



Strategic Plan

2010-2015

OICR timeline *from 2000 to 2010*



The Government of Ontario asked Dr. Calvin Stiller to lead a group to recommend how a \$50 million investment in cancer research could have the greatest impact.

Cabinet approved the Stiller Committee recommendation to focus on translational research related to development of new cancer therapies.

The Government of Ontario created the Ontario Cancer Research Network (OCRN), a three-year initiative with three components: Cancer Research Fund Virtual Information Network Tumour Bank Network.



The Government of Ontario hired Dr. Robert Phillips to set up and run OCRN.

OCRN was incorporated as a federal not-for-profit corporation.

OCRN's board of directors held its first meeting. Mr. George Glover was appointed the first chair of the board of directors.

05 . 2000

12 . 2000

11 . 2001

09 . 2000

09 . 2001

01 . 2002

The Cancer Research Fund held its first grant competition.

The Government of Ontario announced \$50 million in additional funding for OCRN, extending its mandate to four years.



The Ontario Innovation Trust provided funding to explore what it would take for Ontario to make a significant impact on cancer; Mr. George Connell, Dr. Louis Siminovitch, Dr. Charles Hollenberg, Ms. Michele Noble and Dr. Patrick Lafferty began work on a proposal.



Dr. Bette Stephenson

The Government of Ontario announced it would spend \$1 billion over 10 years to create a cancer research institute; Drs. Bette Stephenson and Calvin Stiller were asked to spearhead the development of the institute.



Dr. John Evans was appointed chair of OCRN's board of directors.

Drs. Stephenson and Stiller submitted their report to the Government of Ontario.

05 . 2002

07 . 2002

03 . 2003

10 . 2003

01 . 2004

06 . 2002

The Government of Ontario announced its intent to create a new cancer research institute and asked OCRN to evolve into the new institute.

OCRN's board of directors was expanded to include representatives of the University Health Network (UHN) (Princess Margaret Hospital), Cancer Care Ontario, the Council of Ontario Universities and the Council of Academic Hospitals of Ontario. It became the founding board of directors of the new institute.



Ontario Premier Dalton McGuinty announced the launch of the Ontario Institute for Cancer Research (OICR) at a news conference at the Hospital for Sick Children in Toronto.



Dr. Elizabeth Eisenhauer



Dr. Phillip Sharp

OICR appointed Dr. Elizabeth Eisenhauer, Director, Investigational New Drug Program NCIC Clinical Trials Group, Professor, Department of Oncology, Queen's University and Co-Chair Canadian Cancer Research Alliance and Dr. Phillip Sharp, Institute Professor, Center for Cancer Research, Massachusetts Institute of Technology, as co-chairs of, as well as seven members to, its Scientific Advisory Board (SAB).

OICR's board of directors began a search for the founding President and Scientific Director.

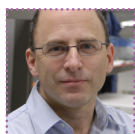
05 . 2005

12 . 2005

12 . 2005

01 . 2006

06 . 2005



Dr. Tom Hudson was appointed President and Scientific Director. Dr. Phillips was appointed Deputy Director.

Dr. Hudson began consultation with the Ontario cancer research community and external experts to develop a strategic research plan.

The SAB held its first meeting and discussed strategic directions for OICR.

The Ministry of Research and Innovation approved OICR's strategic plan.

02 . 2007

Dr. Robert Sutherland was appointed Vice-President, Commercialization.

OICR joined the RNAi Consortium based at the Broad Institute of Harvard and MIT. The Consortium will create research reagents consisting of specific RNAi inhibitors targeting human and mouse genes which will be used to discover key genes underlying normal physiology and disease.



The Premier of Ontario announced the creation of the Cancer Stem Cell Consortium at an event at MaRS with California Governor Arnold Schwarzenegger. He also announced \$30 million in funding for this initiative.

06 . 2006

09 . 2006

04 . 2007

07 . 2006

03 . 2007

05 . 2007

OICR launched the Intellectual Property Development and Commercialization Program (IPDCP) to facilitate the development and commercialization of cancer-related discoveries.



The Terry Fox Foundation announced the creation of the Terry Fox Research Institute (TFRI). The TFRI established nodes across Canada and launched the Ontario node in partnership with OICR.

OICR contributed funding for the creation of the Centre for Probe Development and Commercialization (CPDC), a Centre of Excellence for Commercialization and Research, funded by the federal Networks of Centres of Excellence. The CPDC is the world's first facility focusing on all areas related to the development of molecular imaging probes.



OICR hosted its first Annual Scientific Meeting.

OICR awarded up to \$500,000 each to four recipients to continue the early commercial development of their discoveries.

OICR invested in five signature initiatives: Cancer Stem Cell Program (\$17 million); One Millimetre Cancer Challenge (\$12.5 million); Imaging Pipeline Platform (\$10 million); Cancer Research Fund (\$8.7 million); and state-of-the-art equipment in 11 research institutions across Ontario (\$9.8 million).

07 . 2007

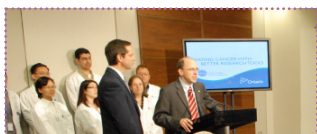
10. 2007

02 . 2008

02. 2008

04 . 2008

04 . 2008



The Premier of Ontario announced the launch of the International Cancer Genome Consortium (ICGC) at a news conference at MaRS. OICR was selected by the Consortium to house the Data Coordination Centre and host the Secretariat for the ICGC.



The Canadian Partnership Against Cancer (CPAC) announced the launch of The Canadian Partnership for Tomorrow Project with \$42 million in funding. The Project will study 300,000 Canadians to explore how genetics, environment, lifestyle and behaviours contribute to the development of cancer. OICR is a partner in the project; its Ontario Health Study will follow 150,000 people in Ontario for 20 years.



A single dream. A world of hope.
The Terry Fox Foundation

OICR and the TFRI launched the Selective Therapies Target Identification Program.

OICR invested \$500,000 in DVS Sciences Inc., for a novel technology to facilitate the identification of biomarkers to study and diagnose cancer.

04 . 2008

06. 2008

06 . 2008

07 . 2008



The ICGC announced the launch of eight cancer genome projects by 11 funding organizations. Ontario scientists are sequencing pancreatic cancer.



Dr. Stiller was appointed chair of OICR's board of directors.

GE Healthcare announced that Hamilton is the first site in the world to receive new prototype technologies for molecular breast imaging research because of the strong research partnerships among OICR-funded scientists at the Centre for Probe Development and Commercialization and the oncology and nuclear medicine programs at McMaster University and Hamilton Health Sciences.

OICR invested \$2.25 million in five promising early stage cancer technologies to continue the early commercial development of these discoveries.

The Premier of Ontario announced funding of \$10 million through OICR for the Ontario Regional Biotherapeutics Program (ORBiT) to develop therapies based on cells, genes and viruses, which can be programmed to target diseased tissue without harming normal tissue.

OICR received \$12.5 million from the Canada Foundation for Innovation to support the Pancreatic Cancer Genome Project and the Data Coordination Centre for the ICGC.

01. 2009

01. 2009

04. 2009

06 . 2009

06. 2009

Pfizer Global Research and Development announced an investment of \$6 million in the POP-CURE Project, a partnership of Pfizer, OICR, and the Ontario Cancer Institute, the research arm of UHN's Princess Margaret Hospital. POP-CURE will discover and validate new targets for the diagnosis, prognosis and treatment of colorectal cancer. The Government of Ontario awarded \$900,000 to Pfizer through its Biopharmaceutical Investment Program for the POP-CURE project.



Dr. Nicole Onetto



Dr. Eric Lander

Dr. Phillips retired as Deputy Director of OICR and Dr. Nicole Onetto was appointed Deputy Director. Dr. Sharp resigned as co-chair of the SAB. Dr. Eric Lander, President and Founding Director of the Broad Institute of MIT and Harvard was appointed co-chair of the SAB (with Dr. Eisenhauer).



Mr. Frank Stonebanks

Dr. Sutherland retired as Vice-President, Commercialization and Mr. Frank Stonebanks was appointed Vice-President, Commercialization and Chief Commercial Officer.

07 . 2009

11. 2009

02 . 2010

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Background

Vision

The Ontario Institute for Cancer Research (OICR), launched December 2, 2005, is a new centre of excellence that is moving the province to the forefront of discovery and innovation in cancer research. OICR is making Ontario more effective in knowledge transfer and commercialization, to maximize the health and economic benefits of research findings for the people of Ontario.

Strategic Plan 2007-2010

In keeping with the directions set in its first Strategic Plan for 2007-2010, OICR has, in a remarkably short period, distinguished itself by taking on significant challenges in cancer research with multi-disciplinary, multi-institutional teams to tackle the incidence, diagnosis, management, morbidity and mortality of cancer. OICR has invested significantly in translational research that will move new discoveries in prevention, detection and treatment of cancer directly from the bench to practical applications in patients.

OICR has established major partnerships with public organizations: in Ontario, e.g., Cancer Care Ontario (CCO); in Canada, e.g., the Terry Fox Research Institute (TFRI) 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 (GEHC) and discussions are ongoing with a variety of other commercial organizations. These partnerships have generated more than \$100 million of direct support for OICR programs based in Ontario and more than \$250 million for 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.

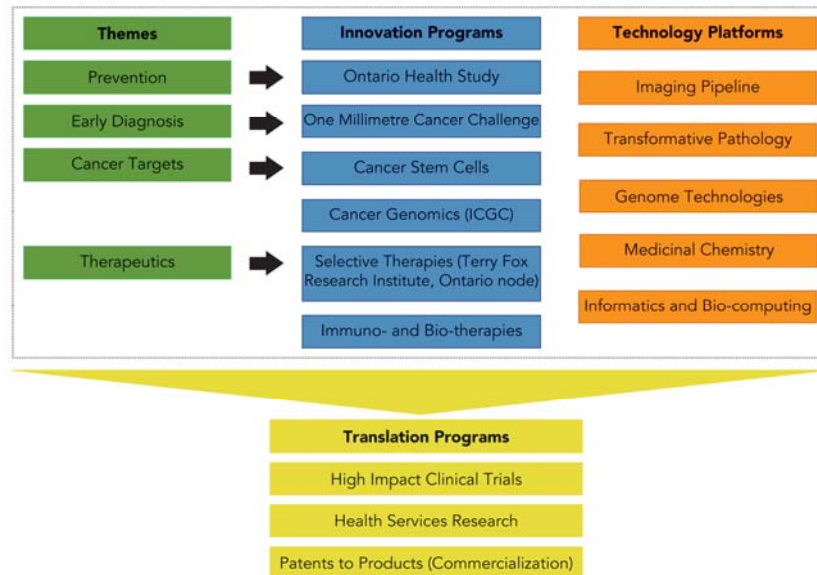
Between 2008 and 2010, OICR's Intellectual Property Development and Commercialization (IPDC) Program made twelve investments to advance Ontario discoveries to market and create high-value jobs in the province. Of these, two have already raised \$5 million in seed or 'A' round financing to advance their business models and one is generating revenues through sales. OICR's strengthening of Ontario's cancer clinical trials infrastructure has continued to attract significant biopharmaceutical investment in what has become one of the highest recruitment jurisdictions in North America for cancer clinical research.

Strategic Plan 2010-2015

OICR's research ethos starts with a deep commitment to understanding the biology of cancer and developing novel prevention, early detection, therapeutic approaches and follow-up programs that can be tailored to subsets of patients where they can be most effective. OICR's research and clinical activities have been carefully selected to concentrate on areas of unmet clinical need. These activities are built on Ontario's acknowledged global strengths and include:

- prevention, through the Ontario Health Study;
- early diagnosis, with new imaging techniques to detect very small tumours;
- target identification, through the cancer stem cells and genomics programs;
- therapeutics, through the selective therapies initiative;
- biological therapeutics associated with specific diagnostic tests or biomarkers, leading to more personalized medicine.

OICR Blueprint



The Institute's second Strategic Plan, for 2010-2015, builds on the foundation of the first Strategic Plan for 2007-2010. It sets out the directions to be undertaken to move towards the realization of the Institute's vision that will lead to health and economic benefits for the population of Ontario. The Strategic Plan articulates the fundamental importance of sustaining the ongoing OICR flagship programs to reap the benefits from these investments to date. It also identifies approaches to capitalize on emerging opportunities to further advance the achievement of OICR's goals.

In its first five years, OICR focused on creating or enhancing existing infrastructure, recruiting outstanding scientists and launching new programs and technology platforms to establish the foundation necessary to fulfil its translational research and commercialization missions. The organization has reached a level of maturity allowing it to set ambitious goals that will: 1) result in tangible patient benefits within a five year time horizon; 2) bring it to the leading edge of high risk/high gain science that could yield significant breakthroughs within the next decade; and 3) achieve success in commercialization.

The OICR Strategic Plan 2010-2015 was generated in parallel with the Pan-Canadian Cancer Research Strategy 2010-2014 and the National Breast Cancer Research Framework. These efforts involved dozens of cancer funding agencies and more than 1,000 clinicians, researchers, patients, and policymakers. A key outcome of OICR's participation in these planning efforts has been a tight coordination among funding organizations, particularly in the development of new translational initiatives. OICR assumed national leadership in many areas, including training and dissemination of bioinformatics tools related to cancer genomes to the Canadian cancer research community for the acceleration of translational research and the development of a collaborative Canadian cancer drug development program. Planning meetings of the Canadian Cancer Research Alliance led to a new partnership with Prostate Cancer Canada (PCC) and Cancer Research UK (CRUK) to support a large-scale cancer genomics project that will analyze five hundred prostate cancer genomes.



OICR and Ontario organizations hosting OICR initiatives in 2009

1 Ontario Institute for Cancer Research

Located in the MaRS Centre (Toronto)

- 180 scientists and staff

Host of two OICR Programs:

- Cancer Genomics including the ICGC's Secretariat and Data Co-ordination Centre
- High Impact Clinical Trials (co-hosted with Queen's University in Kingston)

Host of four OICR Platforms:

- Genome Technologies
- Informatics and Bio-computing
- Medicinal Chemistry
- Transformative Pathology

Central office for:

- Ontario Cancer Research Ethics Board (OCREB)
- Ontario Tumour Bank (OTB)
- Clinical Trials Infrastructure Program
- Next Generation Clinical Training Program

▲ Institutions Using OCREB

◆ OTB collection centres

■ Clinical Trials Centres supported by OICR

OICR host institutions

2 Institute for Clinical and Evaluative Sciences (Toronto)

- Health Services Research Program

3 McMaster University (Hamilton)

- Centre for Probe Development and Commercialization (CPDC)

4 Sunnybrook Health Sciences Centre (Toronto)

- One Millimetre Cancer Challenge

5 University Health Network (Toronto)

- Cancer Stem Cell Program
- Selective Therapies Program

6 University of Ottawa (Ottawa)

- BioTherapeutics (ORBiT) Program

7 University of Western Ontario (London)

- Imaging Pipeline Platform

Clinical Trials Networks

8 NCIC Clinical Trials Group (NCIC-CTG)

- Based at Queen's University in Kingston
- Adult cooperative oncology group with national membership
- Spans Phase I testing of novel new agents to large Phase III trials

9 Ontario Clinical Oncology Group (OCOG)

- Based at McMaster University in Hamilton
- Cooperative trials group that evaluates drugs, technologies and quality of care

10 PMH Phase I and II Consortium

- Based at Princess Margaret Hospital in Toronto

Coordinates Phase I and II trials sponsored by the National Cancer Institute (NIH, USA)

11 Cancer Care Ontario (CCO)

Provincial agency responsible for the delivery of cancer services in Ontario:

- Accountable to the Ministry of Health and Long-Term Care (MoHLTC)
- Implements provincial cancer prevention and screening programs
- Develops and implements quality improvements and standards
- Coordinates regional cancer programs in all 14 Local Health Integration Networks

Headquarters of the Ontario Health Study (OHS)

OHS recruiting sites:

▲ Mississauga

▲ Sudbury

▲ Owen Sound

Integrated programs with OICR:

- Health Services Research
- High Impact Clinical Trials

Grand Challenges in Cancer Research

To develop and implement an ambitious strategy to transform the cancer continuum and thereby reduce the burden of disease, OICR first needs to recognize the enormous challenges that it faces. These challenges are summarized as follows:

1. Cancer is a complex disease.
Every tumour is different. Every cancer patient is different.
Transformation requires understanding specific changes in a patient's tumour as well as the patient's genetic variants and tailoring interventions based on the profile of the tumour and the patient (i.e., personalized medicine).
2. Cancer is diagnosed late in the disease process.
Most tumours are identified when there are more than 100 million (and often one billion) cancer cells – at stages where treatment interventions are less effective.
Transformation requires understanding and targeting interventions at early stages – from the origin (cancer stem cells) to clinically-relevant micro-tumours.
3. Cancer is a disease that can affect any member of our society.
Cancer varies according to environmental or genetic factors. Everyone is at risk of developing cancer because the predisposing mutations often come about as naturally occurring errors during the normal growth of cells. Cancer control requires preventive and therapeutic interventions that reach every member of society, irrespective of age, language, education, cultural group, or socio-economic status.
Transformation requires population interventions as well as direct means of delivering a complex portfolio of services uniquely applicable to each individual in that population.
4. Optimal cancer care requires new cancer care services, technologies and therapeutic interventions that the healthcare system can afford.
Transformation requires an understanding of costs and benefits, and an approach to balancing these costs and benefits to optimize the interventions available to the residents of Ontario. The magnitude of this challenge requires stronger collaborations among academic researchers, private industry and government agencies at the provincial, national and international levels.

ACCELERATING TRANSLATION

OICR Translation Priorities

OICR leaders have identified the need to formulate translation priorities that are aligned with and will support OICR objectives. These priorities will use the operational framework (e.g., Innovation and Translation Programs and Technology Platforms) established in the first years of the Institute. To achieve the Institute's ambitious objectives and hasten the translation of cancer discoveries with high potential for impact, OICR will engage additional stakeholders in academia, industry, healthcare organizations and government willing to work together on important but complex problems that OICR cannot tackle alone.

Four translation priorities have been selected:

1. Adoption of more personalized medicine for cancer.
2. Solutions to clinical issues that could benefit patients in the next five years.
3. Digitization and interpretation of cancer data.
4. Acceleration of OICR's Patents to Products Program.

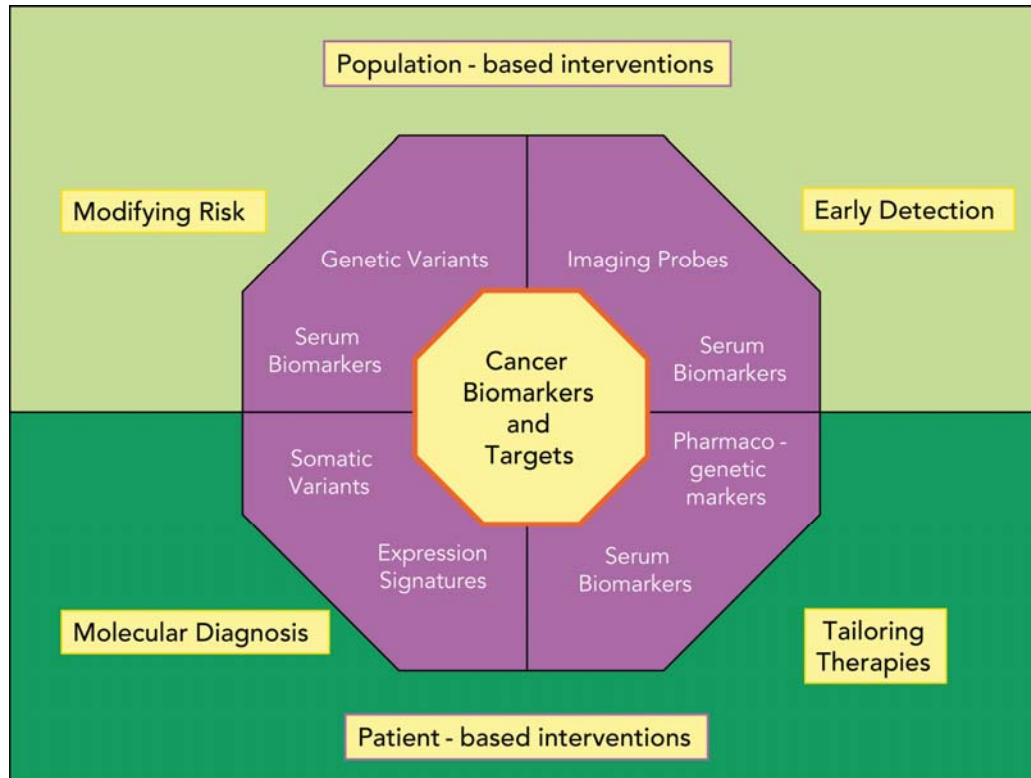
Adoption of more personalized medicine for cancer in Ontario

Solutions for many of the great challenges in cancer research will be realized in the context of an evolving landscape of clinical medicine that will better tailor interventions to patients, a concept widely referred to as "personalized medicine." Personalized medicine is defined by the National Cancer Institute in the U.S. as "A form of medicine that uses information about a person's genes, proteins and environment to prevent, diagnose, and treat disease." While conventional medicine has always attempted to practise personalized medicine, conventional practice of patient care relies on the symptoms and signs detected upon physical examination by a clinician. In this paradigm, patients with the same signs and symptoms receive the same treatment. The new approach to personalized medicine is a natural evolution of clinical medicine that comes from a better understanding of disease, which shows that the same disease defined by clinical presentation can have multiple underlying causes. Progress in knowledge of the diversity of genomic alterations that can lead to a similar clinical presentation has created an understanding that therapies should not be guided only by clinical symptoms but should be based on an understanding of molecular, genetic and functional alterations specific to each patient or subset of patients.

One of the most striking insights that has arisen in common diseases such as diabetes, atherosclerosis and cancer has been that different patients with similar symptoms have many differences affecting many genes, and that these differences can stratify individuals into distinct subsets with regard to risk, subtype of disease and response to therapy. These observations provide the rationale for a new approach to personalized medicine and even in their infancy, generate exciting implications with regard to the potential to transform clinical management of patients. The implications are also daunting, particularly for clinicians, patients and healthcare systems striving for better health care at an affordable cost. The stratification of similar diseases into many subtypes, each requiring a unique therapy, will lead to the creation of many new treatment interventions. Although the cost of targeted therapeutics in a variety of diseases will be high, predictive genomic tests will identify those patients who will respond to these drugs and can help select subpopulations of patients that will benefit most from these interventions. From health economics perspective it will be important to evaluate the cost effectiveness of these new therapies, which would require the coexistence of expertise spanning genomic discovery and clinical/health outcome research. In addition, new tools may

allow physicians to rapidly evaluate response to treatment and shorten therapies that are ineffective and potentially toxic.

Key to implementing more personalized medicine is the development of reliable biomarkers that inform the physician of disease prognosis as well as the effect of treatment interventions. This should allow for the development of therapies that target the underlying cause and not just the symptoms of the disease. The figure below shows how cancer biomarkers will lead to a broad range of tests and interventions that will impact cancer patients, populations and health care.



Personalized Medicine will develop at different speeds for different diseases. In the case of cancer – it has already started and cannot be ignored, because its first applications are compelling. New drugs such as Roche/Genentech's Herceptin[®] (trastuzumab) and Novartis' Gleevec[®] (imatinib) treat categories of breast tumours and leukemia respectively that harbour specific tumour markers or molecular alterations. The drugs are responsible for significant decreases in morbidity and mortality, but only in patients whose tumours have specific protein or signalling pathway abnormalities. In the case of trastuzumab, clinical and pathology laboratories as well as regulatory agencies had to rapidly adopt the companion tests (called theranostics) to identify the responsive subsets of patients. An equally striking example of gene-based tests that inform drug therapy is K-RAS mutation detection, as patients with such mutations do not respond to expensive drugs that inhibit a growth factor receptor (EGFR) commonly found in colonic tumours. A fourth example is Oncotype DX, which is a test that examines genes expressed in a breast cancer patient's tumour tissue. Its ability to predict whether a patient will benefit from chemotherapy has justified its high cost to U.S. payers (> \$3,000) because of its ability to spare chemotherapies in subsets of women. These examples illustrate how target- specific tests are used to make decisions on prescribing expensive products. They have the potential to optimize patient care, prevent the administration of ineffective therapies to subsets of patients and save costs for healthcare payers.

Finally, the implementation of personalized medicine will require the translation of complex data generated, for example, from extensive genetic analyses of patient tumours and sophisticated imaging techniques generated in pre-clinical and clinical studies aimed at optimizing treatment interventions. OICR is well poised to be a significant player in the establishment and validation of personalized medicine, as a result of its extensive experience in genomics, target validation, biomarker discovery, imaging technologies, clinical research infrastructure and health outcome expertise. OICR is also in a unique position to facilitate partnerships with the private sector.

Partnership with healthcare providers, payers and policymakers in Ontario

OICR will only succeed in its mission if personalized medicine products and services are appropriately transferred to healthcare agencies and institutions that deliver health care in Ontario. OICR has thus entered into a new partnership with CCO and the Ontario Medical Advisory Secretariat (MAS), a division of the Ministry of Health and Long-Term Care (MoHLTC). This partnership will catalyze opportunities for translation of personalized cancer services and products in Ontario. The initial goals are to establish prognostic and predictive genetic tests in cancers that guide the proper and effective use of cancer therapies. The program will monitor efficacy and produce full economic analyses. Over time, other modalities of personalized medicine will be dealt with.

The MAS is comprised of health-care specialists, including physicians, clinical epidemiologists, policy analysts and health economists. The MAS produces evidence-based analyses of health technologies that are then published in the Ontario Health Technology Assessment Series, which lead to recommendations to the MoHLTC. MAS oversees and funds field evaluations for technologies that appear promising, but for which there is inadequate evidence. Ontario has one of the largest field evaluation programs in the world.

CCO is a key partner since it has the direct links with the entire pathology, imaging and treatment clinical communities and with hospitals providing cancer services. The research expertise of OICR and the clinical interface provided by CCO together create a unique opportunity to advance the personalized medicine agenda on a large, indeed, population-based, scale. Specific programs embedded within CCO are relevant to the adoption of personalized medicine for cancer. Firstly, the same person is the head of CCO's Experimental Therapeutics Research Network and OICR's High Impact Clinical Trials Program. This enables good dialogue between CCO and OICR about the relevant research questions in personalized medicine. Secondly, the Ontario Clinical Oncology Group (OCOG) coordinates large randomized controlled trials; its track record in conducting trials of effectiveness of positron emission tomography (PET) imaging is now viewed as outstanding work by the international community, particularly as cost effectiveness research essential to the adoption of new technology in a government-funded healthcare system. Thirdly, CCO's New Drug Funding Program (NDFP) has the potential to help facilitate and oversee registration trials. In this model, a new cancer drug/biologic with evolving evidence of efficacy could be approved by the existing MoHLTC mechanism under the category of "conditional listing with post-market surveillance." This would allow for the accumulation of real world experience with a new drug under quasi-experimental conditions. The NDFP would administer these cohort studies. With direction from the Experimental Therapeutics Network and CCO's Molecular Oncology Oversight Committee, appropriate molecular tests would be performed to identify subsets of patients with differential benefit from the new drug/biologic. The CCO Health Economic Unit would then conduct a cost effectiveness analysis of this real world experience to advise the MoHLTC on whether, and under what conditions, new drugs/biologics should remain publicly funded on an ongoing basis. Finally, CCO's

Program in Evidence-Based Care would produce an evidence-based guideline to inform individual treatment decisions.

The NDFP associated with the Evidence-Based Case approach is an appealing model for several reasons: it would enhance access to new cancer drugs for the patients and clinicians who want to use them, provide the MoHLTC with Ontario-derived data on which to base permanent listing decisions for new drug/biologics, provide more precise guidance to clinicians and patients and it might be appealing to biopharmaceutical companies who currently face challenges in getting new expensive drugs added to the public formulary.

The partnership will catalyze opportunities at many levels:

Level 1: OICR, CCO and MAS propose to initiate a collaboration that will focus on molecular tests that are used to guide the use of targeted therapies, e.g., trastuzumab (Her2 test), EGFR inhibitors (K-RAS mutation), or to help decide whether or not a conventional treatment is appropriate according to the characteristics of the tumour (Oncotype DX). This initiative will provide an opportunity to align expertise in partner organizations with opportunities and challenges of immediate relevance to the delivery of potential new therapies that require the incorporation of new diagnostic services. The partners will evaluate recent experience in Ontario, Canada, the United States and Europe. They will examine scientific and clinical evidence, implementation challenges and factors that influence policy decisions. They will leverage Ontario's expertise in clinical trials and health services research (including health economics) to develop guidelines for evaluating drug/diagnostic products that will allow cost effectiveness to be evaluated in parallel with efficacy and safety, so that the studies are powered to detect clinically meaningful results at costs that society considers acceptable.

Level 2: CCO, OICR and MAS will move from reactive to proactive decision-making for the many dozens of similar tests/drugs that are already in clinical development. They will develop a framework that will allow evidence-based decisions to be accelerated and prioritized, based on potential impact to patients. A process will be developed to create clear guidelines for practitioners, as well as their rapid dissemination. Clinical and pathology laboratories will upgrade sample-processing and molecular testing systems (automation, instrumentation and informatics upgrades may be necessary). The partnership may evolve to enable mechanisms that would measure the effects of treatments at earlier stages, and/or allow treatment optimization of targeted therapies at all stages (prior, during, or after).

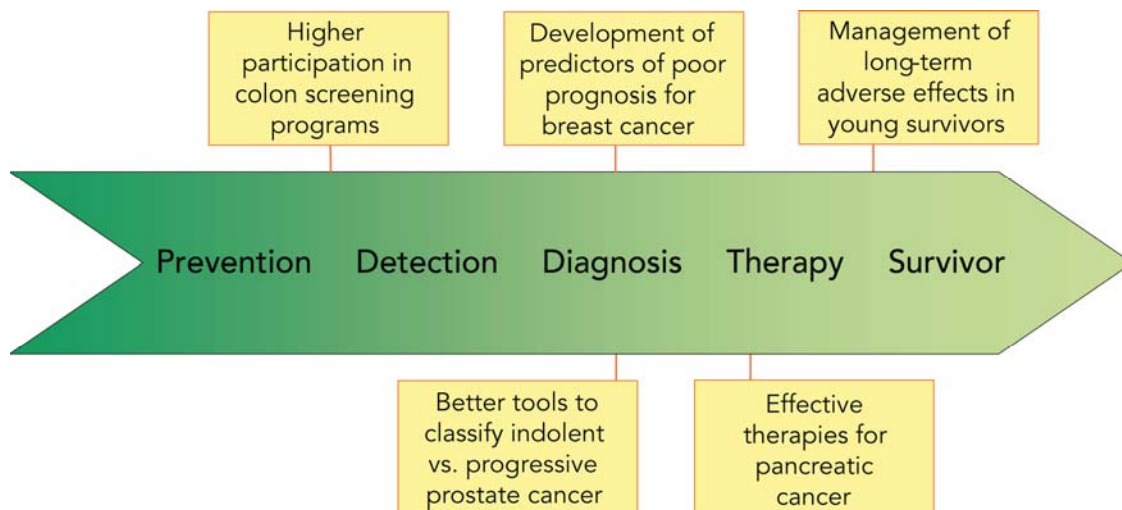
Level 3: They will engage additional stakeholders in government (Ministry of Research and Innovation, Ministry of Economic Development and Trade, Health Canada), experts in other disease sectors and industry to create a fertile environment in Ontario to support companies that develop products for personalized medicine (pharmacogenomics, target identification/drug development, diagnostic, imaging, etc.). They will work with regulatory agencies to streamline approaches for approval of targeted therapies or new diagnostic and/or prognostic tests.

This initiative combines OICR's research and translational expertise in cancer with MAS and CCO's evaluative and evidence-based capabilities to enhance patient care, provide cost savings and maximize cost effectiveness for the Ontario healthcare system. It will also establish a platform for Ontario-based discoveries to be used locally and worldwide.

Solutions to clinical issues that could benefit patients in the next five years

Ontario's clinical leaders have identified five clinical challenges of high priority for patients with cancer, cancer survivors, physicians and public health that can benefit from existing expertise within OICR. OICR aims to achieve results that will have an impact within five years.

By focusing on problems that span the continuum of cancer care, OICR researchers will make advances that are of clinical utility for specific issues, but at the same time inform on strategies for other cancer types that face or will face similar challenges. For example, clinicians are realizing more and more that over-detection, over-diagnosis, and overtreatment of both prostate and breast cancer are leading to potentially unnecessary invasive therapy and complications. This issue merits consideration for other tumour types as new technologies arise to screen for them.



1. High fatality rate of pancreatic cancer

OICR will identify targets and new therapies through its large-scale genomic analyses of pancreatic cancer. Clinical impact over a five-year period may be realized by defining subsets of patients with tumours containing mutations in gene pathways that can be targeted by existing drugs or compounds in clinical development.

Although less common than breast, colon, lung and prostate cancer, the lethality of pancreatic cancer makes it the fifth leading cause of cancer death. It has a one per cent lifetime risk and an overall five-year survival rate of only five per cent - an outcome that has not changed appreciably in the last 30 years. Pancreatic ductal adenocarcinoma (PDAC) is resistant to most chemotherapeutic agents and is highly metastatic. Most cases are diagnosed after the cancer has already spread to regional lymph nodes and more distal sites. Only 15-20 per cent of pancreatic tumours can be surgically resected due to early involvement of major vessels or other vital organs.

2. Over-diagnosis of prostate cancer

OICR will seek urine, serum, imaging and pathological markers that predict aggressive disease. OICR's imaging groups have developed technologies to guide repeat prostate biopsies and optimize the characterization of significant tumours needing treatment. Magnetic Resonance Imaging (MRI) studies suggest a potential role in active surveillance and screening. MRI parameters derived from apparent diffusion coefficient and MR spectroscopy have been correlated with cancer risk. Although further validation in screening and surveillance is needed, it is hoped that by improving patient selection and targeting of prostate biopsy, over-diagnosis can

be reduced through the identification of patients who really need interventions at early stages. A new collaboration between Prostate Cancer Canada, Cancer Research UK, and OICR will generate comprehensive genome datasets from indolent and aggressive tumours, from which novel candidate biomarkers will be identified, leading to future tools to guide this initiative.

The risk of over-diagnosis is now a well recognized issue in prostate cancer and is related to the extent and frequency of PSA screening. Recently published randomized trials of screening in Europe and North America showed a much higher incidence of prostate cancer in the screened group. Over-detection rates have been estimated at 48 per cent for a four-year screening program in men aged 55-67. An estimated 48 additional men would need to be treated to prevent one death. The treatment of prostate cancer with radical prostatectomy or radiation therapy carries quality of life altering risks such as sexual, urinary and rectal dysfunction as well as financial and emotional burdens. There is unquestionably a need for screening and surveillance methods that would allow for better characterization of clinical prognostics and for determining the best treatment strategy (type and timing of intervention). In concert with this, there is a need for effective therapies that have fewer side effects than current approaches for the most aggressive tumours that require treatment either at an early stage or in the metastatic setting.

3. Over-aggressive treatment of early stage breast cancer

OICR will develop imaging and pathological markers that predict the risk of metastatic disease. OICR has a unique opportunity to have an impact as a result of having brought together breast cancer biologists and imaging probe developers with Ontario teams that have made significant contributions to breast cancer imaging, including MRI. OICR also supports the development of improved quantitative pathology to be used in the validation of new biomarker-based imaging techniques.

In breast cancer over-diagnosis refers to the possibility that not all diagnosed cancers would become lethal, i.e., that some, if untreated, would remain innocuous or might even regress. This idea has been put forward by several authors, who have gone further to suggest that a considerably less aggressive treatment could be used for some types of cancer. This suggestion has been made particularly for ductal carcinoma *in situ*, but also for some more invasive biological types. There is considerable variation in estimating how much over-diagnosis actually exists. Unfortunately, at present there are no reliable screening methods that can distinguish between aggressive cancers and those that are not. Furthermore, even current pathology tools provide limited information with which to make treatment decisions. Therefore, to avoid over-diagnosis and more importantly, overtreatment, there is a need for more specific diagnostic tools as well as for more informative pathology techniques that will provide better prognostic information. This could help define whether a cancer requires treatment and how aggressive the treatment should be. OICR will involve its health research team, CCO, and the MAS to validate the relevance of new guidelines developed as a result of these new diagnostic tools.

4. Maximizing participation in population-based screening programs with a focus on colon cancer screening

OICR is partnering with CCO to develop interventions that will increase colorectal cancer (CRC) screening and increase participation in ColonCancerCheck, Ontario's \$193.5-million investment over five years to establish a colorectal cancer screening program. OICR also supports internationally recognized studies into the genetic and environmental causes of colorectal cancer and the development and evaluation of risk assessment tools that may optimize CRC screening programs.

CRC is the second leading cause of cancer-related death in Canada. Because mortality can be reduced through screening programs, it is one of the key causes of avoidable cancer-related death. There is strong evidence from large, well-designed randomized controlled trials that regular screening using fecal occult blood testing (FOBT) reduces both incidence and mortality from CRC. Unfortunately, historically, colon screening rates in Ontario have been poor. They are now demonstrating improvement with the introduction of the ColonCancerCheck program. Prior to ColonCancerCheck, only 23 per cent of people over 50 years of age reported ever having had colorectal cancer screening. Preliminary estimates indicate that this may have increased to more than 40 per cent for FOBT, although the total number appears to exceed 50 per cent when primary screening colonoscopy is added to the mix. These numbers nevertheless remain low in contrast to leading jurisdictions and health-care plans internationally.

Population-based interventions to increase screening participation are complex. Screening requires people who are well to sustain activity without an immediate direct benefit, and potential risks, costs, and inconvenience, over many decades to benefit. Consequently, there is a need to constantly re-evaluate and improve approaches. OICR is currently supporting research to maximize population participation in screening programs. Through partnerships with CCO and the MoHLTC, these studies evaluate the use of data systems derived from the universal health-care system to identify eligible members of the population who have not had screening and directly reach out with evidence-based interventions to both patients (through screening invitations and reminders) and their primary care physicians (with practice management tools, awareness outreach, and performance feedback) to increase screening rates by FOBT or colonoscopy, as appropriate. Future studies will examine ways to improve the quality and completeness of followup after an abnormal screen, and ways to reach vulnerable populations. The results of this line of inquiry can ultimately be generalized to almost any emerging screening modality, including biomarkers from blood and other tissues or new imaging techniques, as well as to screening for different types of cancer.

5. Long-term adverse effects affecting children and young adults

OICR will partner with other Canadian agencies seeking to create a national program to improve quality of life for young cancer survivors.

It is estimated that approximately 10,000 children and young adults will be diagnosed with cancer this year in Canada. There are currently more than 150,000 Canadians with a personal history of having been diagnosed and treated for cancer prior to middle age. These survivors face a number of challenges not shared by patients diagnosed later in life:

- Growth and developmental disorders;
- Long-term toxicities appearing several years after discontinuation of initial treatments;
- Emotional and social integration problems.

Despite these specific challenges, this group of cancer survivors has received relatively little attention and is now identified as a priority area for research by national and international cancer research bodies. OICR can provide expertise as a result of its pharmacovigilance research initiatives examining the long-term effects of cancer drugs and variation in follow-up practices, as well as its engaged scientists from the radiation oncology, surgical oncology and social science communities, among others.

Digitization and Interpretation of Cancer Data

New technologies used to screen, detect, diagnose, and monitor cancer are data-intensive. The promise of personalized medicine will not be achieved without parallel efforts to handle the management and delivery of clinically useful and easily interpretable information for healthcare providers. This will be challenging for many reasons:

1. There will be many different data types, including:
 - a. clinical and pathological annotations;
 - b. genomic, epigenomic, transcriptomic and proteomic profiles of normal and cancer tissues;
 - c. digital images from multiple radiological technologies and pathology;
 - d. safety outcomes, quality of life and health economic measures.
2. As the digital technologies increase in scale and sophistication, the data files they generate are rapidly increasing in size. A prominent example is genome sequencing technologies, where the data generation rate is increasing more than twice as rapidly as corresponding increases in data storage technologies, network bandwidth or CPU speed.
3. Many new data-intensive datasets of potential use in clinical management are not standardized, poorly annotated and provide insufficiently validated information to guide clinical decisions.
4. There are inadequate linkages between efficacy, safety, outcomes and clinical and laboratory datasets to validate new interventions.
5. Privacy issues around sharing these types of electronic records to maximize their utility have not been completely resolved at this time.

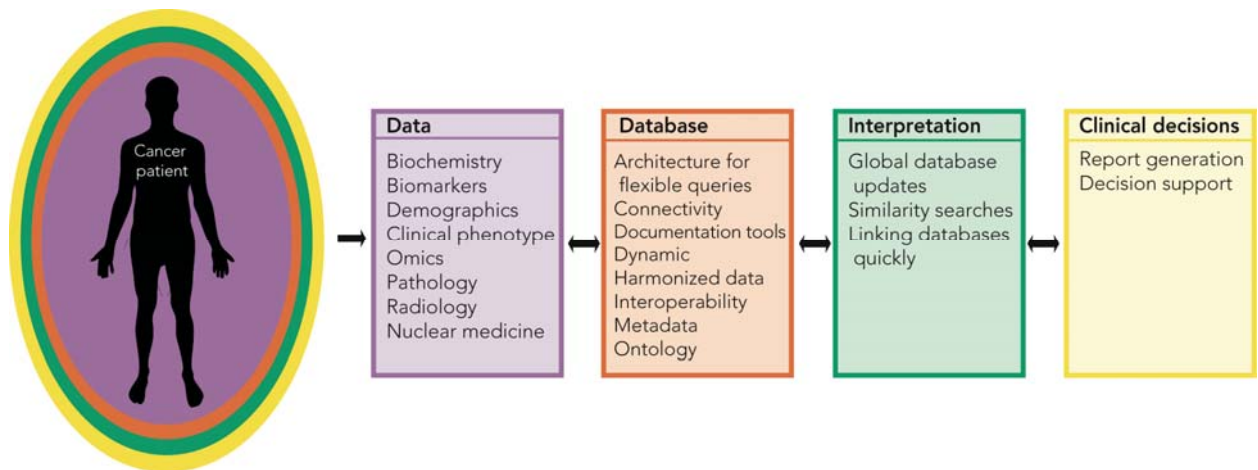
In October 2009, OICR co-hosted a workshop at the University of Waterloo and invited leaders in cancer research, healthcare informatics, computer science and the IT industry to discuss strategies to prepare the health-care system to adopt the new data-intensive technologies that can impact cancer care. The objectives of these brainstorming sessions were not to resolve current issues regarding the implementation of Electronic Medical Records (EMR) in the short term, but to develop a strategy that will enable a digitization-ready health-care system that will handle new technologies that will improve clinical management and patient outcomes.

Many of the hurdles associated with adopting the next generation technologies in the context of the current bioinformatics and medical informatics challenges faced in cancer research and hospital environments were explored. Presenters from the University of Waterloo provided context around the themes of data management, bioinformatics, and machine and statistical learning, topics which together were intended to foment ideas for leveraging developments in computer science, data mining and statistics. The day ended with two very productive sessions during which participants addressed the most important question of global need and identified opportunities that could be catalyzed in Ontario to make a real difference.

"The sheer volume of data that will be available in the next few years is daunting and well beyond comprehension of the human brain. Without electronic systems in place, we will miss or delay opportunities in translational research that will impact on diagnosis, treatment and cure rates."

Lawrence Shulman, Chief Medical Officer and
Senior Vice-President for Medical Affairs at
Dana-Farber Cancer Institute

Workshop participants agreed that the challenges are significant, but that they can be overcome by a careful consideration of the issues by experts and stakeholders in academia, the health sector and IT industry. Participants were in agreement that there is an urgent need for the development of tools and applications to support evidence-based clinical decisions relevant to cancer patients.



Workshop participants enumerated a number of attributes of the ideal IT system to manage and analyze cancer patient data. Most of these need significant development:

- Data and reports must be understandable by clinicians; critical pieces of clinical and diagnostic information need to be easy to access and prioritized according to their clinical utility and level of validation;
- There is a need for smart user interfaces that provide the support for clinical decisions depending on the needs and expertise of the decision maker;
- Databases will need to be curated and annotated in a dynamic fashion, to accommodate new information and changing standards of practice;
- Patient data that resides in multiple databases, e.g., genomic, tissue, and others, will need to be organized in ways that allow for access while protecting patient confidentiality; such linkages will need to occur across organizations, including multiple providers of services, e.g., clinical groups, hospital-based vs. third party laboratories, medical records, government agencies, etc.;
- Documentation tools will be needed to address data quality; measures of data quality will change with each different type of technology and will evolve along with the technology itself;
- Data support systems will need to facilitate physician-patient interactions more globally and reduce the inequities based on community biases that shape physician practices;
- Data should flow in two directions. Clinical information should inform research and research should inform clinical decisions. By making clinical data accessible to data mining, under the appropriate protections of patient confidentiality, new knowledge can be gained from studying clinical and laboratory datasets. For example, such data could be mined to identify the common factors among patients experiencing similar adverse drug reactions;
- Decision support systems should be structured around best practices, especially given the errors in communication that affect patient safety, but there is also a responsibility to respect work flow and patient priority. Data such as drug interactions should be available to physicians at points of care.

Next steps

1. Over the next five years, OICR will catalyze further discussions among cancer researchers, computer scientists, healthcare providers and medical IT companies and promote partnerships between academic teams and Ontario-based companies.
2. OICR will capitalize on its large data-intensive initiatives, i.e., the Ontario Health Study, Imaging Pipeline Platform (IPP), Cancer Genomics, Transformative Pathology, High Impact Clinical Trials, and the Ontario Cancer Data Linkage Project, to generate fully interoperable systems across programs, develop an integrated, comprehensive environment for storing, exchanging and analyzing datasets obtained from human subjects. There will be many results arising from this work: standardization of data models, harmonization of nomenclatures, support for new discoveries from merging datasets, optimization of database architecture, etc.
3. OICR will provide incentives, such as external grants, to groups able to contribute new approaches, e.g., algorithms, data storage solutions, clinical tools for data visualization interfaces and decision support tools. OICR will also support the commercialization of software and hardware tools through its investment program.

OICR is uniquely poised to address these challenges as a result of the quality of its informatics expertise in basic and clinical research and the amount of data already available in hospitals throughout the province and at CCO.

Acceleration of OICR's Patents to Products Program

Discoveries arising from OICR research have the potential to become products. The discoveries have to be successfully transferred to receptor companies that can transform them, manufacturing and distributing them as commercial products. OICR research will lead to numerous prototype instruments, software tools, validated biomarkers and candidate agents (including candidate drugs and immunotherapeutic agents) for research and clinical applications.

In the Strategic Plan for 2007-2010, OICR undertook a multi-step approach to implement its initial commercialization strategy. The strategy was founded on the principle that inventions derived from OICR-funded research will benefit the people of Ontario. This is referred to as the "Ontario First Policy." To ensure the Ontario First Policy succeeds, several mechanisms were developed to allow the policy to take hold. The initiative surpassed expectations and a key element of the success has been in the "innovation friendly" nature of OICR's interactions with partners in Ontario, Canada and internationally.

The results of the program:

Culture of commercialization

As part of its mandate OICR has, from the outset, contributed to the establishment of a culture of commercialization among its partners around the province and within its walls. The OICR Commercialization team has ensured that each program and platform has integrated mechanisms for the identification and capture of intellectual property arising from its research. The Commercialization team provided input to program teams as plans were developed with regard to intellectual property (IP)-related factors and opportunities to innovate in areas where there is market need.

Identification of existing cancer IP in Ontario

The team has made meaningful progress in understanding the IP landscape in the cancer field in Ontario. A study of patent databases generated a comprehensive list of Ontario's academic IP. OICR contributed to the Oncology Asset Map prepared by the Ministry of Research and Innovation for BIO 2009, the Stem Cell company resource developed by the ministry for BIO 2008, and advised MaRS on its white paper entitled "Molecular Diagnostics: New tools for evidence-based medicine".

Engagement of industry and market receptors

OICR is gaining a well-earned reputation for attracting potential receptors interested in doing business in cancer in Ontario. The Commercialization team has been proactive in project management, building constructive relationships among the key stakeholders in this initiative and several other industry partners including major pharmaceutical firms (e.g., Abbott, Pfizer) instrumentation and device companies (e.g., GE Healthcare) and others in the imaging and biotechnology industries. As part of the due diligence under the Intellectual Property Development and Commercialization (IPDC) Program (see below), OICR regularly engages members of the venture capital community and biotech industry executives in the evaluation of Ontario cancer-related IP.

The position of Director of Business Development, Clinical Trials has been integrated into both the Commercialization and High Impact Clinical Trials programs at OICR to ensure efficient coordination of all industry engagements. The Clinical Trials program activities have led to an increase in number, quality and speed of multi-institutional trials, and have furthermore made inroads with trial sponsors regarding research partnerships.

Support early-stage commercialization activities with funds and expertise

OICR created a targeted investment funding and commercial development mechanism, the IPDC program. It aims to de-risk and accelerate the advancement of particularly promising cancer innovations by providing meaningful funding and expert development, regulatory and commercial guidance. The IPDC program has gained considerable attention in the community and is widely regarded as having value both as a barometer of commercially viable technology, as well as a desired partner that provides useful and timely guidance. In just over two years the IPDC program portfolio has funded 12 projects and several more are under review. OICR contributions have been helpful in advancing a number of these projects to commercially important milestones such as licensing agreements, clinical development strategies, first-in-man clinical studies and sales initiatives.



One of OICR's IPDC investments is in a disruptive analytical instrumentation platform known as CyTOF™, developed by DVS Inc., a spinoff company headed by the former inorganic mass spectrometry team at MDS Inc. The CyTOF is a mass analyzer that enables the absolute quantitation of multiple parameters simultaneously, at the level of a single cell. Commercial prototypes are being sold and have been installed at Stanford University, University Health Network and at Nodality in California.

Next Steps

In the next five years, OICR plans to increase the size and scope of its Commercialization Program. Although the initial success of the IPDC program was the result of seeking assets that had been developed in Ontario prior to the launch of OICR's programs and platforms, the Institute anticipates that an increase in assets needing IPDC support will result from discoveries emanating from OICR-supported research. OICR also recognizes a need for funding at the latest stages of pre-clinical studies, up to and including early clinical (first-in-man and proof-of-concept) studies. It has been determined that this stage of development is best supported through industry or venture capital involvement. To accelerate the advancement of opportunities at this important stage, OICR will focus on attracting industry partners, private investment and company creation.

Support innovation throughout product development

OICR's Commercialization Program is continuously researching and adopting new mechanisms to fund and advance promising translational research discoveries. Where appropriate, it will work with the internal OICR programs to maintain the momentum of developing technologies by handing development off to the subsequent level. For example, it is anticipated that lead compounds identified by the Medicinal Chemistry Platform will make excellent prospective IPDC investments, which, once developed further, can be partnered with the High Impact Clinical Trials program to create a powerful continuum of development and rapidly increasing value prior to spinning out to an industry receptor. The Commercialization team will also leverage broader OICR relationships, including those with the Innovation Accelerator Fund (IAF), MaRS Innovation, the Ontario Centres of Excellence (OCE), Ontario-based clinical trials groups and others with a view to securing creative collaborations or licensing situations that lead to new product developments.

The program will further stimulate new product development by supporting the in-licensing of IP and/or bundling of Ontario oncology-related investment opportunities with other technologies or businesses in Ontario or internationally. This will include scouting for complementary IP from Ontario institutes, OICR industry partnerships or other sources with the goal of augmenting OICR's pipeline, accelerating the development of in-house programs or IPDC program initiatives and broadly supporting the innovation agenda in Ontario.

Establish a network of investors and business partners

OICR has met with angel investors from Ontario and venture capital groups from Ontario and beyond. There is considerable interest in creating investor networks to support the creation of one or more startup companies to serve as receptors for the promising therapeutics or medical devices (including diagnostics, informatics and imaging) under development in the province. In addition to the OICR-funded programs and platforms, MaRS Innovation and Ontario government programs (such as the Emerging Technologies Fund) are seen as key factors that attract investors to the table. The program will continue to explore models that will benefit inventors, institutions, investors and Ontario.

Attract large-scale international investments to Ontario to capitalize on its innovative and cutting-edge research base

OICR intends to pursue large-scale collaborations with multinational therapeutics and diagnostics companies interested in establishing footprints in Ontario. The Commercialization team has begun to move from a role of largely supporting the partnering process to an expanded role in which it plans and proactively seeks out these opportunities more strategically.

Innovation Programs

1. The Ontario Health Study

The Ontario Health Study (OHS) aims to recruit 150,000 subjects over five years and has been designed to bring more effective prevention strategies to the population of Ontario. It is also linked with other provincial, national and international initiatives to maximize this large and long-term investment. Ultimately, data on 300,000 participants from across Canada, which are harmonized with data from more than 10 million subjects in other international cohorts, will be available and enable population and public health researchers to establish evidence-based prevention programs. In the first five years, baseline data will become available and provide feedback on health indicators in Ontario that may help modify some of the current policies for early detection and/or prevention of cancer. Several of the questions and observations made during the maturation of the OHS will be essential to help develop and implement the concept of more personalized medicine focused on subsets of patients and ultimately individual patients. OICR will integrate its investment in building data management systems for the Canadian cohorts in developing a comprehensive system of digitization and management of cancer data.

2. The One Millimetre Cancer Challenge

The One Millimetre Cancer Challenge aims to facilitate early diagnosis and treatment of cancer through the development of sensitive biomarkers and imaging technologies. For example, this program will play a central role in discriminating between small quiescent prostate tumours that do not require therapeutic intervention and those with aggressive characteristics which require rapid treatment. Similarly, some of the diagnostic tools developed by the One Millimetre Cancer Challenge Program (which is working collaboratively with the Imaging Pipeline Platform) will generate data to help characterize early breast cancer tumours and determine which patients will benefit from aggressive therapies versus those requiring careful observation during follow-up. In addition, the One Millimetre Cancer Challenge will contribute to the personalized medicine initiative with the development of specific probes that will identify and monitor molecular alterations in individual tumours. This will help to determine the prognosis of individual patients, inform on the most appropriate intervention and monitor the tumour response at a molecular level.

3. The Cancer Stem Cell Program

The Cancer Stem Cell Program aims to:

1. Characterize a specific subset of tumour cells called cancer stem cells (CSCs) that are functionally different from other tumour cells, not usually eradicated by conventional therapy and potentially responsible for long-term tumour growth, relapse and treatment failures.
2. Develop new therapies that will specifically eradicate the CSCs and consequently allow complete tumour remission, resulting in long-term survival.

The program builds upon seminal discoveries of Ontario scientists initially focused on leukemic stem cells, and later demonstrated in many solid tumours. Ultimately, a better understanding of CSC biology should improve the means of predicting cancer prognosis and allow the discovery of CSC-targeted therapies which will be a novel approach for improving cancer outcomes in many tumour types. The scientific importance of this program has been clearly validated through international, industry and academic partnerships, including the approval of two major multinational projects (combined \$80 million funding over four years).

This program is well aligned with the concept of personalized medicine which is central to the OICR strategic plan. In the field of leukemia, for example, in parallel to discovering new CSC-specific agents, the team is developing CSC-specific biomarkers to aid in selecting the patients who will benefit most from certain therapies. The team has already established remarkable resources and advanced the study of CSCs in solid tumours such as breast, brain, head and neck, musculoskeletal, ovarian and colon cancer. The large xenograft core within the CSC Program supports drug discovery approaches that are based on individual tumour samples rather than the conventional approach of cell lines. This places the CSC Program at the forefront of scientific excellence by making it possible to evaluate therapeutic responses with better performing models than the ones used currently by most drug discovery organizations, including most pharmaceutical companies. The colon cancer CSC project is the basis of the substantial partnership that OICR and the University Health Network established with Pfizer in 2009.

In the next five years, the CSC Program will identify new targets of critical importance for discovery of specific anti-CSC agents. These agents are a new class of drugs that will have a major clinical impact in eradicating stem cells in various tumours and result in definitive cures. Up to now, investment in this field by the pharmaceutical industry has been relatively limited. OICR is in a unique position to be a leader and contribute to meaningful therapeutic innovations.

4. The Pancreatic Cancer Genome Project and the International Cancer Genome Consortium

As part of an alliance with international funding agencies in Asia, Australia, Europe and the United States, 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 more than 50 types of cancer. 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 some 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 (Imaging Pipeline, Cancer Stem Cells, Selective Therapies, and Medicinal Chemistry) and should lead to new interventions that will optimize the diagnosis and management of pancreatic cancer patients, ultimately leading to an improvement in long-term survival.

The Cancer Genomics Program will expand its scope to a large number of patients and a multitude of tumour types through genomic studies of tumours collected from other programs, such as High Impact Clinical Trials, and inform future personalized medicine strategies for a range of common and rare cancers. The Informatics and Bio-computing team, tightly integrated with the Cancer Genome Program and the ICGC will make a substantial contribution to OICR's data digitization objectives.

5. Selective Therapies Program

The Selective Therapies Program is a partnership with the TFRI that seeks to validate cancer targets that can be used for anti-cancer therapeutics and to initiate targeted drug development projects. In ramping up this program, TFRI and OICR engaged Ontario cancer researchers who have developed innovative models to study cancer.

The Selective Therapies Program was designed to accelerate the process of target discovery, validation and development by creating a collaborative matrix organization that includes cancer biologists, molecular biologists, medicinal chemists, bioinformaticians, pathologists and clinicians from several institutions. The collective breadth of experience of this collaborative network exceeds typical discovery and development organizations based in a single public institute or private firm.

The Selective Therapies Program is tightly connected with the OICR Medicinal Chemistry Platform established in 2008-2009 to bring powerful new tools and world-leading expertise in drug development and discovery to Ontario. The platform is focused on making available the highest level of expertise in medicinal chemistry to the Selective Therapies Program, the CSC initiatives and Ontario-based researchers who have identified novel targets and small molecule hits. The Medicinal Chemistry Platform has already identified and evaluated 15 projects, from which four have been selected for immediate collaborative support. The approach to advancing these opportunities is to follow a disciplined pharmaceutical methodology starting with Hit Assessment, then moving from Hit to Lead Development, undertaking Lead Optimization and finally nominating a Lead Candidate suitable for Pre-clinical Development.

These efforts will contribute to the tool kit of personalized medicine and to solving the clinical challenges identified in the Strategic Plan. In particular, they will elucidate the functional meaning of genetic lesions identified by the Cancer Genomics team for pancreatic cancers and ultimately other cancers. This will help target the development of new and selective therapies with a superior therapeutic index for many patients. Finally, the Selective Therapies program will help identify new biomarkers that are essential for discerning patients with aggressive tumours and for monitoring response to therapy.

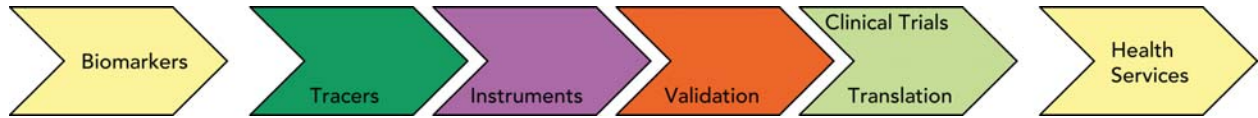
6. Biotherapeutics Program (ORBiT)

The Biotherapeutics (ORBiT) Program's main 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 the 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 and a Good Manufacturing Practice (GMP) facility has been established for biological agents which already support 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 that is specific for 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 groups 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.

Technology Platforms

1. Imaging Pipeline Platform



Ontario imaging investigators have faced significant barriers in translation of their innovations from the laboratory into clinical practice and the private sector. There are several critical activities necessary to bring an imaging innovation capable of being used for early diagnosis of cancer forward to the point where its value can be assessed in a clinical trial, or it can enter the commercialization process. These activities are complex, often expensive, and require specialized infrastructure and expertise such that they can be carried out to meet applicable standards. When the IPP was established, research groups in Ontario worked independently. As a result, each group with a promising imaging probe or technique would have to confront and negotiate the pathway to clinical translation individually. Although each group had unique strengths, no group had all the necessary components to translate innovation through the complex pipeline from discovery to clinical translation and commercialization. In most cases, this represented a practical impediment to further progress, or at least markedly slowed progress.

Thus, OICR's Imaging Pipeline Platform was established to meet these challenges by developing the necessary pipeline elements to allow the obstacles to be overcome. The ultimate goal of this effort is to build capability in Ontario to accelerate translation of research findings and developments of new imaging probes and techniques that will benefit cancer patients and accelerate the commercialization process.

Over the past two years, the IPP has addressed this challenge and developed the necessary elements to overcome these obstacles. The activity involved integration of expertise in six imaging laboratories in Ontario, located in Toronto, Hamilton, and London. The IPP will be a key contributor to OICR's initiatives for the development of new tools to identify the poor prognosis in breast cancer and to differentiate indolent from progressive prostate cancer.

2. Transformative Pathology

OICR is recruiting a Platform Leader for the Transformative Pathology Platform to establish an innovative research program in molecular pathology and cytopathology that will combine molecular probes, biomarkers and histology to better understand the heterogeneity of cancer and develop effective approaches for clinical translation, including analytical methods, standards and clinical evaluation. The Leader will recruit additional research pathologists and collaborate with several OICR programs where high quality specimens are required.

Developing better diagnostic tools and new drug therapies often involves working with tissue samples. The Ontario Tumour Bank (OTB) is a provincial tumour banking network with accredited laboratories across Ontario that collect tumour samples, each linked to clinical and outcome data. It is an indispensable resource that provides academic and industry-based cancer researchers with an extensive inventory of biospecimens and data. The OTB's collection now includes more than 60,000 samples from 6,500 donors. High-quality samples from more than 30 disease sites provide researchers with crucial information about a wide range of cancers.

These samples are collected from five participating medical centres across Ontario following a rigorous set of procedures and ethical guidelines. A unique feature of the OTB is its link to the cancer registry at CCO, a real time inventory of all cancer patients in Ontario. By linking the OTB to the registry, OICR obtains accurate information about the diagnosis, treatment and follow-up of all tumour donors, allowing for complete annotation of each tumour specimen. The information provided to the OTB is stripped of major patient identifiers.

3. Genome Technologies Platform

The landscape of genomic analyses has changed dramatically, with high-throughput DNA and RNA sequencing rapidly replacing traditional methods such as microarrays in many applications. Genome-wide single nucleotide resolution is now possible obviating the need for selecting candidate gene targets to match limited analysis pipeline potential. Sequence output per instrument has increased dramatically while the cost per base has decreased as well. A complete human genome sequence at a depth of coverage to permit robust detection of variants is now within reach at \$50,000 for reagents alone. It is likely that within two to three years the coveted \$1,000 genome will be reached – again for reagent cost only. Streamlined sample processing is reducing associated labour costs; however, the tremendous growth in throughput has put a strain on data analysis with the cost of storing and analyzing the data soon to be the driving factors. Nonetheless, the decreasing cost of sequencing now enables the characterization of large numbers of tumours and matched normal controls in a comprehensive manner. Complete catalogues of somatic mutations and tumour associated expression changes are readily achievable with a dynamic range and resolution not previously possible. In addition, the increasing analytical capacity of the Genome Technologies Platform readily supports OICR's programs with, for example: sequencing of oncolytic viral genomes, characterization of cell lines used in high-throughput screening, determination of viral insertion sites, analysis of stem cell populations and measurement of alterations in expression of protein coding fractions and regulatory elements (mRNA, lncRNA, miRNA, transcription factors and histone modifications).

4. Medicinal Chemistry

The overall mission of OICR's Medicinal Chemistry Platform is to build a drug discovery program that can efficiently translate cancer related academic discoveries into novel oncology therapies that will have a significant impact on the cancer patient population and will support OICR's translational research and commercialization mission.

The group is dedicated to the design, synthesis and evaluation of novel anti-tumour agents. The major goals of the Medicinal Chemistry group are to optimize lead molecules and progress them to drug candidates that can translate into therapeutic benefits to cancer patients. These drug candidates will either be initially developed within the OICR network, or may be taken on as partnered programs with other organizations, including companies.

The Medicinal Chemistry Platform is comprised of three major functional areas; chemistry (medicinal, analytical and computational), drug delivery and formulation (focused on nanotechnology) and biology and screening support. Group members bring a collective depth and breadth of academic, big pharma and biotech experiences and have a track record of delivering high quality leads and clinical candidates. Coupling this expertise with the strong tradition of basic biological and clinical research in the province, and establishing collaborations with world experts and thought leaders in the field of oncology, allows the Platform to leverage the strengths of each group and create a unique collaborative research environment from which potential high-value commercial opportunities can be derived.

5. Informatics and Bio-computing

Over the past two decades, the innovations in genome sequencing and other high-throughput technologies have transformed biology. What was once a discipline driven by painstaking single-investigator experimentation is now an information science that is moved forward by large teams of researchers working in highly collaborative interdisciplinary environments. The key to productive scientific collaboration is information management and communication. High-throughput biological data from sequencing, small molecule screens, microarrays and proteomics are organized into large shared databases, and accessed and manipulated by geographically dispersed researchers. The researchers use electronic communication and collaboration tools to discuss and share their findings, and to create new integrated data sets for other researchers to build upon. In this environment the computer, the server farm, and the Internet play as central a role in biological research as the microscope, centrifuge and electrophoresis unit played in the past.

The Informatics and Bio-computing platform is responsible for developing and deploying the computer and network infrastructure for OICR and its affiliates, building software systems to manage, share and analyze biological data and providing OICR staff and collaborators with the training necessary to effectively utilize and build on these tools. The Platform's vision is to provide OICR's researchers with an integrated, comprehensive environment that gives each scientist unfettered access to the whole of the work being performed at OICR. The Platform's goal is to make it possible for cancer risk markers validated by the Ontario Health Study to guide the choice of regions to sequence by the Genomics Platform, for sequencing information from the Genome Technologies Platform to be mined by the Selective Therapies Program for cancer targets to validate, and for validated targets from the Selective Therapies Program to feed into the Medicinal Chemistry Platform's drug discovery pipeline and ultimately test new agents in clinical trials supported by the High Impact Clinical Trials Program. The platform sees this integrated data environment as being a component of a comprehensive collaboration system that encourages OICR researchers to share their results, pass off tasks to each other, and to engage with each other electronically. Only by bringing many minds and points of view together will it be possible to make progress against the complex and multifaceted disease that is cancer.

The Informatics and Bio-computing effort will contribute to the development of new paradigms in personalized medicine and will be proactive in advancing the translational theme related to the digitization and interpretation of cancer data. This will ultimately lead to support tools that will be used in the clinical setting to make treatment decisions for cancer patients.

Translation Programs

1. The High Impact Clinical Trials Program

The High Impact Clinical Trials Program (HICT) is a collaboration involving OICR and CCO that has been designed to supplement and create additional synergies with the already existing high quality clinical trials groups in the province. The mission of this program is to help support the introduction of more translational research within cancer clinical trials, allowing the discoveries from OICR programs to be tested rapidly and effectively in well-designed clinical trials. This program has also been conceived to fulfill the promise of personalized medicine of refining diagnosis, guiding optimum treatment and avoiding unnecessary side effects.

The program will initially focus on three areas: experimental therapies, biospecimen-based diagnostics, and imaging of patient response to treatment. These areas were chosen because they directly support several OICR objectives and technology/new agents originating from existing initiatives supported by OICR or partners and are available for immediate clinical testing.

Some examples of evaluations that will be performed in the initial phase of the HICT Program are as follows:

1. Measuring drug levels and clinical outcome and correlating these with genetic variation in drug metabolism. *This could very rapidly improve the clinical utilization of drugs already approved or help optimize the development of experimental agents.*
2. Monitor tumour or drug specific molecules or drug metabolism using functional imaging. *This could enhance the way tumour response is currently evaluated and optimize treatment decisions, taking advantage of the progress made by OICR scientists in imaging technologies.*
3. Measure tumour- or patient-specific markers to predict treatment benefit or toxicity and collaborate with the Cancer Genomics team so that genomic analysis performed on tumour samples of patients participating in clinical trials can lead to a better understanding of their efficacy. *These initiatives are vital to the introduction of personalized medicine.*

The examples above are illustrative of the various questions that can be investigated by the HICT Program. This program will be conceived “dynamically” to be receptive to the advances made by OICR scientists and will be adapted to allow the rapid and efficient testing of the most promising discoveries made in the next few years at OICR.

The HICT Program will invest in reinforcing the infrastructure for clinical trials in Ontario, and specifically will ensure that modern technology which is required to perform high quality translational research studies is available at the key academic centres involved in oncology drug development. This effort should immediately benefit most cancer patients in Ontario by facilitating access to state-of-the-art technologies that allow for more precise monitoring and clinical management. Such investments are attractive to drug trial sponsors who will be receptive to conducting more clinical trials in Ontario, since infrastructure allowing sophisticated translational studies is not commonly available elsewhere.

2. The Health Services Research Program

The Health Services Research (HSR) Program is a partnership between OICR and CCO. Its focus is to analyze the benefits, risks and cost of new interventions (prevention, diagnostic, therapeutic, etc.) to inform new policies that can benefit cancer patients and help optimize the administration of health care in the province and elsewhere.

The program undertakes research at the provincial level to:

1. Analyze the benefits, risks and cost of new diagnostic and therapeutic interventions.
2. Provide evidence-based assessment regarding the use of such interventions in the health-care system.
3. Help understand the barriers to dissemination of new services or treatment interventions.
4. Evaluate the quality of care provided to cancer patients including supportive and palliative care.

This partnership with CCO is essential to ensure that the progress and discoveries made at OICR will benefit the entire community of cancer patients in Ontario. Also, it will ensure that the existing constraints on Ontario's health-care system will be taken into account when OICR's discoveries are translated into decisions and policies that have an impact on the delivery of care in Ontario.

The specific projects included in the HSR Program were selected to ensure that the expertise and methodologies necessary to evaluate new technologies arising from OICR's discovery program are in place and aligned with OICR's translational research priorities. In particular, HSR has initiated projects that will help solve two of the clinical challenges identified in OICR's Strategic Plan. The first is investigating the impact of the ColonCancerCheck colorectal screening program which was launched in 2007 by Cancer Care Ontario and the Ministry of Health and Long-Term Care. This project will allow better optimization of colon cancer screening in the province and will gather information in parallel on the principles and processes for effective cancer screening applicable to many other tumour types. The second is evaluating long-term and late effects of treatments in young women with breast cancer. This project helped launch the paediatric/young adult cancer survivor initiative that is currently being planned by several Canadian organizations including OICR.

The HSR Program will enable effective digitization and exchange of cancer data. The program has already been successful with its ongoing data-linkage project to establish a data collaboration agreement between CCO and the Institute for Clinical Evaluative Sciences (ICES). This should make it possible for existing data from various organizations in Ontario to be made available to qualified researchers. An immediate application of this initiative is the possibility of optimizing some of the current health-care practices based on retrospective analyses of these data sets. Merging and exchanging data should result in the determination of how best to integrate new interventions and therapeutic approaches in the management of cancer patients. The OICR/CCO HSR Program will help inform Ontario policymakers regarding complex decisions and contribute to high quality but also economically affordable progress in cancer care.

3. The Patents to Products (Commercialization) Program

In the Strategic Plan for 2007-2010, OICR undertook and 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. OICR is proactive in engaging industry and market receptors including major pharmaceutical firms (e.g., Abbott, Pfizer) instrumentation and device companies (e.g., GE Healthcare) and others in the imaging and biotechnology industries. OICR created the 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 twelve 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.

In the next five years, OICR plans to increase the size and scope of its commercialization program. It is anticipated that an increase in assets needing IPDC support will result from discoveries emanating from OICR-supported research. There is considerable interest in creating investor networks to support the creation of one or more startup companies to serve as receptors for the promising therapeutics or medical devices (including diagnostics, informatics and imaging) under development in the province. It is also OICR's intention to pursue large-scale collaborations with multinational therapeutics and diagnostics companies interested in establishing footprints in Ontario. The Commercialization team has begun to move from a role of largely supporting the partnering process to an expanded role in which it plans and proactively seeks out these opportunities more strategically.

Other OICR initiatives

1. OICR Investigator Program

OICR will continue its program to attract and retain in Ontario a total of 50 outstanding basic scientists and clinician researchers to augment capacity needed for the province to bring cancer discoveries to cancer patients and the population. The majority of OICR awards to investigators are made at Ontario universities and research institutions, supplemented by a cluster in genomics, informatics and medicinal chemistry at OICR's headquarters at the MaRS Centre in downtown Toronto. The investigators complement a larger number of cancer researchers already based in Ontario who are also engaged in OICR programs. OICR-funded investigators have demonstrated success in obtaining external peer-review grants from dozens of national and international funding agencies. In 2008/2009 (when OICR PI recruitment and OICR programs were partially ramped up and large-scale partnerships listed above had not yet started), OICR-funded PIs reported \$40.6 million in leveraged funds. The downstream outcomes derived from this large research enterprise are increased by the translational opportunities created by OICR.

2. OICR Personalized Medicine Fund

OICR recognizes the importance of supporting investigator-driven research that is initiated independently from the OICR programs. The Personalized Medicine Fund will support projects related to:

1. Biomarker validation studies that will impact cancer prevention, early detection and therapies.
2. Pre-clinical validation of potential therapeutic targets.
3. Clinical evaluation of new therapeutic agents/modalities that make use of biomarkers (such as clinical trials companion studies).
4. Development of algorithms or software that will enable the management and delivery of clinically-useful information to health-care providers.

Funds will be available through annual grant competitions, with selections based on recommendations made by peer review panels.

3. Ontario Cancer Research Ethics Board

The Ontario Cancer Research Ethics Board (OCREB) works in collaboration with Ontario institutions to ensure that clinical research involving human subjects meets the highest standards of scientific and ethical conduct. OCREB is an independent body constituted of medical, scientific and non-scientific members, whose responsibility it is to ensure the protection of the rights, safety and well-being of human subjects involved in a clinical trial. OCREB contributes significantly to the efficiency of multi-institutional trials and currently 21 Ontario sites involved in cancer clinical trials participate in OCREB.

Conclusion

In summary, the OICR programs are still new and the objectives of the Strategic Plan for 2010-2015 are ambitious. However, the science is moving quickly and there are unique opportunities to strengthen existing programs and accelerate translation towards new services and products. The collaborative effort among all programs at OICR has the potential to impact prevention, early detection, treatment paradigms and outcomes for cancer survivors as well as public policies for the management of cancer patients. The co-existence of excellent science, clear and focused strategic vision as well the high level of competence and motivation of OICR's scientists provide all the ingredients necessary to achieve breakthrough results in translational medicine that will optimize the care of cancer patients in the province and improve treatment outcomes.

OICR's strategy is to continue to build partnerships, including research partnerships with industry, and pursue national and international research funding. In addition, OICR is supporting and will continue to support partnerships with organizations that provide health services to Ontario residents and this will result in improved services to cancer patients and ultimately to a more cost-effective approach to the treatment of cancer. However, success will be dependent on investment support by the Government of Ontario. The return on investment for Ontario will be tangible results including the attraction of both public and private research investment, the creation of start-up companies, the expansion of the footprint of international companies and job creation. As a result of this continuous investment by government, OICR and Ontario will be at the forefront of international cancer research and the translation of discoveries into the clinic.

OICR Leaders

Thomas J. Hudson, MD

President and Scientific Director, and Senior Principal Investigator, Cancer Genomics Program

Dr. Hudson has extensive expertise in large-scale research and in building large, multi-disciplinary research groups. A member of the Human Genome Project from its inception, he led the team that built the first physical map of the human genome. He was the Assistant Director of the Center for Genome Research at the Whitehead Institute/Massachusetts Institute of Technology (MIT) and returned to Canada in 1996 to become the founder and Director of the McGill University and Genome Quebec Innovation Centre. His team contributed 10 per cent of the HapMap Phase 1 dataset published in Nature in 2005. Dr. Hudson is co-founder of the International Cancer Genome Consortium.

Nicole Onetto, MD, M.Sc.

Deputy Director

Dr. Onetto is working on OICR's strategic directions and priorities. Her extensive experience in the pharmaceutical industry includes responsibility as the international project director for Taxol™, resulting in the filing of the initial new drug application for Taxol worldwide. She subsequently led the clinical development of Tarceva® in collaboration with the NCIC, which resulted in the approval of Tarceva for non-small cell lung carcinoma and pancreatic cancer. Before joining OICR, she was Senior Vice-President, Product Development and Chief Medical Officer at ZymoGenetics in Seattle, Washington. She also had positions with Hoeschst Canada Inc. in Montreal, Immunex in Washington, Bristol-Myers Squibb, NeXstar Pharmaceuticals, Gilead Sciences and OSI Pharmaceuticals in Colorado.

Frank Stonebanks

Vice-President, Commercialization and Chief Commercial Officer

Mr. Stonebanks is leading OICR's Commercialization program. He has a broad knowledge of health care and extensive experience in biotechnology, the pharmaceutical industry, medical devices, drug delivery and healthcare IT. He founded Blackcomb Advisors LLC, a global advisory firm in the life sciences and healthcare IT sectors. Previously, he was President and CEO of Cynvec, an oncology-focused biotechnology firm, where he led it through the investigational new drug process at the FDA. As Senior Advisor, Healthcare and Life Sciences, for IBM, he co-managed its \$500 million venture fund. He was Vice-President and General Manager at Johnson & Johnson's venture unit, where he was also Co-founder of Johnson & Johnson Internal Ventures and Co-founder & CEO of the Macroflux Corporation, a Johnson & Johnson spin off. Mr. Stonebanks was also the founder and Executive Director of the Oncology Biologics Business Unit at Centocor.

Rima Al-awar, PhD

Platform Leader, Medicinal Chemistry and Senior Principal Investigator

Dr. Al-awar earned her degrees in synthetic organic chemistry prior to joining Eli Lilly and Company in Indianapolis. While at Lilly, she was an active medicinal chemist in the oncology area working in multidisciplinary teams on the antimicrotubule agent Cryptophycin and on several kinase-focused efforts. Dr. Al-awar took on additional responsibilities as Head in Discovery Chemistry Research and Technologies and later

as Head, Route Selection, in Chemical Product Research and Development prior to joining OICR in July 2008.

John Bell, PhD

Program Leader, Immuno- and Bio-therapies, Senior Scientist, Cancer Therapeutics, Ottawa Hospital Research Institute

Dr. Bell is using viruses that selectively target cancer cells as a therapeutic strategy. He is also optimizing the vesicular stomatitis virus as a cancer-fighting agent and testing the role of the immune system in both the enhancement and the inhibition of oncolytic virus activity.

Janet Dancey, MD

Program Leader, High Impact Clinical Trials Program

Dr. Dancey is based at Queen's University in Kingston and has an office at OICR in Toronto. Prior to joining OICR in 2008, Dr. Dancey was the Associate Branch Chief with the Investigational Drug Branch of the Cancer Therapy Evaluation Program, at the National Cancer Institute (NCI) in Rockville, Maryland. Prior to this, she was a Senior Clinical Investigator with the NCI for several years.

John Dick, PhD

Program Leader, Cancer Stem Cell Program, Senior Scientist, Research Institutes of Toronto General and Princess Margaret Hospitals, University Health Network

Dr. Dick published the groundbreaking results that documented the existence of cancer stem cells. Over the past 15 years, his laboratory has validated the critical role of leukemia stem cells in therapy resistance. His work has been recognized by senior awards from the American Society of Hematology and American Association for Cancer Research.

Craig Earle, MD, M.Sc.

Program Leader, Health Services Research

Dr. Earle is a practicing medical oncologist, a Scientist in Clinical Epidemiology at the Sunnybrook Research Institute and a Senior Scientist at the Institute for Clinical and Evaluative Sciences. He was previously Director, Perini Adult Survivorship Program, Dana-Farber Cancer Institute in Boston, Massachusetts and an Associate Professor at Harvard Medical School. Dr. Earle's research program focuses on using administrative data to evaluate the accessibility, quality, costs and outcomes of care delivered to cancer patients and survivors.

Aaron Fenster, PhD, FCCPM

Co-Platform Leader, Imaging Pipeline, Co-Program Leader, One Millimetre Cancer Challenge

Dr. Fenster is Director and Scientist, Imaging Research Laboratories, Robarts Research Institute and the Chair of the Imaging Sciences Division of the Department of Medical Imaging at the University of Western Ontario. He is developing new 3D ultrasound technologies for a wide variety of indications and applications including ultrasound-guided technology for breast biopsy, minimally invasive prostate therapy and biopsy, vascular imaging, and imaging for diagnosis and management of prostate cancer. Dr. Fenster's research program spans the spectrum from idea generation to translation to the clinic and to the private sector.

John D. McPherson, PhD

Platform Leader, Genome Technologies Platform and Senior Principal Investigator

Dr. McPherson heads the Genome Technologies Platform and the ICGC Pancreatic Cancer Genome Project. He has 18 years of experience in large-scale genomic analyses, having participated in senior management at three genome centres. He was actively involved in the Human Genome Project and was lead author of the human physical BAC-based map. Dr. McPherson has established large-scale production capabilities for resequencing of human genome regions and has experience with integration of new technologies for genome analysis. For the past 10 years he has been a co-organizer of the Advanced Sequencing Course held each year at Cold Spring Harbor Laboratory.

Lyle Palmer, PhD

Program Leader, Ontario Health Study

Dr. Palmer, a genetic epidemiologist and statistical geneticist, was previously the Director of the Centre for Genetic Epidemiology and Biostatistics at the University of Western Australia. He was also a Professor, both in the School of Medicine and Pharmacology and in the School of Population Health at the University of Western Australia. Dr. Palmer was a Research Fellow at The Channing Laboratory, Harvard Medical School, Harvard University, Boston, Massachusetts. He was also an Assistant Professor of Medicine, Harvard Medical School and an Associate Epidemiologist, Brigham and Women's Hospital, Boston.

Robert Rottapel, MA, MD

Program Leader, Selective Therapies, Terry Fox Research Institute (Ontario Node)
Head, Division of Stem Cell and Developmental Biology, Ontario Cancer Institute, the research arm of the University Health Network's Princess Margaret Hospital

Dr. Rottapel has a Clinical Appointment as a Consultant Rheumatologist at St. Michael's Hospital and is a Full Professor at the University of Toronto (with appointments in the Departments of Medicine, Immunology and Medical Biophysics). He was awarded the Amgen Chair in Cancer Research and is Division Director at the Ontario Cancer Institute. His research is focused on the regulation of protein tyrosine kinases in hematopoiesis and the mechanism of T cell co-stimulation. Dr. Rottapel has an established track record in managing large groups of investigators, interacting with academic collaborators and industrial partners, and balancing multiple projects whilst retaining scientific focus.

Lincoln Stein, MD, PhD

Platform Leader, Informatics and Bio-computing Platform and Senior Principal Investigator

Dr. Stein's background is multi-disciplinary: cell biology, medicine, anatomic pathology and informatics. He is a former Director of Informatics at the Whitehead/MIT Center for Genome Research. He maintains an affiliation as Professor of Bioinformatics at Cold Spring Harbor Laboratory (CSHL). He is Co-Principal Investigator of WormBase and Gramene. He is the principal architect of the Gbrowse system. Dr. Stein is a co-organizer (with Suzi Lewis) of the Advanced Bioinformatics and Genome Informatics courses held each October at CSHL. He is also author of several important Perl modules including GD and CGI. Dr. Stein is the 2004 Bioinformatics.org Ben Franklin award winner. He has led the data coordination centre for many international projects including the HapMap project.

Martin Yaffe, PhD

Co-Platform Leader, Imaging Pipeline, Co-Program Leader, One Millimetre Cancer Challenge

Dr. Yaffe is Senior Scientist, Sunnybrook Health Sciences Centre and Tory Family Chair in Cancer Research. The focus of his work is on the development and improvement of imaging techniques for the detection, diagnosis, and treatment of breast cancer and his research was instrumental in the development and clinical introduction of digital mammography. His team is creating a platform for improved quantitative pathology for OICR to be used in the validation of new biomarker-based images techniques for cancer management. He is also developing methods for analyzing image patterns to predict breast cancer risk and using these as tools to study the causes of breast cancer and to help develop preventive measures.

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