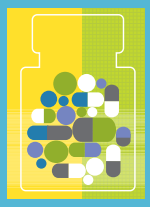
Annual Report 2009/10

OICR

4 HIGHLIGHTS 2009-2010



10 MONITORING RESULTS



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MESSAGE FROM THE MINISTER OF RESEARCH AND INNOVATION

On behalf of the Government of Ontario, I am pleased to congratulate the Ontario Institute for Cancer Research (OICR) on the success it has achieved over the last year.

Our government is committed to ensuring the health and well-being of the people of Ontario. Cancer affects not only the patient, but the patient's family, friends and community. OICR's research in prevention, earlier detection and better treatments is going to make cancer a much less feared diagnosis with improved outcomes.

OICR has made Ontario one of the leading jurisdictions for cancer research in the world. The Institute, under Dr. Tom Hudson's leadership, has fostered an innovative research environment that appeals to scientists with first-rate skills. OICR is helping to build Ontario's innovation economy by attracting the most talented Canadian cancer researchers and some of the brightest and best scientists from around the world.

The collaborations OICR has forged with academia, research institutes, industry, other governments, funding institutions and the financial community give us a global competitive advantage. The Institute's focus on commercialization to move discoveries from the lab into use in the clinic is vital to ensuring that the investment in peer-reviewed research excellence yields a significant return for the people of Ontario.

OICR is moving rapidly to help realize the goal of a vibrant, innovation-driven Ontario economy. I want to thank the dedicated staff of the Institute for their extraordinary work and wish them every success in the future.

Sincerely,

GLEN MURRAY
Minister of Research and Innovation

MESSAGE FROM THE CHAIR OF THE BOARD OF DIRECTORS AND THE PRESIDENT AND SCIENTIFIC DIRECTOR

We are pleased to present the annual report of the Ontario Institute for Cancer Research for 2009–2010. Launched in 2005 to tackle the big questions in cancer research, the Institute has grown from a core group of 15 people to supporting 550 scientists and their team members in OICR at the MaRS Centre and in research institutes and universities across the province.

Our research strategy is in place and the various programs and platforms have developed their implementation strategies, received funding approval and begun to meet the cancer challenge. Through partnerships with industry, other research institutes and not-for-profit organizations, we have generated more than $100 million of direct support to OICR programs based in Ontario, and more than $250 million to international consortia partners.

One of OICR's mandates is to train the next generation of cancer researchers. You will read elsewhere in this report about the talented young investigators who have started their careers in Ontario and are making a significant contribution to finding the causes of cancer and developing better methods to prevent, diagnose and treat the disease.

We have made excellent progress in the recruitment of OICR investigators. We are proud of the number of highly qualified personnel who have been recruited, retained and trained. The OICR Investigator Program has allowed the recruitment of 28 outstanding researchers and clinician-scientists, 21 of whom come from outside Ontario.

Just as important as the ability to make scientific discoveries is the ability to move those discoveries out of the lab and into the clinic where patients can benefit. OICR's Commercialization Program has, through its Intellectual Property Development and Commercialization Program, funded 13 projects and has helped advance a number of these projects to commercially important milestones such as licensing agreements, clinical development strategies, first-in-man clinical studies and sales initiatives. While still in its infancy, OICR has played a critical role in launching six companies in Ontario.

The International Cancer Genome Consortium (ICGC), co-founded by OICR and international funding agencies in Asia, Australia, Europe and North America, is one of the world's largest biomedical projects. It is designed to identify cancer-causing mutations involved in more than 25,000 tumours for over 50 types of cancer. This year saw the addition of 10 new projects and datasets from studies of breast, liver and pancreatic cancer that have been made available on the ICGC website, hosted at OICR.

This past year we welcomed the arrival of two new members of the senior management team, who bring a depth of knowledge and have extensive experience in both large pharmaceutical companies and biotechnology startups.

Dr. Nicole Onetto, appointed Deputy Director, is working with OICR's program and platform leaders on the strategic direction and priorities of the Institute's research program and is providing direct oversight of the OICR operations support teams. She was responsible for filing the initial new drug application for Taxol® and was the international project leader for the drug.

from left to right

DR. CALVIN STILLER
Chair, Board of Directors

DR. TOM HUDSON
President and Scientific Director

Mr. Frank Stonebanks, appointed Vice-President Commercialization and Chief Commercial Officer, is responsible for OICR's Commercialization Program including: identifying and leading collaborative opportunities to work with private equity and corporate strategic investors in oncology; leading the intellectual property program to maximize OICR's extensive pipeline; and identifying and accelerating transformative early stage R&D projects via novel business models. He has co-managed a $500 million venture fund and raised more than $100 million equity financing for the spinoff of a company involved in the development of drugs and devices.

We also welcomed Dr. Eric Lander as the Co-chair of OICR's Scientific Advisory Board. He is President and Founding Director of the Broad Institute of MIT and Harvard, Professor of Biology at MIT, Professor of Systems Biology at the Harvard Medical School and was a principal leader of the international Human Genome Project. He was appointed by U.S. President Barack Obama to co-chair the President's Council of Advisors on Science and Technology.

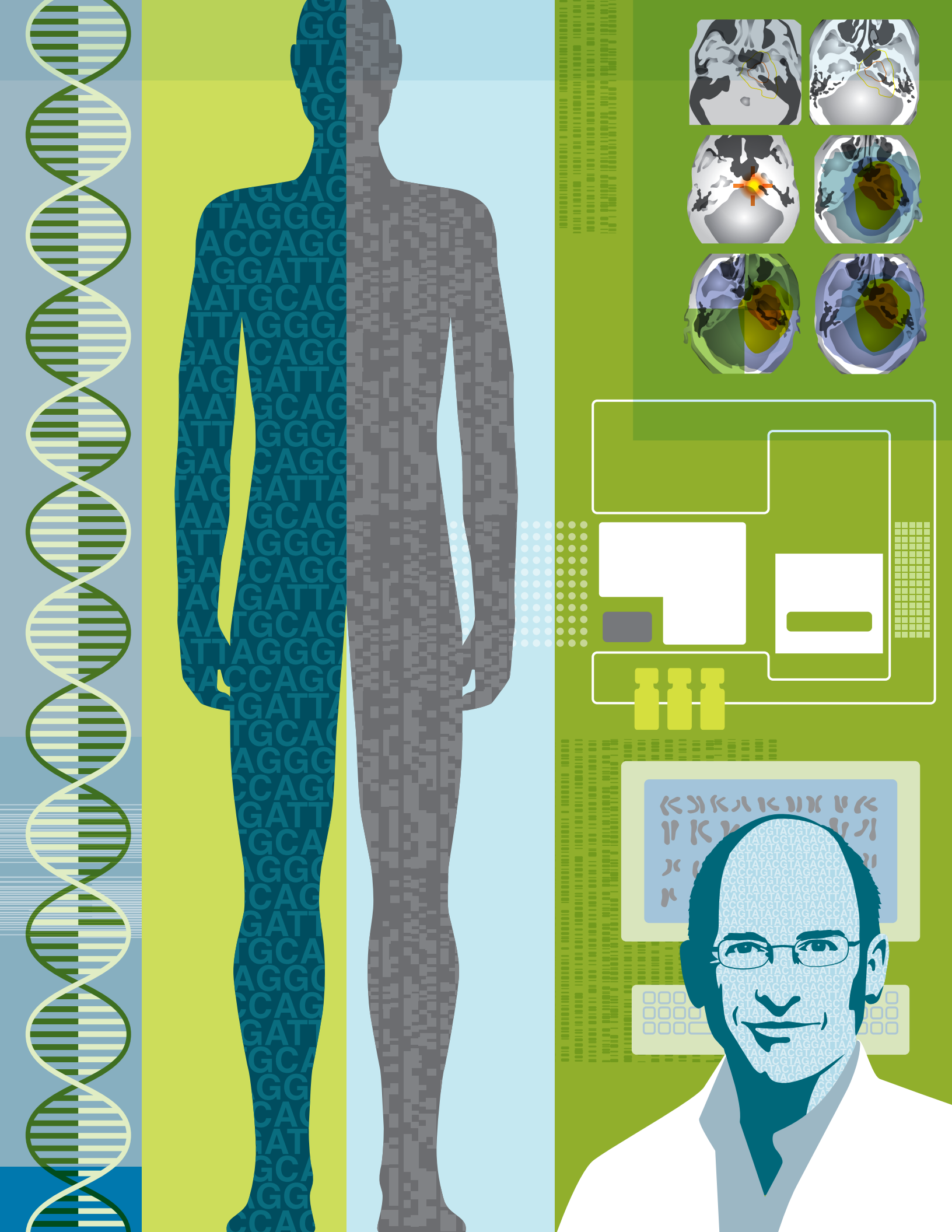
Dr. Lyle Palmer is joining OICR as Executive Scientific Director of the Ontario Health Study. He is a genetic epidemiologist and statistical geneticist and has been the Director of the Centre for Genetic Epidemiology and Biostatistics at the University of Western Australia.

We wish to thank Dr. Bob Phillips, who was the founder of OICR's predecessor, the Ontario Cancer Research Network and who served as interim President and then Deputy Director of OICR. His extraordinary vision and drive, mentorship and dedication to excellence in scientific research resulted in the creation of a new model for cancer research that is the envy of many other countries.

We also wish to extend special thanks to Dr. John Evans, the former Chair, as he retires from the Board. Under his leadership, the Ontario Cancer Research Network was transformed into the Ontario Institute for Cancer Research. He has been an unfailing champion for the ambitious goals of the Institute and through his experience and counsel he made an invaluable contribution to OICR's success to date. He will be greatly missed.

We are most grateful for the continuing excellent support received from the Government of Ontario through the Ministry of Research and Innovation. As a champion of research and development in Ontario, the Government has helped gain recognition for Ontario as a world leader in cancer research.

The staff of the Institute and the principal investigators and their teams contribute their talent, dedication and hard work to OICR and we thank them for their contribution to our continued success. ■



HIGHLIGHTS 2009-2010

The Ontario Institute for Cancer Research is meeting the cancer challenge with its focus on translational research in the prevention, detection, diagnosis and treatment of cancer. The Institute's programs have two major objectives: innovation and translation.

Innovation programs target different time-points in the clinical continuum – prevention, early diagnosis and therapeutics. Because many new avenues for cancer screening, detection and drug discovery rely on the identification of specific components of cancer cells, called cancer targets, and biomarkers, OICR established an additional innovation theme called cancer targets.

In consultation with scientific advisors and the Ontario research community, projects were selected for each of the innovation themes, based on their potential for impact and recognized strengths in Ontario and are the basis for the "innovation projects." Innovation programs involve multi-institutional networks that link basic and clinical researchers from multiple disciplines. Technology platforms composed of principal investigators and staff scientists offer and develop state-of-the-art knowledge and technologies in disciplines to enable OICR programs. OICR's translation programs ensure that the knowledge created by the Institute's research benefits the patient, the health care system and the general population.

Partnerships

OICR has established major partnerships with public organizations: in Ontario with Cancer Care Ontario; in Canada with the Terry Fox Research Institute and five federal agencies; and internationally with the world's foremost cancer and genome research funding agencies in Asia, Australia, Europe and North America. Major corporate partners include international companies such as Pfizer Global Research and GE Healthcare, and discussions are ongoing with a variety of other commercial organizations. These partnerships have generated more than $100 million of direct support to OICR programs based in Ontario, and more than $250 million to international consortia partners. These initiatives have enhanced the international reputation of Ontario as a centre of excellence for cancer research and will help attract additional research investments to the province in the future.

Pfizer Global Research joined forces with researchers in Ontario to discover and validate new targets for the

OICR BLUEPRINT

THEMES	INNOVATION PROGRAMS	TECHNOLOGY PLATFORMS
Prevention	▶ Ontario Health Study	Imaging Pipeline
Early Diagnosis	▶ One Millimetre Cancer Challenge	Transformative Pathology
Cancer Targets	▶ Cancer Stem Cells ▶ Cancer Genomics (ICGC)	Genome Technologies
Therapeutics	▶ Selective Therapies (Terry Fox Research Institute, Ontario Node) ▶ Immuno- and Bio-therapies	Medicinal Chemistry Informatics and Bio-computing

TRANSLATION PROGRAMS
High Impact Clinical Trials
Health Services Research
Patents to Products (Commercialization)

diagnosis, prognosis and treatment of colorectal cancer. The program, entitled POP-CURE (an acronym for Princess Margaret Hospital-OICR-Pfizer-CURE), is led by Dr. Bradly Wouters, Senior Scientist at the Ontario Cancer Institute, the research arm of the University Health Network's Princess Margaret Hospital and OICR Senior Investigator, Selective Therapies Program.

Dr. Wouters and his team are developing a large clinical biobank to find molecular signatures of colorectal cancer cells. These molecular signatures will be used to accelerate the development of biomarkers for early detection, monitoring and treatment of cancer.

Colorectal cancer is currently evaluated using physical criteria and classified based on the stage of the cancer's development. However, patient prognosis and response to treatment varies widely at each stage, with some patients doing much better than others, suggesting there are a number of sub-types of colorectal cancer.

Biomarkers identified by the POP-CURE study could be used to classify colorectal cancer by sub-type at the molecular level, providing doctors with powerful new tools for predicting the progress of the disease and the individual patient's response to treatment. These biomarkers could also aid in the development of new therapies that target cancer cells selectively. Because such treatments will destroy cancer cells, sparing normal cells, fewer side effects are expected compared to current cancer treatments.

In late spring 2008, OICR, Genome Canada, the Canadian Institutes of Health Research, the Canada Foundation for Innovation and the Stem Cell Network founded the Cancer Stem Cell Consortium (CSCC), to focus on identifying cancer stem cell biomarkers and molecular targets for which drugs could be developed. The CSCC entered into a formal partnership with the California Institute for Regenerative Medicine (CIRM) in this exciting new endeavour. CSCC and CIRM awarded funds to two Canadian teams in October 2009, led by Ontario researchers – Drs. John Dick (Program Leader, OICR's Cancer Stem Cells Program) and Tak Mak. They were selected from thirty-one applications which targeted a broad range of diseases and injuries. Each Canadian team will receive approximately $20 million over four years and their partners in California requested similar levels of funding from CIRM. Funding for the Canadian scientists is being provided by two members of the CSCC: CIHR and Genome Canada. California's scientists will be funded by CIRM.

Commercialization

OICR implemented a commercialization strategy that is founded on the principle that inventions derived from OICR-funded research will benefit the people of Ontario. OICR's commercialization team has ensured that each program and platform has integrated mechanisms to identify and capture intellectual property (IP) arising from the research.

The Institute is proactive in engaging industry and market receptors including major pharmaceutical firms, companies that produce instruments and devices, and others in the imaging and biotechnology industries. OICR created the Intellectual Property Development and Commercialization (IPDC) Program to de-risk and accelerate the advancement of particularly promising cancer innovations by providing meaningful funding and expert guidance in development, regulatory affairs, and commercial matters.

In just over two years, the IPDC Program portfolio has funded 13 projects and has helped advance a number of these projects to commercially important milestones such as licensing agreements, clinical development strategies, first-in-man clinical studies and sales initiatives.

OICR has enabled the creation of six new companies. Two of these have already raised seed or 'A' round financing in the order of $3.7 million to advance their business models and one is generating revenues through sales.

Health Services Research

The Health Services Research Program is a partnership between OICR and Cancer Care Ontario. Its focus is on the analysis of the benefits, risks and cost of new ways to prevent, detect, diagnose and treat cancer. It also helps develop new policies that can benefit patients and improve the administration of health care. The Program is looking at the barriers to the dissemination of new services or treatments. It is also evaluating the quality of care provided to cancer patients, including supportive and palliative care.

The Program has initiated projects that will help solve two of the clinical challenges identified in OICR's research strategy. One is investigating the impact of the ColonCancerCheck colorectal screening program, which was launched in 2007 by the Government of Ontario. This project will result in better use of colon cancer screening in Ontario. The information gathered on effective cancer screening will also be applicable to many other types of cancer. Another project is evaluating long-term and late effects of treatments in young women with breast cancer. This initiative will help to launch the paediatric/young adult cancer survivor initiative that is currently being planned by several Canadian organizations including OICR.

Bio-therapeutics

The Bio-therapeutics (ORBiT) Program's goal is to support the clinical evaluation of novel biological-based tumour killing agents such as cancer-specific vaccines and oncolytic viruses. The latter can be considered to be "genetically armed pharmaceuticals" which will specifically target only tumour cells. These agents, developed by world-leading teams in Ontario, are ready to be tested in cancer patients. Two clinical trials directed at colorectal and paediatric tumours have already started. A Good Manufacturing Practice (GMP) facility has been established for biological agents, which already supports the production of vaccines for clinical trials. ORBiT is also developing cell-based therapeutic approaches that involve the isolation of anti-tumour immune cells from cancer patients and allow customization of immune therapy specific to each patient.

The field of oncolytics and immune therapies has been associated with many challenges. However, recent data (i.e., Provenge™) has shown that targeted vaccination can significantly delay disease progression in prostate cancer, validating the potential importance of this field of research as a new approach for personalized cancer treatment. OICR's participation in such an initiative is important for Ontario researchers to remain at the forefront of potential breakthrough therapies. A distinctive feature of the ORBiT Program is the use of combination therapies involving cells, viruses and immunomodulators to create synergistic therapeutic interactions at the tumour site with minimal effect on normal tissues to minimize toxicity to the patient while focusing therapeutic activity against the tumour.

Pancreatic Cancer Genome Project and the International Cancer Genome Consortium

As part of an alliance with international funding agencies in Asia, Australia, Europe and North America, OICR co-founded the International Cancer Genome Consortium (ICGC), one of the world's largest biomedical projects. The ICGC is designed to identify cancer-causing mutations involved in more than 25,000 tumours for over 50 types of cancer.

ICGC member organizations and participating centres have agreed upon common standards for informed consent and ethical oversight to ensure that all samples will be coded and stored in ways that protect the identities of the participants in the study. To maximize the public benefit from ICGC member research, data will be made rapidly available to qualified investigators. In addition, all Consortium participants will agree not to file any patent applications or make other intellectual property claims on primary data from ICGC projects.

OICR's role in the ICGC is considerable, as it hosts the Data Coordination Centre and the ICGC Secretariat, in addition to tackling pancreatic cancer, one of the deadliest cancers. Large-scale sequencing of cancer genomes is fundamental to OICR's vision of personalized medicine. In early years, the focus on mining the genome of a large number of pancreatic cancer tumour samples should help identify genetic alterations that may determine whether some of the currently approved targeted therapies will be beneficial for very well-defined subsets of pancreatic cancer patients or identify new targets amenable to new therapies. The better understanding of genomic alterations in pancreatic cancer will create synergies with other OICR teams such as the Imaging Pipeline, Cancer Stem Cells, Selective Therapies and Medicinal Chemistry. This will lead to improvements in the diagnosis and management of pancreatic cancer patients ultimately leading to an improvement in long-term survival.

New projects in Italy and the European Union will contribute to efforts already underway in Australia, Canada, China, France, Germany, India, Japan, Spain, the United Kingdom and the United States. Twenty-one projects in progress will examine more than 10,000 tumours for cancer types found around the globe that affect a diversity of organs including blood, brain, breast, colon, kidney, liver, lung, pancreas, stomach, oral cavity and ovary.

Studies of breast, liver and pancreatic cancer have already generated datasets which are now available on the ICGC website at www.icgc.org. The genomic analyses of the tumours were conducted by ICGC members in the U.K. (breast cancer), Japan (liver cancer) and Australia and Canada (pancreatic cancer). The data can be used immediately by cancer researchers worldwide. ■

THANK YOU FOR AN OUTSTANDING CONTRIBUTION TO OICR

We thank Dr. Peter George, former President and Vice-Chancellor, McMaster University and Dr. Christopher Paige, Vice-President Research, University Health Network who completed their terms this year as members of the Board, for their significant contribution. They provided leadership and sage advice to a "startup" research institute and provided a solid foundation for OICR's growth.

We thank Dr. Phillip Sharp, Institute Professor, Center for Cancer Research, Massachusetts Institute of Technology, who completed his term as Co-chair of the Scientific Advisory Board. His advice was invaluable in shaping both the research strategy and its execution.

HONOURS

NAME	AWARD
DR. DAN DUROCHER Senior Investigator, Samuel Lunenfeld Research Institute, Mount Sinai Hospital Recipient, OICR Cancer Research Fund Award	Canada's Top 40 Under 40
DR. AARON FENSTER Director, Imaging Research Laboratories, Robarts Research Institute, University of Western Ontario OICR Co-Platform Leader, Imaging Pipeline Platform and Co-Program Leader, One Millimetre Cancer Challenge	2010 COMP Gold Medal Canadian Organization of Medical Physicists
DR. BENJAMIN NEEL Director, Ontario Cancer Institute, the research arm of the University Health Network's Princess Margaret Hospital Principal Investigator, OICR-Terry Fox Research Institute Selective Therapies Program	Premier's Summit Award
MR. MICHAEL POWER Vice-President, Regional Cancer and Diagnostic Services, Thunder Bay Regional Health Sciences Centre CEO, Thunder Bay Regional Research Institute Member, OICR Board of Directors	Canada's Top 40 Under 40
DR. CALVIN STILLER Professor Emeritus, University of Western Ontario Chair, OICR Board of Directors	Member, Canadian Medical Hall of Fame Canada Gairdner Wightman Award
DR. JOHN VALLIANT Scientific Director and CEO, Centre for Probe Development and Commercialization Principal Investigator, OICR Imaging Pipeline Platform	Canada's Top 40 Under 40
DR. JEFF WRANA Senior Investigator, Samuel Lunenfeld Research Institute, Mount Sinai Hospital Principal Investigator, OICR-Terry Fox Research Institute Selective Therapies Program	Premier's Summit Award

MONITORING RESULTS

OICR's strategic programs and the projects supported by OICR grants result in scientific discoveries, commercial activity, communications and the creation of jobs for highly qualified personnel.

OICR grant supported projects

FUNDED PROJECTS

ROUND	DATE	PROJECTS FUNDED	FUNDS AWARDED (IN MILLIONS OF DOLLARS)
1	May 2002	15	$6.9
2	November 2002	19	$8.7
3	May 2003	9	$4.1
4	November 2003	14	$7.4
5	May 2004	12	$7.0
6	May 2005	2	$8.4
7	November 2005	11	$5.4
8	May 2006	6	$0.8
9	November 2006	15	$7.1
10	May 2007	6	$0.8
11	November 2007	17	$8.2
12	November 2008	13	$6.4
13	November 2009	11	$6.0
		150	$77.2

PROJECT TYPES 2002-2010

	CANCER RESEARCH FUND	CANCER RESEARCH PROGRAM	ONTARIO TUMOUR BANK	CLINICAL TRIALS INFRASTRUCTURE FUND
Clinical trials	26	4	–	–
Companion studies	16	–	–	–
Translational	108	166	–	–
Equipment	–	109	–	–
Other	–	–	6	24

CANCER TYPES AND NUMBER OF PROJECTS IN ROUNDS 1-13

	CANCER RESEARCH FUND	CANCER RESEARCH PROGRAM	ONTARIO TUMOUR BANK	CLINICAL TRIALS INFRASTRUCTURE FUND	INTELLECTUAL PROPERTY DEVELOPMENT AND COMMERCIALIZATION PROGRAM
Brain	13	–	–	–	–
Breast	35	–	–	–	1
Colorectal	9	–	–	–	1
Head and neck	10	–	–	–	–
Haematological	29	–	–	–	3
Lung	20	–	–	–	–
Multiple cancers	13	286	6	24	3
Melanoma	8	–	–	–	–
Other	15	–	–	–	2
Ovarian	9	–	–	–	1
Pancreatic	6	–	–	–	–
Prostate	19	–	–	–	2

ARTICLES PUBLISHED IN JOURNALS

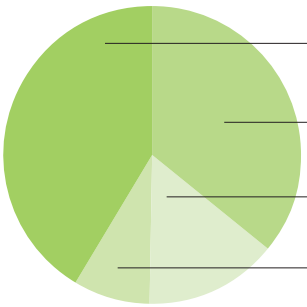
PROGRAM	JOURNAL IMPACT FACTOR RANGE	NUMBER IN RANGE
Strategic programs	0-10	170
	11-20	27
	21-30	8
	31-60	3
	NA*	16
Grant supported programs	0-10	47
	11-20	5
	21-30	0
	31-60	4
	NA*	13

** NA = unrated journals*

HIGHLY QUALIFIED PERSONNEL WORKING ON FUNDED PROJECTS

62	Undergraduate students
88	Master's degree students
123	Doctoral students
5	Medical students
209	Postdoctoral fellows
400	Researchers
191	Technicians
118	Research associates
52	Research assistants
24	Co-op students
27	Other
20	Program/project manager
32	IT/informatics specialists
6	Senior management
13	Health service specialists

COMMUNICATIONS ARISING FROM FUNDED PROJECTS



404 Oral presentations in Canada

352 Oral presentations outside Canada

140 Poster presentations in Canada

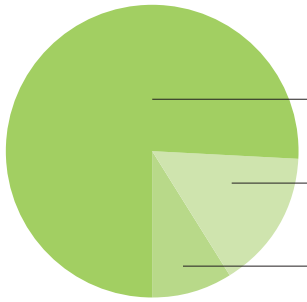
80 Poster presentations outside Canada

COMMERCIAL ACTIVITY

COMMERCIAL ACTIVITY GENERATED BY FUNDED PROJECTS	CANCER RESEARCH FUND	CANCER RESEARCH PROGRAM	INTELLECTUAL PROPERTY DEVELOPMENT AND COMMERCIALIZATION PROGRAM
Disclosures	22	2	–
Patent applications	18	1	4
Patents pending	2	2	–
Patents awarded	2	–	–
Spinoff companies	–	2	3

SOURCE OF OICR PROJECT FUNDS

IN MILLIONS OF DOLLARS



$81.6 Ministry of Research and Innovation

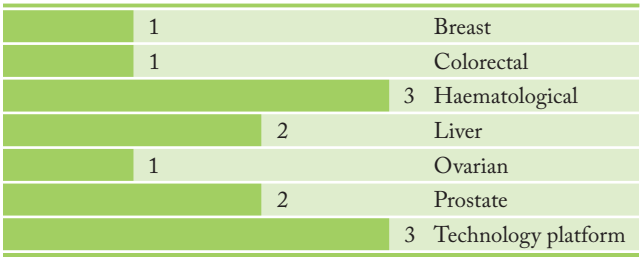
$16.4 Partner site leveraged funding

$9.5 OICR leveraged funding

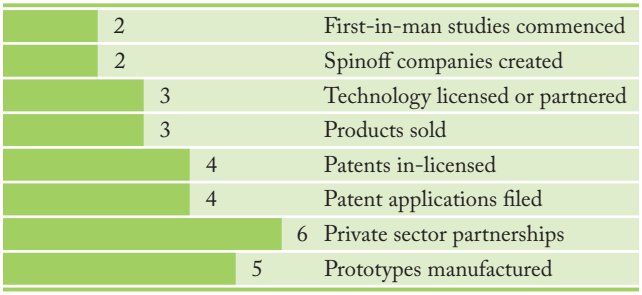
INTELLECTUAL PROPERTY DEVELOPMENT AND COMMERCIALIZATION PROGRAM (IPDCP)

Investments under co-management by OICR	13
OICR funding in 2009-2010	$2.35 million
Private sector funding (cash) 2009-2010	$1.20 million
Private sector funding (in-kind) 2009-2010	–

CANCER TYPES AND NUMBER OF INVESTMENTS



MILESTONES AND NUMBER OF INVESTMENTS



INVESTMENT IMPACT SECTOR AND NUMBER OF INVESTMENTS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THE NEXT GENERATION

OICR's mandate is to strengthen Ontario's research capacity and contribute to the development of the next generation of cancer researchers. It does this by attracting outstanding researchers to the province and ensuring that the very best of the established and newer, rising stars of the scientific world choose to do their cancer research in Ontario.

NADEEM MOGHAL
Principal Investigator
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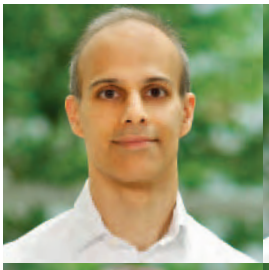

SHYH-DAR LI
Junior Principal Investigator
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PENNY BRADBURY
Investigator
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STEPHEN WELCH
Investigator
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BYRAM BRIDLE
Postdoctoral Fellow
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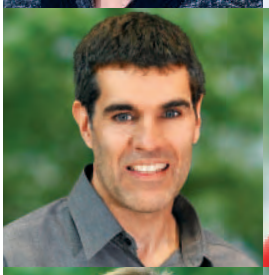

IRINA KALATSKAYA
Postdoctoral Fellow
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JEFF BAX
Graduate Student
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ANNA BENDZSAK
Graduate Student
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SHIRLEY TAM
Graduate Student
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THIWANKA WIJERATNE
Graduate Student
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NADEEM MOGHAL

Principal Investigator

Dr. Nadeem Moghal took a long, winding path to get to Toronto, where he works as a researcher in the city's Discovery District. Along the way, he picked up knowledge and skills that are helping him make unique contributions to lung cancer research.

Moghal is a Scientist at the University Health Network in Toronto and a Principal Investigator at OICR. His research focuses on stem cells in lung development, an area that could shed light on how to improve treatments for cancer and other diseases of the lung, such as cystic fibrosis.

He excelled in his undergraduate studies at McGill University and was offered an opportunity to complete his graduate studies at Harvard. After earning his PhD in the laboratory of Dr. Benjamin Neel, Moghal decided to stay in the United States. He worked with C. elegans, a small roundworm that is widely used as a model organism.

"After finishing graduate school, I was concerned about some of the limitations of *in vitro* research methods to fully understand the pathogenesis of cancer *in vivo*. So I decided to learn how to use organisms like C. elegans to study how genes associated with human cancer are normally kept in check in developing organisms *in vivo*," he says.

"Shortly after finishing my postdoctoral work, I was amazed at how quickly genomic and molecular methods had developed for mammalian systems."

He launched a lung cancer program at the University of Utah. One day he received a call from Neel, to visit him in Boston to discuss opportunities at Harvard, but by the time Moghal arrived, Neel had decided to accept an offer to become Director of the Ontario Cancer Institute and a professor at the University of Toronto. He encouraged Moghal to join him.

Moghal was really impressed by OICR's funding approach. "In other jurisdictions it's often beneficial to have a narrowly focused background, and someone like me who has a diverse skill-set is at a disadvantage. But OICR invests in developing the scientist and his or her research program over the long term. In this environment, an interdisciplinary background and a willingness to try new approaches are considered assets."

Moghal's recent research, which focuses on the tracheal and bronchial cell populations in the upper part of the lungs, has shown that certain cells in this region can have stem cell-like properties.

"From a cancer point-of-view, it would seem logical that some self-renewing stem cells would accumulate mutations over our lifetime that could turn them into cancer cells. Alternatively, some cancer-causing mutations might reprogram a terminally differentiated cell into thinking it's a stem cell. Either way, purifying lung stem cells and studying the genes that govern their stem cell-like properties could yield important insights into how lung cancer cells originate and how they might be combated."

His experiments showed that when a pure population of lung basal cells were exposed to conditions where other types of cells were needed, such as ciliated and goblet cells, these cells eventually emerged from the population of basal cells. Clearly, some of the cells within the basal cell population acted as stem cells in terms of their ability to create the various types of cells required in the lung.

Moghal says this experimental approach could be used to elucidate the genetic causes of lung cancer. It is likely that some of the genes involved in normal lung stem cell biology play important roles in generating the stem cell-like properties of various lung cancers. In addition, since cancers are genetically unstable, patient tumours tend to have far more mutations than the ones initially causing the cancer. To determine which mutations are the "driver" mutations that are causally linked to specific lung cancers, as opposed to the "passengers" which are not causally linked, candidates can be genetically introduced into his normal basal cells and examined for their effects on normal lung biology.

While cancer stem cell research is still in its early stages, in the long run it has enormous potential, including the possibility of major breakthroughs in the not-so-distant future. The same could be said of Moghal's career as a cancer researcher in Ontario. ■

SHYH-DAR LI

Junior Principal Investigator

Nanotechnology is likely to be revolutionary for drug delivery and imaging technologies. It offers the possibility of destroying tumours with minimal damage to healthy tissues and organs.

With the ability to manipulate biocompatible materials, nanotechnology can be used to create remarkable clinical formulations. "If we can move the drug directly to the tumour, then we will have better results," says Dr. Shyh-Dar Li, a junior principal investigator in the field of drug delivery and formulation at OICR. His nickname is "Star" and like a star, he is shining a light on smaller objects, enabling us to better see what is there.

Vessels supplying blood to tumours are usually leakier that those feeding into healthy tissues, allowing drugs made from nanoparticles to have the ability to permeate into the tumour but not normal tissues and increase the selectivity of the treatment.

Li aims to use nanotechnology to develop compounds for use in tumour detection and treatment. New materials are being produced in the nanometre (a billionth of a metre) scale. Materials less than 1,000 nanometres are known as nanoparticles. They are about the same size of a virus but smaller than bacteria, consisting of biodegradable materials such as natural or synthetic polymers, metals and lipids. "Nanoparticles will help resolve the challenge of transporting and delivering water insoluble and toxic drugs."

Li became interested in drug development while in high school in Taiwan after learning about the structure of Aspirin and its broad clinical applications. He studied pharmacy at the National Taiwan University. After completing a master's degree, Li earned a PhD in Pharmaceutical Sciences at the University of North Carolina at Chapel Hill.

Through OICR, Li has been able to work with other organizations to help advance his projects. "OICR is a great place to work as it provides a lot of support for young scientists," he says. "We are a translational institution that is involved with the development of products and treatments not just producing research papers. More importantly, everyone shares the same passion for curing cancer."

Overall, Li would like to see his research address the needs of patients. He explains that nanoparticles have the ability to reduce adverse reactions experienced by patients. Most drugs affect the tumour as well as normal tissues and organs; however the nanoparticles are more selective. Li is also trying to reduce the pain and discomfort experienced in intravenous treatments of the patients by increasing the oral absorption of those drugs.

Li is also investigating the use of nanotechnology to develop enhanced probes for cancer imaging. They allow for a more accurate and sensitive detection of a tumour at its earliest stage. Nanoparticles have the ability to deliver high concentrations of imaging agents to the tumour and can be designed to light up when imaged. He expects that the combined use of nanoparticles with imaging technologies will help predict, monitor and adjust treatments.

Li anticipates that medicine will become more personalized in the future. He believes that biomarkers will play an important role in personalized medicine in determining which therapy a patient should receive and also for an early assessment of the therapeutic outcome. This will mean that every patient can receive his or her own treatment according to the disease, increasing the likelihood of success and avoiding over-treatment. ■

PENNY BRADBURY

Investigator

Cancer is a disease that can affect any part of a person's body and sometimes it is difficult to access the cancer site to perform a biopsy. Ethical and toxicity concerns and issues of cost can also be barriers to researchers who need to obtain tissue samples to carry out their studies.

The collection and characterisation of circulating tumour cells (CTCs) from the blood stream of cancer patients may prove to be a solution to this problem.

One scientist working to evaluate this technique is Dr. Penny Bradbury, a physician coordinator working at the NCIC Clinical Trials Group (NCIC CTG) and a level two Cancer Care Ontario Research Chair in Experimental Therapeutics. Bradbury initially joined NCIC CTG through a one year drug development fellowship. During her fellowship Bradbury became involved in an initiative to evaluate the feasibility of including the collection and characterisation of CTCs within NCIC CTG clinical trials.

Bradbury is now a co-investigator – working with principal investigator Dr. Jeremy Squire – on a project that has received grant funding from OICR. This project will evaluate the feasibility and technical aspects of collecting CTCs within an early phase clinical trial evaluating a novel agent in prostate cancer. If promising, Bradbury hopes that CTC collection may be included in lung cancer clinical trials, a disease for which it is difficult to collect tissue for biomarker analyses.

CTCs have the potential to enable the collection of serial real-time "tissue samples." These can be used to evaluate a patient's response to treatment and as predictive biomarkers to allow the most effective treatments to be selected. "This is important because it will spare patients the toxicity of treatments that will not help in their particular case," says Bradbury. Currently CTC collection remains a research tool, the challenge being the identification and evaluation of the proper cells.

Bradbury completed her medical training at Cardiff University Medical School in the U.K. and received specialized oncology training, first in New Zealand then in the U.K. Bradbury returned to New Zealand and obtained a Doctor of Medicine, a postgraduate research degree at the Institute of Molecular Biosciences, Massey University, New Zealand.

Following the completion of her education, Bradbury wanted to work with internationally known experts in thoracic cancer research. This led her to the University Health Network's Princess Margaret Hospital in Toronto where she was a thoracic oncology fellow under Dr. Frances Shepherd. Bradbury then moved on to her fellowship at the NCIC CTG and eventually to her current role as a physician coordinator. This allows her to be involved in the development and execution of clinical trials as well as treating patients at the Kingston General Hospital. Bradbury has always had an interest in medicine and research so this position is a great fit.

Bradbury feels that doing research in Ontario has been an incredible experience. "Canada has a well organized research and health care infrastructure and is well known internationally for its work in lung cancer research," says Bradbury. She points to OICR and the NCIC CTG as examples of this, "OICR has a clear direction and a focus on building teams and this is important because you can always get more done as a team. It's remarkable what Canada has been able to accomplish given its relatively small population."

Bradbury is hoping to contribute to a team that will advance lung cancer treatment in Canada and internationally. She plans on doing this by working on clinical trials to evaluate novel therapies that will have a direct impact on patients through the efficient translation of research to clinical applications. Bradbury sees technology leading the way to better cancer diagnosis and treatment and notes that this trend is already emerging with new imaging technologies, with techniques to capture and characterize CTCs moving forward at a very rapid pace in the research arena. ■

STEPHEN WELCH

Investigator

Sutent® (known generically as sunitinib) is a powerful and relatively new drug that is currently being used to treat renal cell carcinoma, the most common type of kidney cancer in adults. In some patients it has shown great success, increasing both life span and quality of life.

The drug is a small pill taken daily and has relatively few side effects compared to other treatments. The problem doctors face, however, is that the drug works better in some patients than it does in others. Doctors today don't know which patients would be successful candidates for the drug and as a result, they must prescribe it and see if it works or not. But if doctors could better predict which patients would respond well to treatment with Sutent (and those that would not), they could ensure that patients received the best treatment for their cancer as soon as possible, without wasting valuable time if treatment will not work.

Dr. Stephen Welch, a medical oncologist and assistant professor at the University of Western Ontario, is part of a multidisciplinary team funded by OICR that is using state-of-the-art imaging technology to try to monitor the blood flow of patients currently taking Sutent to see if they can find an early indicator of which patients are best responding to treatment.

"What we're trying to do is to use imaging tests as a predictive marker to tell us who the drug is going to work for," Welch says. "If we can get a sense that this blood flow is being changed by this drug, then we can predict that it is helping to treat the cancer. This will allow us to better target the drug to patients for whom the treatment would be successful, stop the therapy for those who it is not working and get them onto something else."

Sutent is, in theory, supposed to stop tumour growth because it affects the development of blood vessels that are required for tumours to grow. By stopping the blood vessels from developing, it was thought that doctors could stop the growth of tumours. "But this is clearly not happening with every patient," Welch notes. "This scan is allowing us to see if this drug is doing what we think it is supposed to do."

Welch is a medical oncologist working with OICR's High Impact Clinical Trials Program. He is collaborating with the project's lead investigator, Dr. Masoom Haider, a radiologist and Head of Abdominal MRI at the University Health Network and Mount Sinai Hospital. Dr. Haider is using a special type of CT scan that allows researchers to measure blood flow and detect potentially important changes.

Welch calls the type of collaboration required for this project unique. "Collaboration is what's key for this type of project to work," he adds. "In this study we need radiologists, medical oncologists, clinical pharmacologists all working together – and that's very difficult to do. OICR has realized how difficult this is and is providing funding to research that is very interdisciplinary. Medical oncologists can't do this without the imaging specialists and vice versa. This project could not be completed without OICR's support."

He sees collaborative research becoming more of a necessity as research pushes towards more personalized forms of treatment, and researchers learn more about why some treatments work for some patients and not for others. "I think we are increasingly realizing in cancer treatment that there is no cookie cutter approach to treating patients. All cancers are different and all patients are different. One drug is not going to be the solution for all patients. We need to better understand the individual patient and their individual cancer and we need to work together to tailor treatment for them. Studies like this are steps in that direction."

Welch hopes that once they are better able to establish a predictive marker in kidney cancer, the team can go on to use Sutent, and drugs like it, for treatment of ovarian, breast, lung, brain and other forms of cancer.

"It is an exciting time to be a clinical researcher in cancer," Welch says. "OICR is fostering collaboration amongst world-class researchers across Ontario. I am delighted to be playing even a small part in this progress." ■

BYRAM BRIDLE

Postdoctoral Fellow

Treatment for cancer today includes surgery, chemotherapy and radiation. While these are effective in many cases, they demonstrate limited effectiveness where the disease has already spread by the time of diagnosis.

New approaches with biological agents, bio-therapeutics, offer the promise of treatments that can destroy cancer cells without affecting normal body cells. Dr. Byram Bridle's work as a postdoctoral fellow in the lab of Dr. Yonghong Wan at McMaster University is centered on two types of cancer therapy – oncolytic virus therapy and immunotherapy. He has found that a combination of these treatments was successful in curing over 60 per cent of brain cancer cases in an animal model.

Oncolytic viruses are engineered to multiply inside tumours while sparing normal cells. Immunotherapy uses vaccines to train the immune system to destroy cancerous tumours. Bridle's work has an important third aspect, the use of drugs to modify the effects of these therapies.

Initially, Bridle had treated healthy lab mice and saw limited success in having them generate an immune response that would prevent cancer. In addition, these tests were not clinically relevant so further work was done, using a combination of oncolytic viruses and immunotherapy with drugs to weaken the anti-viral defences of the tumours. The results have been outstanding.

Now Bridle is moving on to the next step – figuring out how this happens so that this treatment can be applied to human cancer. Bridle hopes to move from the pre-clinical stage to clinical trials within two to five years. This will bring Bridle closer to realizing his hope that one day these therapies will be routinely used in the clinic.

Bridle did not have to leave his home province to take advantage of what he considers the best place to do research in the world. "Ontario has all of the funding, resources and expertise you could need. Nowhere else in the world can outdo Ontario," says Bridle. He earned his bachelors and masters degrees in biomedical science and a PhD in immunology from the University of Guelph.

Bridle believes that the value of bio-therapeutics will be in combining them with current treatments. "We are starting to hit a wall with conventional treatments so it is essential that we start looking into new areas such as oncolytics and immunotherapy," says Bridle. He also points out that these therapies will become even more useful as imaging and diagnostic tools get better at detecting cancer at its earliest stages, allowing treatments to be used when they are most effective.

At the centre of Bridle's research is the combination of oncolytic virus therapy, immunotherapy and drugs. This combination of therapies was made possible by the power of OICR's collaborative approach to research. "Working within OICR meant that I was able to get together with other scientists whose expertise complemented my own. Together we were able to make some really major advancements," says Bridle.

Bridle credits the funding he is receiving from OICR with boosting his research, by allowing him to start the new work necessary to move his discoveries from the lab towards clinical use.

From an investment standpoint Bridle's research carries more risk than research into conventional therapies and imaging technologies, but he is encouraged by the approval of the first vaccine to treat cancer by the FDA in April 2010. It is a prostate cancer treatment called Provenge™ (Sipuleucel-T), manufactured using the patient's own immune system cells and a protein. It is then administered to the patient intravenously. Once in the patient's blood stream it helps the immune system recognize the cancerous prostate cells as foreign. Results have been good; trials indicate that on average this treatment adds about four months of survival time to the patient's life. Bridle hopes that the approval of this treatment will generate more interest in immunotherapy and make it easier to have his own therapeutics tested.

Bridle is also spurred on by how receptive OICR has been of his work. "I think that this area of research has a very bright future. There's a lot of hope that one day these therapies will be mainstream and highly effective," says Bridle. ■

IRINA KALATSKAYA

Postdoctoral Fellow

With accelerating technological advancements of genomics laboratory equipment, genetic data is now being processed at a much faster rate than in recent years resulting in large quantities of data output. All of this data needs to be analyzed to discover new cancer targets.

Scientists in the Informatics and Bio-computing Platform at OICR are responsible for organizing and interpreting the genetic data, a vital step on the road to improved diagnostic treatments and personalized medicine.

"Extensive amounts of genetic data are being collected worldwide, but a lack of powerful tools to help store, classify, organize and analyze the information is hindering the capacity for discovery in cancer research," says Dr. Irina Kalatskaya, a postdoctoral fellow in the Informatics and Bio-computing Platform at OICR.

The standard method of analyzing cancer data is to search for frequently mutated genes, e.g., genes found in at least 50 per cent of samples, which may become cancer targets. More research is needed to understand why a frequently occurring mutation is not found in all tumour samples of the same cancer type. Kalatskaya is examining infrequent mutations in an effort to identify common cancer-specific patterns and biomarkers.

When analyzing massive amounts of patient data, some mutated proteins are infrequently found and may only affect about four or five per cent of patients. Kalatskaya does not dismiss this data as insignificant; this is her focus. She is investigating how these infrequently-found mutated proteins from different patients with the same type of tumour interact with each other. "I'm looking for regions of highly-interconnected proteins that might help to understand the mechanism of cancer progression," she says.

The ultimate objective of the research is to identify molecular proteins specific for each type of cancer which will help physicians detect mutations in patients before they develop cancer. "It is very difficult to treat cancer at an advanced stage. We need to put more effort into preventing cancer and developing personalized medicine." Kalatskaya predicts that in the future, patients will have their genomes sequenced leading to elaborate and effective treatment regimens.

Kalatskaya is passionate about prevention of cancer because of a family connection with the disease, "I want revenge. I want to prevent cancer." Her determination to defeat cancer and a life-long love of mathematics and science inspired her to become a cancer researcher.

She presented a scientific project at the International Environmental Project Olympiad in Istanbul in 1995 and was awarded a bronze medal. This experience furthered her passion for science. Kalatskaya tailored her education to focus on her favourite subjects of mathematics, computer-science, chemistry and physics. In 2005, she earned her PhD in Biochemistry in Ludwig-Maximilians-Universität (LMU) in Munich, Germany and three years later she completed her first postdoctoral fellowship in Molecular Pharmacology and Biochemistry at the Université de Montréal in Quebec. Kalatskaya's love of different sciences and her lab experiences eventually led her to the field of informatics and bio-computing.

In November 2008, after completing courses in programming, Kalatskaya moved to Toronto to join OICR's Informatics and Bio-computing team. "I was interested in the position at OICR, but when I fully understood the size and scope of the project, I knew I had to be a part of it. I feel confident, rewarded, reassured and relaxed even when I am under pressure. The close community of researchers at OICR and Toronto's Discovery District are good sources of new collaborations, fresh ideas, new data and support. I am very excited to be here." Kalatskaya hopes her algorithm will make an impact on how patients are screened not just in Ontario, but throughout the world. By predicting which diseases patients are likely to develop over their lifetimes, Kalatskaya would love a future health care system that focuses on prevention and screening, reducing the need for treatment.

"Hopefully, in 25 years there will be protocols filtering people who are predisposed for certain types of cancer and prevent its development. I hope my grandchildren will think about cancer like we think now about the bubonic plague or smallpox." ■

JEFF BAX

Graduate Student

For Jeff Bax, a PhD program is about more than education. It's also an opportunity to improve the way prostate cancer is treated and diagnosed.

Bax, a biomedical engineering student at the University of Western Ontario works at the Robarts Research Institute in London. He has an impressive record of inventing cutting-edge medical devices – some of which are already being used in the clinic.

Bax has developed a new prostate biopsy tool that overcomes several limitations of diagnostic procedures, as well as a new therapeutic device that delivers treatment more precisely and effectively. He also collaborated on an improvement to a standard breast biopsy device.

"My goal is to have all three technologies in use in the clinic by the time I finish my degree," Bax says.

When Bax and his colleagues were asked to solve a problem related to breast biopsy procedures, they opted to create a device that attaches to already available mammogram technologies, allowing doctors to improve the accuracy of breast cancer diagnosis without re-vamping their procedures. This approach allowed them to develop a concept, create prototypes and gain regulatory approval in just six months.

Bax's main task is to lead the development of two new technologies that will improve the precision of prostate cancer diagnosis and treatment.

Doctors now use a two-dimensional (2D) passive transrectal ultrasound (TRUS) needle guidance system to biopsy the prostate. However, the physician has limited anatomical reference points, leading to false-negative rates as high as 34 per cent and many patients have to undergo multiple biopsies.

Bax's diagnostic tool uses three-dimensional (3D) ultrasound and a balanced mechanical arm to overcome these problems. This should improve the recording procedure as well as the physician's ability to accurately guide the biopsy needle to selected targets.

One of the most common treatments for prostate cancer is brachytherapy, which involves permanently inserting tiny radioactive "seeds" in the prostate. In current practice doctors determine the location of the cancer using 2D ultrasound. They then use a fixed template to guide the needle that delivers the seed. The template has holes which are 5 millimetres apart and it must stay in place as multiple needles are inserted. "This means that some of the needles will be up to 2.5 millimetres from the target." Bax explains.

Bax has developed a device that solves the problem. A 3D ultrasound guidance system lets doctors target tumours with much greater precision and flexibility and a robotic arm capable of angular movement can reach areas of the prostate that were previously inaccessible.

The biopsy device has been approved by Health Canada and doctors in London, Ontario, have been using it for two years. The brachytherapy device has been prototyped and will be clinically tested in Toronto and London, Ontario; it is currently being reviewed by Health Canada for use in humans.

Both technologies have been licensed to a medical device company. The commercial version of the biopsy device is undergoing clinical trials at Los Angeles Medical Centre and at a hospital in The Netherlands. After the therapeutic device gains regulatory approval, it could quickly enter wide-scale production and distribution.

Bax and his colleagues collaborate with surgeons at the London Health Sciences Centre and St. Joseph's Healthcare, also in London. "They become almost like a mentor for the project, they'll work with you through the design process, they'll be able to tell you whether you're on the right track," he says. "That's really important. But in the biomedical field there are all sorts of hidden problems that arise in the clinic. These don't show up unless you try it or work with the surgeon who's actually going to use it."

He is due to finish his PhD in April 2011, leaving almost a full year to reach his goal of developing three devices and seeing them used to improve patient care before graduation day. With two diagnostic tools in the clinic and a therapeutic device at the regulatory review stage, he should have time to spare. ■

ANNA BENDZSAK

Graduate Student

In 2007 Ontario implemented a new policy that required all thoracic (chest) surgeries for cancer in the province to be performed in one of 14 high volume hospitals.

The policy was based on a large body of research showing that hospitals that perform more thoracic surgeries have better outcomes for patients. Now it is up to Dr. Anna Bendzsak, a Thoracic Surgery Fellow and PhD candidate in the Institute of Medical Science at the University of Toronto, to determine if a change based on a large body of research is actually helping patients in practice.

It is thought that treatment is improved because in high volume centres surgeons can specialize in performing particular surgeries and become better at them, a theory that Bendzsak refers to as "practice makes perfect." By concentrating all thoracic surgeries in high volume centres it is hoped that surgeons, oncologists, nurses and other health care providers will become more familiar with the disease and will be better prepared to deal with complications, and that opportunities for more collaboration between specialists will lead to better care.

But another theory exists saying that the evidence merely shows that better centres attract higher volumes of patients because more patients are referred there – in other words, they have high volume because they have better reputations, rather than providing improved service because they have high volume. If this is the case, the policy change in Ontario may not have a strong impact for patients overall.

Bendzsak is currently piecing together patient administrative data as well as testimonials from patients and health care workers to find out, three years after the policy was implemented, what the effects have been both for hospitals and for patients.

"I think we can say that it probably isn't good for patients to have their surgery done in a very low volume centre that perform only a handful of cases in a year," Bendzsak says.

Bendzsak is focusing only on thoracic oncology in Ontario, but her conclusions could be used for a wide range of other high-risk surgical procedures where evidence of volume-outcome relationships suggests that policies to regionalize services would be beneficial.

Ontario provides an ideal research environment for this type of health-services study because of the huge volumes of administrative information available on a large, regionally diverse population that, for the most part, is managed by one health care provider. All patient information that Bendzsak works with is de-identified for patient confidentiality.

Bendzsak appreciates that governments have come to see they have a vested interest in fostering research about the health care system. "I think there is a lot more dialogue between research and government," she says. "Governments are very interested and more responsive to research findings. That is encouraging because it shows you are not just working in isolation when producing these results. The uptake and use of findings is really improving."

Bendzsak obtained a Masters of Health Sciences degree from the University of Toronto in 1999 and an MD from the University of British Columbia in 2004. She returned to Ontario to complete a residency in general surgery and became very interested in thoracic surgery during her residency. She will start her clinical thoracic surgery fellowship after completion of her PhD.

The current study combines her interest in health services research with her growing expertise in surgery. "I've always been interested in questions related to equality and quality of care for patients," she says. "Thoracic surgery is really quite focused on cancer care and trying to get patients the best outcomes for their cancer, and sometimes doing that involves very complicated decision-making as well as performing highly technical procedures. It's definitely challenging. We need to continue asking these questions so we can find new ways to provide better care for patients."

Bendzsak's current research project is funded by OICR through the Health Services Research Program. ■

SHIRLEY TAM

Graduate Student

We are moving quickly into the era of personalized medicine. An individual's medical history, lifestyle and genetic makeup will help design individual prevention strategies and indicate which diagnostic procedures and treatments will likely be successful for the patient.

It will also help avoid over-diagnosis and unnecessary treatment that might not be effective. Lung cancer is the most common and lethal type of cancer in the world, yet current diagnosis and treatment options are inadequate. As a result, although there are more than a million cases of lung cancer diagnosed each year, most are diagnosed too late.

Shirley Tam, a graduate student in OICR's Cancer Genomics Platform, believes that personalized medicine holds the key to identifying the best treatment for individual lung cancer patients.

Originally from Toronto, Tam completed an Honours Bachelor of Science degree in Biochemistry at McGill University. There she developed an interest in research and decided to pursue further studies at the University of Toronto. She is now working under the supervision of Dr. John McPherson at OICR and Dr. Ming-Sound Tsao at the University Health Network.

Tam is using genomics to examine non-coding RNA transcribed from DNA; both are nucleic acids containing genetic material. A small class of non-coding RNA, or microRNAs (miRNAs), is responsible for cell development and proliferation. When altered by inherited traits or environmental factors, miRNAs can cause cancer. Tam analyzes the data collected from miRNA to find its characteristic biomarker or signature. Biomarkers are small molecules found in blood, tissues and bodily fluid, which can indicate or predict disease.

"The use of biomarkers for diagnosis, prognosis and personalized treatment has really just started to emerge," says Tam. "Biomarkers will help us identify the patients that are most likely to benefit from chemotherapy, and those that won't benefit at all, which will make current treatments safer and more effective for patients." This also reduces exposure to the side effects sometimes caused by cancer treatments.

There are many treatment options for lung cancer, yet physicians do not have enough information to know how a patient will respond to a treatment.

Non-small-cell lung cancer (NSCLC) is the most common type of lung cancer, yet current treatment options are limited mainly because there are no effective screening tests for this disease, which means the tumour is not always detected early enough for successful treatment. Tam studies miRNA expression in NSCLC patients to gain a greater insight into the disease.

Tam is tackling the tumour at its molecular level, where the disease begins to develop. Most physicians rely on diagnostic tests to confirm or rule out lung cancer in patients who show signs or symptoms, and to advise them on what sort of treatment should be pursued. NSCLC patients are often diagnosed at a late stage, limiting the effects of treatment like surgery, radiation and chemotherapy on the patient.

"Cancer statistics show that approximately one in four Canadians will die of cancer," she says. "The overwhelming number of new cases reminds cancer researchers of the importance of our work, and the need to eradicate cancer as a major cause of death in the general population." ■

THIWANKA WIJERATNE

Graduate Student

In the past two decades, hormonal therapies like tamoxifen and, more recently, aromatase inhibitors have become an important part of breast cancer treatment. They have been proven to help reduce cancer recurrence and improve patient survival.

But large scale clinical trials suggest there are adverse events associated with these drugs, including an increased risk of stroke. Based on this evidence, many physicians are either reluctant to prescribe hormonal therapies to patients with existing cardiovascular risks or may choose one therapy over the other based on a patient's risk of stroke.

However, the existing studies may present an incomplete picture. Dr. Thiwanka Wijeratne, a graduate student at Women's College Research Institute in Toronto, is taking a different approach to this research. He's conducting a population level observational study that uses de-identified patient data to retrospectively follow all breast cancer patients in Ontario from the 1990s to the late 2000s to see if there is an actual real world relationship between hormonal therapies and stroke as clinical trials suggest.

"Much of the information used for prescribing treatment is currently based on clinical trials," says Wijeratne. "But the population included in clinical trials is very restricted with stringent guidelines about who can enrol in a study. It is very important to look at the real world situation and look at patients with co-morbidities to see how they perform on these medications – and if their outcomes are any different from those people in clinical trials." There is also very little known about how older patients perform with these medications because they are underrepresented in clinical trials. Wijeratne's study focuses on a population over 65 years.

If Wijeratne's research proves that there is no major difference in the risk of stroke between tamoxifen and aromatase inhibitors, two of the most frequently prescribed hormonal therapies for breast cancer, it could mean that both these medications would be a treatment option for many more women. It would also give patients who are currently using these medications peace of mind knowing their treatments aren't increasing their risk of stroke.

"This work will help both clinicians and patients evaluate the real risks or benefits these treatments can offer," Wijeratne says.

The study is near completion at Women's College Research Institute in Toronto. The results form the basis of Wijeratne's master's thesis at the University of Toronto (U of T).

Ontario's health care system provides a unique opportunity for researchers like Wijeratne. Because all patient information is recorded by the health care administrative system using health card numbers, and all patients are in the same system, researchers have access to the entire population over long periods of time.

Ontario, with a relatively large population, is one of very few jurisdictions in the world where this type of research is possible on such a large scale.

Wijeratne first came to Toronto in 2008 from Sri Lanka after completing a medical degree (MBBS) from the University of Colombo in Sri Lanka. He enrolled at U of T as a graduate student in Clinical Epidemiology.

As a lecturer in the Faculty of Medicine at the University of Colombo he developed an interest in pharmacology and pharmacovigilance, the impact of drugs once they are dispensed. "I saw a beautiful merger to look at pharmacovigilance plus cardiovascular outcomes together," he says.

He just completed his thesis this summer while starting a residency in internal medicine at Queen's University this year.

"Young researchers should always be open to pursuing new interests," he says. "It is exciting to be able to go with your instincts, do what you are interested in and not jump into conclusions about what you would ultimately like to do right away."

He hopes to be able to use his current research as a template to answer other, similar research questions. "Breast cancer patients are surviving longer today than ever before, which means that we as researchers must better understand and predict their longer term outcomes thereby offering them a better quality of life." ■

FINANCIAL STATEMENTS
2009–2010

Excerpt from the audited financial statements.

AUDITORS' REPORT

To the Members of the Ontario Institute for Cancer Research

We have audited the statement of financial position of Ontario Institute for Cancer Research as at March 31, 2010 and the statements of operations and surplus and cash flows for the year then ended. These financial statements are the responsibility of the Institute's management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with Canadian generally accepted auditing standards. Those standards require that we plan and perform an audit to obtain reasonable assurance whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation.

In our opinion, these financial statements present fairly, in all material respects, the financial position of the Institute as at March 31, 2010 and the results of its operations and its cash flows for the year then ended in accordance with Canadian generally accepted accounting principles. As required by the Canada Corporations Act, we report that, in our opinion, these principles have been applied on a basis consistent with that of the preceding year.

The financial statements for the preceding year were audited by other auditors.

Ernst & Young LLP

Chartered Accountants
Licensed Public Accountants

Toronto, Canada
June 3, 2010

A copy of the complete audited financial statements is available upon request.

Excerpt from the audited financial statements.

BALANCE SHEET

AS AT MARCH 31	2010	2009
ASSETS		
Current		
Cash	**$ 12,275,907**	$ 9,511,781
Investments	**10,000,000**	10,000,000
Receivables	**3,070,125**	1,981,907
Supplies	**525,915**	599,842
Prepaid expenses	**2,120,874**	1,227,737
Current portion of deferred lease incentive	**124,848**	124,848
Total current assets	**28,117,669**	23,446,115
Long term portion of prepaid expenses	**644,529**	595,537
Deferred lease incentive	**572,222**	697,070
Property and equipment, net	**25,400,320**	24,151,496
Equipment under capital lease	**2,286**	16,001
Note receivable	**451,673**	426,107
	55,188,699	49,332,326
LIABILITIES AND DEFERRED CONTRIBUTIONS		
Liabilities		
Current		
Accounts payable and accrued liabilities	**$ 10,389,442**	$ 8,590,050
Current portion of unearned rental revenue	**102,627**	116,467
Current portion of deferred gain	**180,689**	180,689
Current portion of obligation under capital lease	**5,425**	13,544
Current portion of term loan	**500,000**	–
Total current liabilities	**11,178,183**	8,900,750
Unearned rental revenue	**1,729**	8,645
Deferred gain	**45,172**	225,861
Obligation under capital lease	**–**	5,425
Term loan	**–**	500,000
Total liabilities	**11,225,084**	9,640,681
Deferred contributions	**40,665,857**	36,902,668
Surplus	**3,297,758**	2,788,977
	55,188,699	49,332,326

Excerpt from the audited financial statements.

STATEMENT OF OPERATIONS AND SURPLUS

YEAR ENDED MARCH 31	CANCER RESEARCH PROGRAM	ONTARIO CANCER RESEARCH NETWORK	EXTERNAL GRANTS	2010	2009
REVENUE					
Grants from Ministry of Research and Innovation	$ 67,466,335	$ 12,163,714	$ –	$ 79,630,049	$ 73,255,651
Other grants	2,179,817	–	6,034,778	8,214,595	3,340,396
Rent	1,258,619	–	–	1,258,619	1,357,659
Gain on sale of leasehold improvements	180,689	–	–	180,689	173,160
Fees and workshops	48,976	508,781	–	557,757	1,016,007
Overhead recovery and other income	53,749	–	–	53,749	45,335
	71,188,185	12,672,495	6,034,778	89,895,458	79,188,208
EXPENSES					
Amortization	6,600,592	–	–	6,600,592	5,239,489
Audit	67,650	–	–	67,650	76,875
Capital	31,250	430	–	31,680	68,920
Contracted services	647,279	264,273	658,895	1,570,447	1,269,310
Grants, Cancer Research Fund	–	8,707,905	–	8,707,905	8,977,886
Grants, Tumour Bank Operations	–	886,037	–	886,037	883,058
Honoraria	124,448	70,388	–	194,836	161,340
Information system support	884,584	572,965	60,572	1,518,121	2,150,398
Insurance	91,444	–	–	91,444	76,900
Investigator and research support, external	34,915,397	–	2,674,707	37,590,104	35,179,932
Legal	82,921	31,631	–	114,552	167,976
Marketing and communications	237,683	21,218	2,573	261,474	249,751
Maintenance, office and general	1,553,664	167,306	18,331	1,739,301	1,115,523
Rent	4,184,651	49,500	–	4,234,151	3,991,732
Research operations, internal	7,125,889	–	1,211,583	8,337,472	6,108,899
Salaries, benefits and recruiting	13,817,453	1,192,332	1,324,567	16,334,352	11,557,827
Travel	552,746	137,539	80,381	770,666	620,332
Workshops and conferences	270,534	62,190	3,168	335,892	322,607
	71,188,185	12,163,714	6,034,778	89,386,677	78,218,755
Excess of revenue over expenses	–	508,781	–	508,781	969,453
Surplus, beginning of year	–	2,788,977	–	2,788,977	1,819,524
Surplus, end of year	$ –	$ 3,297,758	$ –	$ 3,297,758	$ 2,788,977

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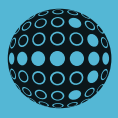
11 trees preserved (1 ton of wood)

3 million BTU's net energy not consumed

999 lbs. greenhouse gases prevented

4,813 gallons wastewater flow saved

292 lbs. solid waste not generated



Ontario Institute
for Cancer Research

science → discoveries → solutions

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