

ANNUAL REPORT

2015/2016



Message from the Minister of Research, Innovation and Science

On behalf of the Government of Ontario I am pleased to have the opportunity to extend my thanks to the Ontario Institute for Cancer Research (OICR) for another successful year in its progress to meet the cancer challenge.

A report issued recently by Cancer Care Ontario tells us that one in two Ontarians will develop cancer in their lifetime and cancer is the leading cause of death in the province. We have to do everything possible to alleviate the burden of cancer on Ontario families by improving the prevention, detection, diagnosis and treatment of cancer. We are proud of our investment in OICR over the last 10 years and recently approved the Institute's Strategic Plan for 2016-2021.

OICR has demonstrated leadership in the cancer community not only in its research programs but also in its focus on moving discoveries into the clinic. An example is the development of a novel oncolytic viral immunotherapy which is now in clinical trials. Through OICR's commercialization partner, the Fight Against Cancer Innovation Trust, financial and in-kind support are attracted which makes it possible to accelerate development and therefore bring new hope to patients.

The past year has been one of accomplishment and one of transition. Dr. Calvin Stiller, who was instrumental in the creation of the Institute, has stepped down as Chair of the Board of Directors. We are most grateful for his vision and leadership.

Dr. Tom Hudson, who built the Institute, attracted talented researchers and launched provincial, national and international initiatives that are helping to make Ontario a world leader in cancer research, has moved on to the next phase of his career. He leaves a legacy of collaboration and innovation which serves as a model on how to improve the quality of life of the people of Ontario and how to enhance economic opportunities.

The next decade will see remarkable progress in cancer research in Ontario as OICR builds on the foundation created by Stiller and Hudson.

We thank the staff of the Institute for their dedication and hard work and wish them every success in the future.

Sincerely Reza Moridi Minister of Research, Innovation and Science

Table of contents

01 From the Chair of the Board of Directors 02 From the President and Scientific Director 04 Monitoring results07 Our people, our science 19 The Next Generation 22 Financial Statements 27 OICR's Leaders

From the Chair of the Board of Directors



The past year marked a time of transition at the Ontario Institute for Cancer Research. On behalf of the Board of Directors, I would like to thank Dr. Calvin Stiller for his significant contribution to OICR as he steps down from the Board, where he has been a member since the launch of the Institute in December 2005 and the Chair since 2009. He was the inspiration for the creation of the Institute and has been an invaluable resource since the beginning of the Ontario Cancer Research Network, OICR's predecessor.

The contributions of Mr. Allan Rock, Ms. Leslee Thompson and Dr. Dave Williams who stepped down as members of the Board of Directors is gratefully acknowledged. A welcome is

extended to Drs. Roger Deeley and Samuel Weiss as members.

It is difficult to say goodbye to someone who built the Institute and whose drive and passion created a collaborative centre of excellence. Dr. Tom Hudson, who was appointed President and Scientific Director in 2006, has left OICR to take up a new challenge. He joined the staff of OICR, then consisting of 20 people, and in a short time, fostered its growth into a world-leading cancer research institute. He strengthened Ontario's cancer research capacity by attracting outstanding investigators and clinician-scientists who are now located at 12 institutions in the province. Moving cancer devices and treatments from the bench to the clinic improves the lives of cancer patients and benefits the economy of Ontario. This has been one of Hudson's priorities and he was instrumental in the creation of the Fight Against Cancer Innovation Trust (FACIT), OICR's commercialization partner.

Hudson provided leadership and vision not only for the Institute but also within the Ontario cancer research community as well as nationally and internationally. He was pivotal in the launch of three international initiatives, the International Cancer Genome Consortium, the International Cancer Genome Consortium for Medicine and the Global Alliance for Genomics and Health, which are making genomic data more accessible to researchers. The work of these organizations is improving and accelerating the search for more effective cancer therapies.

The Board of Directors is engaged in a search for a new President and Scientific Director. Mr. Peter Goodhand, who is the Executive Director of the Global Alliance for Genomics and Health, will be the Interim President. Dr. Lincoln Stein, who is the Program Director, Informatics and Bio-computing, will be the Interim Scientific Director.

In 2015-2016 the Institute completed its second five year strategic plan. Last fall, the Board of Directors approved a new Strategic Plan for 2016-2021 (see page 10). Developed in consultation with the Ontario cancer research community, the Plan builds on OICR's achievements over the past 10 years and sets an ambitious agenda for OICR's research, with a focus on collaboration to improve outcomes for cancer patients and to enhance the economy of the province.

While Stiller and Hudson will both be greatly missed, they have built an incredibly strong institute, an amazing team of researchers and leaders and a legacy of important work that will continue. OICR's mission to translate the most important cancer research discoveries to patients remains unchanged and I am confident OICR's contribution to cancer research worldwide will only continue to grow in the years to come.

From the President and Scientific Director



In December the Institute celebrated its 10th anniversary and looking back over the Institute's first decade it is remarkable to see just how far we have come. The Institute has grown from being a very ambitious idea to today supporting more than 1,700 investigators, clinicianscientists, research staff and trainees located at OICR's offices and labs in the MaRS Centre in Toronto and in research institutes and academia across the province of Ontario. We have created world-class research programs and

facilities, recruited top talent from around the world and built new networks that are facilitating cancer research across the province and around the globe. With the launch of the Fight Against Cancer Innovation Trust we have also developed an entity that is facilitating the commercialization of OICR's research and of cancer research province-wide. There have been many successes and much to be proud of.

We have highlighted some of those successes from the past year in this report. New companies have been created, such as Turnstone Biologics and Novera Therapeutics, stemming directly from OICR's research (see pages 12-13). Our partnerships with groups like Stand Up to Cancer Canada, have led to new research projects and planned clinical trials in Ontario (see page 15). OICR is a world leader in the move to cloud computing in research, forming new partnerships with companies such as Intel and Amazon Web Services, which will allow cancer researchers to work faster and tackle bigger problems (see page 16).

In April 2016 OICR was instrumental in the launch of the International Cancer Genome Consortium for Medicine, which builds on the foundation of many years of research by the International Cancer Genome Consortium and adds a clinical component for even more potential impact for patients. In May 2016, the creation of the Joseph and Wolf Lebovic Cancer Genomics and Immunity Research Program was announced with a significant multi-year commitment of funding by Joseph Lebovic. OICR is collaborating on the Program with the Institute for Medical Research Israel-Canada of the Hebrew University of Jerusalem. The program will advance scientific knowledge and translate findings to benefit cancer patients.

I am pleased to announce the launch of OICR's new Strategic Plan 2016-2021 this year. The Plan sets out OICR's commitment to achieve its translational research mission while also making the Institute more open, accessible and even more collaborative (see pages 10 and 11).

This past year OICR welcomed the appointment of Dr. Christine Williams to the leadership team as Deputy Director and Vice-President, Outreach. In this new role, she will help advance OICR's vision and mission by building partnerships with the scientific community, research institutions and funding agencies in Ontario, Canada and globally. Williams has held senior positions with the Canadian Cancer Society and was most recently the Chief Mission Officer & Scientific Director.

I extend thanks to Dr. Nicole Onetto, OICR's Deputy Director and Chief Scientific Officer since 2009, for her many contributions to the Institute. Her leadership and direction of the Institute's research programs have been vital to the organization's success.

The support of the Government of Ontario through the Ministry of Research, Innovation and Science over the past decade and its continuing support over the next five years with the approval of the strategic plan for 2016-2021 are gratefully acknowledged.

Finally, a big thank you to OICR's staff at the MaRS Centre and its many researchers and scientific staff across the province. Working together, they have built something truly extraordinary. Everything they do on a daily basis ensures this success continues.

While much has been accomplished, there is much more work to be done. Over the next five years OICR's researchers and staff, collaborating with the cancer research community, will deliver on the promise of the new Strategic Plan and to bring more benefits to the people of Ontario and to cancer patients worldwide.



The Ontario Institute for Cancer Research

OICR is an innovative cancer research and development institute dedicated to prevention, early detection, diagnosis and treatment of cancer.

The Institute is an independent, not-for-profit corporation, funded by the Government of Ontario. OICR and its funding partners support more than 1,700 investigators, clinician-scientists, research staff and trainees located at the MaRS Centre and in research institutes and universities across Ontario. OICR has key research efforts underway in small molecules, biologics, stem cells, imaging, genomics, health services research and in informatics and biocomputing.

The Fight Against Cancer Innovation Trust is an independent business trust established by OICR to accelerate breakthrough cancer innovations into viable opportunities that benefit patients, researchers, investors and Ontario's economy.

Quick facts

The Ontario Institute for Cancer Research:

- Supports more than 400 trainees on research projects;
- Has a global strategy and an Ontario focus;
- Is a founding partner of four Networks of Centres of Excellence to advance novel cancer diagnostic and therapeutic solutions;
- Raised the profile of Ontario as an international leader in cancer research and innovation by being instrumental in launching or supporting:
 - Cancer Stem Cell Consortium;
 - Global Alliance for Genomics and Health;
 - International Cancer Genome Consortium;
 - International Tobacco Control Policy Evaluation Project.

Monitoring results

Source of OICR project funds expended

(in millions of dollars)



\$72.9 Ministry of Research, Innovation and Science

Sources of leveraged funds expended by OICR



Areas of scientific interest



Note: Some projects have an impact on more than one research area.

Research workforce 1,755 highly qualified personnel



Attendees at educational events organized or partially funded by OICR



508 publications in peer-reviewed journals, 76 of which are in the top 1% of journals¹

Over 230,000 Ontarians

participating in the Ontario Health Study

¹ Journals in the top 1% across all categories when ranked by impact factor per Thompson Reuters 2015 Journal Citation Reports®

Commercial activity - FACIT

Attracting investment to Ontario

Cumulative leveraged funds - all sources (in millions of dollars)



Creating new jobs in Ontario

Staff at startups



23 startup companies have now generated a total of more than 300 jobs in Ontario Commercial activity generated by projects funded by FACIT and OICR in 2015-2016

22 Disclosures

24 Patent applications

4 Patents awarded

Our people, our science



The year in review



DREAM Challenge

In May leaders of the DREAM Challenge, including Dr. Paul Boutros at OICR, announced that the research community had successfully answered its call to address the need for accurate methods to identify cancer mutations and successfully developed a new "gold standard" for genomic data analysis. In December the group launched a similar challenge to optimize the discovery of genetically distinct groups of cells within cancer.



Maraba enters clinical trials

In July, OICR and its partners launched a world first clinical trial combining two viruses to attack and kill cancer cells. The trial is currently underway in Hamilton, Ottawa, Toronto and Vancouver.



OICR announces collaboration with Janssen

In October OICR, in partnership with Novera Therapeutics and University Health Network, announced a major new collaboration with Janssen Biotech to advance the development of new small molecule drug candidates from OICR's Drug Discovery Program. The research collaboration and option and license agreement are worth \$450 million.



MinION

A team of researchers in Canada and the U.K., including OICR's Dr. Jared Simpson, announced in June that they had sequenced and assembled the first full genome of a living organism using a tiny, handheld sequencer called the MinION. In early 2016 they showed its use in a real world setting, tracking the spread of the Ebola virus in Africa in real time.



OICR comes together for Terry Fox

2015 marked the 35th anniversary of Terry Fox's Marathon of Hope. In September OICR partnered with the MaRS community to mark the milestone and held two events: the annual Great Canadian Hair 'Do' and the new 35-Hour Run. Additionally, OICR staff participated in the annual Terry Fox Run. Together the events raised over \$22,000 for the Terry Fox Foundation.



Biostatistics Training Initiative

In November OICR expanded the Biostatistics Training Initiative, a program designed to help train the next generation of qualified biostatisticians to work with the large amounts of data required in cancer research today. The expanded initiative will engage a broader group of trainees, including PhDs and postdoctoral fellows.



OICR's 10th anniversary

December marked the 10th anniversary of OICR, which was launched by the Government of Ontario in 2005. The Institute has made great progress in its first decade, building a new world-class cancer research centre, attracting top talent to Ontario and developing innovative translational research projects. More detail on OICR's recent successes can be found in the following pages.



ASIST trial completes accrual

The Active Surveillance Magnetic Resonance Imaging (ASIST) trial reached a major milestone at the end of 2015 when it completed recruitment of patients for its Phase III clinical trial for men diagnosed with low-risk prostate cancer. The study is comparing men undergoing standard active surveillance with those supplemented with a novel, developed-in-Ontario imaging solution to better detect and flag aggressive disease that needs to be treated.



New money for drug development in Ontario

In January the Drug Discovery Program announced \$1.2 million in funding for five promising early-stage research projects to help bring them closer to the clinic. The funded projects cover a wide range of cancers and are based at major research institutions across Ontario. In addition to funding, the team will provide expertise and in-kind support.



Launch of bilingual website

In March OICR launched a bilingual website with information of interest to the general public. The all-new site features an overview of the Institute, its programs and initiatives and news in both French and English.

OICR's new strategic plan for 2016-2021



OICR has, since its inception, supported the recruitment of a cadre of outstanding cancer investigators to Ontario, catalyzed high-quality research around key cancer priorities and worked to fill gaps in translational cancer research capacity in the province. With a robust pipeline of innovative assets poised to reach the clinic over the next five years, as well as important and timely initiatives being launched to foster collaboration and bolster translational research excellence within the Ontario oncology ecosystem, OICR is furthering the transformative impact of this investment.

The Institute developed and executed two five-year strategic plans. OICR now has a new strategic plan for 2016-2021 that sets out strategic initiatives to advance the Institute's mission, goals and translational research priorities, building on the foundation established over the first 10 years.

The plan was developed after extensive consultations with the Ontario cancer research community. It also takes into consideration the recommendations of an independent review panel.

Research at the Institute will be divided among four major strategic initiatives (see the blueprint above). The research themes selected are areas where Ontario scientists can have a significant impact.

Clearly reflected in OICR's vision and mission is the Institute's commitment to collaboration and to focusing on achieving impact for the benefit of patients. Five goals have been set to achieve the vision and mission:

- Perform cutting-edge translational cancer research;
- Mobilize Ontario research strengths around key cancer priorities;
- > Partner with the Ontario cancer community to leverage and elevate the level and impact of cancer research in the province;
- Drive the adoption and/or commercialization of cancer innovations in Ontario;
- Enhance Ontario's global leadership in cancer research.

OICR's Vision

A collaborative centre of excellence in cancer research that moves Ontario to the forefront of discovery and innovation so that the people of Ontario and the economy benefit from promising research results and breakthroughs.

OICR's Mission

Partner with the Ontario oncology community to accelerate the development and use of clinically important knowledge, products, services and policies to improve cancer prevention, detection, diagnosis and treatment and enable patients in Ontario and worldwide to live longer and better lives.

Technology Programs

Through its Technology Programs, OICR will build on the strong legacy of cancer research developed during its first 10 years, leveraging the critical mass of principal investigators and staff scientists that deliver innovation, provide state-of-the-art technological expertise and support analytics for the interpretation of data.

The six Technology Programs will:

- Enable cancer research in Ontario by providing access to technical services/training, resources and expertise;
- Contribute vital expertise to the Strategic Initiatives;
- Catalyze technology innovation;
- Seed new research projects aligned with OICR's priorities.

Translational Research Initiatives

Translational Research Initiatives (TRIs) will be launched to translate concepts, knowledge and innovations developed in Ontario to address important medical needs of cancer patients. The TRIs are large-scale, multi-disciplinary collaborations between laboratory and clinician-scientists, focussed on areas of excellence in Ontario with a defined clinical need.

Cancer Therapeutics Innovation Pipeline

The role of the Cancer Therapeutics Innovation Pipeline is to efficiently develop cancer discoveries from Ontario labs into therapeutic lead compounds with potential to treat difficult cancers. The Pipeline will address a clear gap in early oncology drug discovery, where there is limited funding available and assets are often too risky to attract private sector interest. It will capitalize on Ontario's expertise in medicinal chemistry, biologics and structural biology to advance promising discoveries into lead compounds (small molecules or biologics) that have the potential to attract partners for further development.

Global Leadership in Precision Oncology

The goal of this initiative is to improve patient outcomes by tailoring interventions to genomic characteristics of individual patients and their presenting disease. To accomplish this, OICR will partner with Ontario institutions to strengthen and catalyze translational cancer genomics so Ontario patients can benefit from the latest research. OICR will continue to lead and participate in global initiatives that generate the robust datasets and insights critical for guiding patient management and treatment decisions.

Collaborative Research Networks

The Collaborative Research Networks will strengthen and enable the province's capacity for translational cancer research. They will collectively improve Ontario's ecosystem and capabilities for undertaking high-quality translational research by providing access for researchers and clinicians to shared expertise, resources and enabling infrastructure.

The Institute has established the Ontario Molecular Pathology Research Network to bolster research capacity, collaboration and leadership in cancer pathology. OICR will continue to invest in five existing collaborative research networks that facilitate translational cancer research in Ontario.

Provincial initiatives include a new cohort study, the Ontariowide Cancer TArgeted Nucleic acid Evaluation (OCTANE) study and the creation of a clinical genomics laboratory, the Princess Margaret-OICR Translational Genomics Laboratory (TGL).

International initiatives include the International Cancer Genome Consortium, the International Cancer Genome Consortium for Medicine and the Global Alliance for Genomics and Health.

The OICR Investigator Awards Program is designed to strengthen Ontario's research capacity by attracting top research talent and retaining existing talent in the province. The program provides stable funding for principal investigators in the Institute's Strategic Initiatives, Technology Programs and in other affiliated research projects, with the ultimate goal of using this world class expertise to help accelerate the delivery of Ontario research discoveries to patients.

The Strategic Plan positions the Institute to build on its established expertise and capabilities. Using this foundation OICR will strive to become more integrated in Ontario's clinical and research communities. This greater engagement will result in better outcomes for cancer patients and economic benefits for the province of Ontario.

Investing in the cure and the economy

Ontario has some of the finest cancer researchers in the world who are developing new cancer therapies, diagnostic tools and other anti-cancer technologies. When these novel products make their way into clinical use they improve outcomes for cancer patients and reduce the cancer burden on society.

However, it takes more than just years of research to get new technologies into the hospital. It takes investment and business expertise to further develop them and turn them into commercially viable products. The Fight Against Cancer Innovation Trust is working with researchers across Ontario to see that their promising ideas become products that help patients and benefit the province's economy. FACIT was established by OICR to propel the development and commercialization of discoveries from its own research programs as well as those from cancer researchers across Ontario. Over the last year FACIT was central to the formation of three new companies with a diverse array of anti-cancer technologies. One of the companies formed by FACIT was Turnstone Biologics Inc., which is focused on developing treatments for cancer that stimulate and harness the patient's own immune system. Turnstone's technology platform is a first-in-class oncolytic viral immunotherapy and is based upon the research of Dr. John Bell, leader of OICR's Ontario Regional Bio-therapeutics Program (ORBiT) and Senior Scientist at the Ottawa Hospital Research Institute, Dr. David Stojdl of Children's Hospital of Eastern Ontario and Dr. Brian Lichty of McMaster University. It combines the benefits of oncolytic viral therapy with a tumourtargeted, immune-stimulating vaccine into a single treatment and has great potential. Immunotherapies have recently emerged as one of the most promising forms of treatment for cancer.

OICR and FACIT played a critical role in translating our discoveries...

"Turnstone Biologics is the culmination of a long-term collaboration between the founding scientists, their institutions and many supporters of cancer research across our country," says Bell. "OICR and FACIT played a critical role in translating our discoveries from the laboratory to the clinic with significant financial and in-kind support to the ORBiT Program. We are now well positioned to accelerate the development of this first oncolytic vaccine, bringing a new hope to patients and building on the recent progress in cancer immunotherapy."

Mr. Jeff Courtney, FACIT's Chief Commercial Officer, is pleased with the company's progress. "Over the last year we have founded the company, secured \$11.3 million in Series A financing led by top-tiered healthcare venture capital firm Versant Ventures, and started enrolment in a clinical trial of Turnstone's oncolytic viral immunotherapy," says Courtney. "Drug development is a high-risk and capitalintensive endeavour, and a committed partner such as Versant with its vast network of resources and partnering experience improves the likelihood of a successful outcome. Turnstone is well-positioned to aggressively accelerate this technology toward clinical use."

The creation of the startups and their subsequent success reflects the active management and hands-on approach that FACIT employs.

As new forms of treatment such as Turnstone's immunotherapies begin to emerge, the development of novel and improved forms of traditional therapy types has continued. Scientists in OICR's Drug Discovery Program, together with collaborators at the University Health Network, discovered and developed a promising new small molecule drug candidate for the treatment of haematological cancers. Getting a new drug such as this into the clinic can take several years and cost hundreds of millions of dollars. To ensure the continued development of the drug candidate, FACIT formed Novera Therapeutics Inc. and the company entered a collaboration with Janssen Biotech, a Johnson & Johnson company. The research collaboration and option and license agreement could potentially provide \$450 million to Novera. Under the agreement Janssen will take over

responsibility for pre-clinical, clinical and commercial development once it exercises its option.

Courtney explains the importance of this deal to the development of the Drug Discovery team's drug candidate. "I don't want to discount the importance of the financial aspects of this partnership, but what is truly important is that we have the right groups at the table to see that this molecule is advanced through development. Being able to leverage the expertise of a partner like Janssen is crucial to success."

FACIT also invested in Fusion Pharmaceuticals Inc., because of

> its unique expertise in creating alpha-emitting therapies and its novel radiotherapeutic FPX-01 for the treatment of cancer, with the aim of advancing the

technology into a Phase I/II clinical trial. FPX-01 is based on a radiolabelled human antibody directed against the cancer cell surface receptor target IGF-1R. For therapeutic effect, the antibody is linked to a high energy, alpha particle-emitting isotope. Unlike previous generations of therapeutic radiopharmaceuticals, alpha (particle)emitting agents possess a much more favourable safety profile that enables patients to be treated in conventional cancer treatment facilities. When FPX-01 binds to its target it immediately internalizes and accumulates, and the alpha particles then produce breaks in the DNA resulting in the cell's death. Fusion's approach is also unique in that images of the cancerous lesion or the effects of FPX-01 can be obtained through the use of a SPECT or PET scan simply by substituting an imaging isotope in place of the therapeutic isotope.

Dr. Michael Cross is General Manager of the Centre for Probe Development and Commercialization (CPDC) Radiopharmaceuticals and one of the key players in setting up Fusion as a spin-off company. OICR was instrumental in the creation of CPDC in 2008, contributing significant funding and resources since its inception. "The guidance and support from FACIT has allowed Fusion to move forward with both drug development and corporate activities that ultimately advanced the company to the point where investors have taken a very keen interest," he explains. "Because of FACIT, Fusion was in a much stronger position to further its negotiations to in-license a needed antibody construct from a major pharmaceutical company, and provide additional leverage to ensure the amount of funds raised will be sufficient to see the advancement of FPX-01 through Phase I/II clinical development."

The creation of the startups and their subsequent success reflects the active management and hands-on approach that FACIT employs. This enables stronger value generation for, and positioning of, OICR's internal and associated discoveries and research. Although it is a relatively young organization, FACIT is gaining momentum and making an impact by catalyzing the development and commercialization of Ontario's most promising oncology technologies to benefit patients, their families and Ontario's economy.



Personalizing prostate cancer treatment

Prostate cancer is the most common cancer in Canadian men and while it has been the focus of extensive research, an estimated 4,000 Canadians die of the disease each year. That is why six years ago Dr. Paul Boutros and Dr. Rob Bristow set out to sequence the normal and diseased tissue of 350 patients and learn from a clinical perspective how genomic information can be used to guide better treatment.

After many years of hard work the Canadian Prostate Cancer Genome Network (CPC-GENE), co-led by Boutros and Bristow, has completed the planned genome sequencing and is publishing results that are poised to improve the treatment of prostate cancer by personalizing therapy for individual patients. The CPC-GENE project is part of the International Cancer Genome Consortium and is funded by Prostate Cancer Canada and OICR.

"This project was different from a lot of the efforts you see in genome sequencing, since there is such a clinical focus to it," explains Boutros. "People working on the project had

One of those trainees, Dr. Emilie Lalonde, published a first

paper describing a novel technique to use both genomics

accurate prognosis. "This research was important in helping

us to understand how we should be analyzing tumours to personalize treatment," says Boutros. "It goes hand-in-hand

with our other recent major paper where we looked at why

mistakes are made in the use of tests in the clinic."

and the tumour's microenvironment to establish a more

to understand both the technical aspects of genome sequencing and analysis as well as the treatment of prostate cancer in the clinic." Boutros says that exceptional graduate students and trainees were essential to bridging this gap.

Differences within the tumour mean that a single biopsy will not tell the whole story

In this second paper Boutros, Bristow and collaborators across Canada reported that differences within tumours are partially responsible for biomarkers not always being as accurate and useful as possible. "We found that differences within the tumour mean that a single biopsy will not tell the whole story," explains Boutros. "Multiple biopsies are needed to get an accurate picture of the patient's prostate cancer and in turn provide better treatment through personalization." He says that their data suggests 10 - 15 per cent of patients have two genetically distinct tumours in their prostate and this highlights the difficulty in personalizing treatment.

> Boutros and Bristow plan to continue to build upon the findings of these papers and validate their work using large cohort studies. "We are excited to keep adding to our understanding of prostate

cancer and to make a push to see that our work is used in the clinic. Armed with this improved understanding of the disease we can offer better diagnostic and prognostic tools that will enhance treatment for prostate cancer patients," says Bristow.

Dr. Boutros is a Principal Investigator in OICR's Informatics and Bio-computing Program and Dr. Bristow is a clinicianscientist at the University Health Network's Princess Margaret Cancer Centre

14



OICR stands up to cancer

Cancer research is changing, with a renewed focus on translation and collaboration. Yet much of the general public still doesn't know about this important shift or what it means for the development of the next generation of therapies and treatments.

Stand Up to Cancer is an international organization helping to change that. It was founded in the U.S. to build broad support for groundbreaking translational research projects. This year Stand Up to Cancer Canada, the organization's Canadian arm, launched two Dream Teams focused on breast cancer and cancer stem cells. Both teams are taking ingenious approaches to cancers that are difficult to treat and for which there are currently few treatment options. OICR has partnered with Stand Up to Cancer Canada to provide funding for clinical trials in Ontario that are expected to arise from the research, ensuring the scientific results are translated to the clinic.

The Breast Cancer Dream Team, led by Drs. Tak Mak and Samuel Aparicio, is focusing on triple-negative breast cancers. This is a classification for breast cancers that do not respond to the three most common avenues to block breast tumour growth and provide few treatment options for patients. The Dream Team is targeting breast cancer at the genomic level, finding areas where cells are much more unstable than healthy cells and therefore vulnerable to treatment. So far the team has identified three promising agents that target these vulnerabilities in triple-negative breast cancer cells. If successful, these treatments will provide a more targeted alternative to chemotherapy with far fewer side effects and a new avenue of treatment for triple-negative breast cancers. The Cancer Stem Cell Dream Team will use genomic and molecular profiling techniques to target brain cancers in children and adults that currently have few treatment options and very poor outcomes. The team, led by Drs. Peter Dirks and Samuel Weiss, is performing detailed analysis of brain tumour stem cells to fully understand their biological profile and how they drive cancer growth. They are then testing new drug combinations on these cells that may be effective in stopping their growth, including five new potential drugs that have already been identified as promising in the lab.

Both teams were selected by an international Scientific Advisory Committee based on their scientific merit and their ability to translate their discoveries to patients. Other partners in Stand Up to Cancer Canada include Astra Zeneca, Canadian Breast Cancer Foundation, Canadian Cancer Society, Canadian Institutes of Health Research, Cancer Stem Cell Consortium, CIBC, Genome Canada and MasterCard.

Constructing the cloud

OICR's reputation as leader in managing and analyzing big data has grown over the past year as the Institute has worked with private and public partners to bring more genomic and health data to the cloud.

As the host of the Data Coordination Centre for the International Cancer Genome Consortium (ICGC), OICR hosts one of the world's most important cancer genomics data sets.

In November 2015 the ICGC announced that 1,200 of its encrypted cancer whole genome sequences were being made available in the cloud via a partnership with Amazon Web Services, allowing access to the data by authorized cancer researchers worldwide. Increased access to the data means more collaboration and will hopefully lead to the acceleration of new treatments for cancer patients.

In March 2016 OICR joined the Collaborative Cancer Cloud (CCC), an initiative started in 2015 by the Knight Cancer Institute and Intel Corporation. Along with the Dana Farber Cancer Institute, OICR was the first of what will soon be dozens of institutions to join the CCC, which allows for secure computation of large datasets across many different sites while still preserving local control of those data.

Both partnerships illustrate the need for public and private institutions to work together and, more fundamentally, the importance of making more data accessible to researchers through the cloud. Major improvements in sequencing technology have made genome sequencing far more accessible to the research community. But analyzing, moving and sharing these massive data sets has become a major bottleneck due to both cost and time. Large-scale sequencing projects like the ICGC are now well underway, but their impact will be limited if researchers can't access these data sets quickly and cost effectively.

Working with the Global Alliance for Genomics and Health, OICR is also ensuring that these data can be shared in a standardized and interoperable fashion to ensure greatest impact for patients.

Partnerships like those with Amazon Web Services and the CCC help to break the current bottleneck and make collaboration faster, more flexible and more cost-effective.

"Cloud services allow researchers to access cloud-based virtual computers from their desktop as they need them and only pay for the time they use," says Dr. Lincoln Stein, Director of OICR's Informatics and Biocomputing Program. "This means a large genome data set might take days or weeks to execute instead of months, which accelerates the pace at which research can be conducted and means that new discoveries can get to patients sooner."





Improving screening for patients with brain cancer

Evaluating new therapies for cancer through clinical trials is one of the most important steps in moving novel drugs from the lab to clinical use. Recently Dr. Michael Taylor and his collaborators discovered a way to improve clinical trials for testing new therapies for medulloblastoma, a common form of brain cancer in children. The study was conducted with OICR's support.

For patients to be enrolled in a clinical trial they need to have already received 'standard of care', meaning they have undergone traditional, non-experimental treatment. However, Taylor says, the discovery research done in the lab to get the drugs to a point at which they can be tested in patients, is performed on cell lines and mice that have not received standard of care.

"The assumption that the biology of a patient's tumour would remain the same after they receive standard care appears to be part of what is causing some clinical trials for medulloblastoma to fail," explains Taylor. "Drugs are being targeted at tumour cells that are no longer the same following standard treatment."

To evaluate the impact of standard of care, Taylor and his team performed microsurgery on mice implanted with medulloblastoma, then gave the mice CAT scan-guided radiation therapy four times a week. This mirrored the standard of care given to children with the disease. Once the medulloblastoma recurred in the mice, the researchers analyzed the cancer cells and found that there was only a five per cent overlap in the tumour biology from before and after standard of care treatment.

"Having only a one-in-twenty chance of the tumour having the target you want to hit is not a very good starting point for a clinical trial," says Taylor. "This is why my colleagues and I met to agree on a better way forward." Following a meeting of European and North American medulloblastoma experts in Heidelberg, Germany, many research groups plan to begin to perform biopsies at recurrence. This will help determine if a given drug in a clinical trial can properly target a patient's tumour.

"We hope that by improving the screening of patients for clinical trials we can provide better outcomes for patients and advance the next generation of treatments for medulloblastoma," concludes Taylor.



Dr. Michael Taylor is a neurosurgeon at The Hospital for Sick Children, Principal Investigator, The Arthur and Sonia Labatt Brain Tumour Research Centre, Senior Scientist, Developmental & Stem Cell Biology and Professor, Departments of Surgery and Laboratory Medicine and Pathobiology, University of Toronto.



The cost of cancer

In Ontario there is a treasure trove of healthcare use information that researchers could be using to understand and improve cancer care that has not yet been fully realized. Dr. Nicole Mittmann is working to change that.

In a research project funded by OICR's Health Services Research Program, Mittmann and her team have spent the last four years successfully finding ways to link the disparate provincial cancer databases and getting a better sense of exactly how people are using the healthcare system. Now that these databases are linked she is developing algorithms to determine the costs of common treatments and how they compare. The ultimate goal is to identify which treatments provide the best value and will ensure that patients receive the highest quality care.

"Understanding how people are being cared for and how much that costs, across different regions and populations, is extremely important for delivering the best treatment," says Mittmann. "Once we know what the health system resources and costs are we can plan and predict how to better deliver treatment. That could be access to better care, different care, or more efficient care."

She cites the example of emergency department visits by women with breast cancer due to complications after receiving chemotherapy, an issue that is currently also being studied in a linked OICR-funded research project led by Dr. Monika Krzyzanowska. Emergency department visits are expensive and don't provide the best treatment for patients, yet many patients end up relying on them. Now that the databases are linked, researchers like Mittmann and Krzyzanowska can track exactly how and why patients are accessing the system. Then they can use this data to make a strong case to change the system to a proactive approach that would provide patients with better care. Understanding how the system is used and how much it costs are both important parts of improving it, Mittmann notes. "Cost is important but you can't cost if you can't count. You need to be able to identify the healthcare resources people are using in order to make the case for a change in practice."

If we understand how care is managed... we can figure out how to create a sustainable healthcare system for all cancer patients.

Her work currently focuses on breast and colorectal cancer, but could be expanded to other cancers once this project is complete.

"We're not going to improve someone's quality of life by simply adding a dollar figure," Mittmann says, "but if we understand how care is managed and we understand what the cost drivers are, then we can figure out how to create a sustainable healthcare system for all cancer patients."

Dr. Mittmann is Chief Research Officer at Cancer Care Ontario. She is creating the first corporatewide research strategy for the organization which will focus on how to improve both patient and health system outcomes. She is also an affiliate scientist at Sunnybrook Health Sciences Centre.

Tamara Jamaspishvili

Dr. Tamara Jamaspishvili always knew she wanted to be a doctor. Growing up in the country of Georgia she was interested from an early age in understanding the intricate processes of the human body. "I wanted to understand how normal physiological processes turned abnormal, what caused it to happen and how to revert these processes back to the normal state to save patients' lives."

Ontario provides vast opportunities to pursue and build a high-quality career in cancer research

Jamaspishvili obtained an MD and a PhD in Pathology and Forensic Medicine and is now working in the lab of Dr. David Berman at Queen's University in Kingston. She was attracted to the province because of the many opportunities here for young researchers. "Ontario provides vast opportunities to pursue and build a high-quality career in cancer research," she says.



In Berman's lab she is discovering and validating potential diagnostic and prognostic biomarkers for prostate cancer that could help in better diagnosing the disease and prescribing treatment. She is a Fellow in OICR's Transformative Pathology Program and works on the PRONTO project, funded by Prostate Cancer Canada.

Jamaspishvili is especially pleased to be working in such a collaborative environment on PRONTO and is excited about the potential of her current work. "It will help clinicians to identify hidden aggressive cancer at a very early stage," she says, "which will help to deliver more appropriate treatments to patients."

Paul Sheeran



After completing his PhD in biomedical engineering at the University of North Carolina Dr. Paul Sheeran headed north and is now a postdoctoral fellow at Sunnybrook Research Institute. There he is developing new ways to treat cancers of the liver. OICR's Smarter Imaging Program is funding Sheeran and his collaborators' work to develop ultrasound contrast imaging agents also capable of delivering therapy.

Part of our strategy is to make things easier to commercialize by not reinventing the wheel

"We have taken a widely used agent called a microbubble and modified it so that it can be activated by ultrasound energy to release drugs into hard to treat tumours further than has been possible," explains Sheeran. "However, our team is concerned with more than just the technical and scientific aspects of this technology - we are also working on ways to get this to the clinic sooner."

They are doing this by looking for 'shortcuts' to the clinic. "Part of our strategy is to make things easier to commercialize by not reinventing the wheel. A good example of this is that the technology we are building can be synthesized directly from agents that are approved for use in humans, meaning that we will save time on what it takes to develop compared to a brand new drug. This means that treatment can get to patients faster."

THE NEXT GENERATION

Mary Anne Quintayo

Mary Anne Quintayo has a very personal connection to cancer. Her mother is a breast cancer survivor and, like so many people, she has family and friends who have had a cancer diagnosis. "I feel that if I am excellent at doing this job, I'll be able to ease even a bit of pain from each patient and their families," says Quintayo.



It was Quintayo's mother, who is a physician, who inspired her to become a cancer researcher. She first wanted to follow in her mother's footsteps, but then found she preferred working in the laboratory, especially in histopathology. She completed a Bachelor of Science in Medical Technology in the Philippines and then received accreditation in the U.K. from the Health Professions Council and Institute of Biomedical Science.

I love everything about this job

She moved to Toronto along with Dr. John Bartlett and several other lab members from Edinburgh to work as a Research Associate when he was recruited to build the Transformative Pathology Program at OICR.

"I love everything about this job," she says of her move to OICR. "I have been able to accomplish many great things to contribute to the knowledge and treatment of breast cancer."

Mary Anne Quintayo received the 2014 Roger Cotton Prize for Histopathology for her exceptional work on virtual tissue microarrays.

Jüri Reimand

Dr. Jüri Reimand likes to tell stories in a different way: with data. Reimand's goal is to make the stories he tells with data so effective that they spur others to follow up on his research and do things like create mouse models or test a compound against a cancer cell line.

Reimand is a new OICR Investigator in the Informatics and Bio-computing Program. He is a computer scientist by training who developed a keen interest in human biology and disease.

Being a principal investigator is a new exciting challenge as one is not formally trained to build teams as a postdoc

"My main focus is broadly defined as pathway and network analysis," he says, "but that really means different types of analyses on large amounts of data generated by technologies such as next generation sequencing, incorporating existing knowledge about networks and pathways to interpret signals in the data and propose hypotheses ('stories') about underlying biology and disease mechanisms."



Reimand is working to establish his lab and recently hired his first bioinformatician and an experimental postdoc. He says that ultimately he would like to see his group establish a niche and help to expand OICR's bioinformatics capacity. "Being a principal investigator is a new exciting challenge as one is not formally trained to build teams as a postdoc," he says. "I strive to create an environment that will empower my lab members to design and complete research projects on their own."

THE NEXT GENERATION



On December 15, 2015, the OICR community was devastated by the passing of Dr. Mark Ernsting, an incredible colleague and friend and a brilliant cancer researcher in the prime of his career.

Mark was developing a cutting-edge drug delivery system for cancer that uses submicroscopic nanoparticles to deliver cancer drugs to tumour cells, sparing healthy normal tissues around them. If successful, this system will provide more targeted drug delivery with fewer side effects for patients.

Mark was intensely passionate about his work, strategic in his thinking and extremely focused on ensuring its success. There were many hurdles to overcome, but Mark's brilliance as a biomedical engineer and his persistence drove the work forward even through the project's greatest challenges.

OICR has committed to continuing this work to ensure Mark's legacy lives on

His colleagues in the Drug Discovery team remember him for this passion, but also for his kindness and generosity. He expected a lot from his coworkers but gave back even more, whether it was a BBQ hosted at his home or providing solutions on a daily basis to problems other colleagues were struggling with. He was driven because his work could help people and he felt responsibility for ensuring its success.

"He was an inspiration to everyone on the team," said Dr. Rima Al-awar, Director of the Drug Discovery Program. "He was a passionate and committed researcher always ready to take on a challenging

Remembering Dr. Mark Ernsting

problem. He found creative and ingenious ways to solve problems and move a project forward. But he always did it with a smile, with kindness and in a spirit of collaboration."

Mark first came to OICR in 2009 to work with Dr. Shyh-dar Li. Together they developed the drug delivery system Cellax[™]. When Shyh-dar left for The University of British Columbia in 2014, Mark took over the project at OICR, continuing the work. He was working with OICR's commercialization partner FACIT to bring Cellax to market. Cellax was the first technology at OICR to receive a patent.

OICR has committed to continuing this work to ensure Mark's legacy lives on. Joseph Bteich, a nanotechnology engineer who worked closely with Mark is now carrying on that effort and FACIT is continuing to partner with OICR to ensure the technology is given every opportunity for success.

"Cellax is a very innovative technology," said Jeff Courtney, Chief Commercial Officer of FACIT. "There is a lot of work still to be done, but we will do everything we can to continue Mark's work and push this project forward."

Colleagues say the lab feels empty without him. Even months after his death there is a palpable void in his former work area. Mark was able to leave a great legacy behind in Cellax, one that can hopefully have a big impact for cancer patients. But his legacy will also continue on in his colleagues, who say that Mark always inspired them to think bigger, work harder, and to never forget to take the time to laugh.

Financial Statements

Independent Auditors' Report

To the Members of the Ontario Institute for Cancer Research

The accompanying summarized financial statements, which comprise the summarized statement of financial position as at March 31, 2016 and the summarized statements of operations and changes in net assets and cash flows for the year then ended, are derived from the audited financial statements of the Ontario Institute for Cancer Research as at and for the year ended March 31, 2016. We expressed an unqualified audit opinion on those financial statements in our auditors' report dated June 23, 2016.

The summarized financial statements do not contain all the disclosures required by Canadian accounting standards for not-for-profit organizations applied in the preparation of the audited financial statements of the Ontario Institute for Cancer Research. Reading the summarized financial statements, therefore, is not a substitute for reading the audited financial statements of the Ontario Institute for Cancer Research.

Management's responsibility for the summarized financial statements

Management is responsible for the preparation of the summarized financial statements in accordance with Canadian accounting standards for not-for-profit organizations.

Auditors' responsibility

Our responsibility is to express an opinion on the summarized financial statements based on our procedures, which were conducted in accordance with Canadian Auditing Standards 810, "Engagements to Report on Summary Financial Statements".

Opinion

In our opinion, the summarized financial statements derived from the audited financial statements of the Ontario Institute for Cancer Research as at March 31, 2016 and for the year then ended are a fair summary of those financial statements in accordance with Canadian accounting standards for not-for-profit organizations.

Ernst * young LLP

Toronto, Canada, June 23, 2016

Chartered Professional Accountants Licensed Public Accountants

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

Statement of Financial Position

Excerpt from the audited financial statements

As at March 31	2016	5 2015
Assets		
Current		
Cash	\$ 20,985,975	\$ \$ 17,319,423
Accounts receivable	4,685,515	5,780,829
Supplies	922,497	7 331,550
Prepaid expenses	2,093,946	5 2,243,476
Deferred lease expense	-	- 72,830
Total Current Assets	28,687,933	3 25,748,108
Long-term portion of prepaid expenses	1,302,665	1,309,772
Capital assets, net	23,243,213	3 27,509,720
Note receivable	232,863	3 300,927
Fight Against Cancer Innovation Trust	4,717,508	3,945,318
	\$ 58,184,182	2 \$ 58,813,845
Liabilities and Net Assets		
Liabilities		
Current		
Accounts payable and accrued liabilities	\$ 9,274,048	\$ \$ 9,303,775
Unearned rental revenue	103,482	2 —
Term loan	240,000) 310,000
Total Current Liabilities	9,617,530	9,613,775
Deferred contributions	15,755,636	5 13,225,467
Deferred capital contributions	23,243,213	3 27,509,720
	48,616,379	9 50,348,962
Net Assets	9,567,803	8,464,883
	\$ 58,184,182	2 \$ 58,813,845

Statement of Operations and Changes in Net Assets

Excerpt from the audited financial statements

	Cancer Research	External Grants	Total	Total
Year ended March 31	Program 2016	Program 2016	2016	2015
Revenue				
Grant from Ministry of Research and				
Innovation	\$ 75,055,559	\$ —	\$ 75,055,559	\$ 82,040,463
Other grants	5,744,146	12,112,377	17,856,523	14,570,893
Rent	1,268,468	—	1,268,468	1,253,677
Fees, workshops and other income	495,493	-	495,493	293,984
Equity income in Fight Against Cancer				
Innovation Trust	772,190		772,190	3,945,318
	\$ 83,335,856	\$ 12,112,377	\$ 95,448,233	\$ 102,104,335
Expenses				
Investigator and research support	\$ 37,000,868	\$ 3,272,497	\$ 40,273,365	\$ 42,547,121
Salaries and benefits	24,963,838	5,264,813	30,228,651	28,940,714
Amortization of capital assets	6,845,478	1,595,695	8,441,173	9,414,593
Rent, utilities, taxes and building				
maintenance	7,638,493	-	7,638,493	8,990,921
Office and general	3,377,665	240,384	3,618,049	4,398,240
Contracted services	1,203,116	1,061,918	2,265,034	1,552,835
Information system support	841,825	456,650	1,298,475	1,391,520
Workshops and conferences	69,172	107,304	176,476	351,564
Marketing and communications	140,899	98,725	239,624	270,954
Professional fees	151,582	14,391	165,973	127,071
	\$ 82,232,936	\$ 12,112,377	\$ 94,345,313	\$ 97,985,533
Excess of revenue over expenses for				
the year	1,102,920	-	1,102,920	4,118,802
Net assets, beginning of year	8,464,883	-	8,464,883	 4,346,081
Net assets, end of year	\$ 9,567,803	_	\$ 9,567,803	\$ 8,464,883

Statement of Cash Flows

Excerpt from the audited financial statements

Year ended March 31	2016	2015
Operating Activities		
Excess of revenue over expenses for the year	\$ 1,102,920	\$ 4,118,802
Add (deduct) items not involving cash		
Amortization of capital assets	8,441,173	9,414,593
Amortization of deferred capital contribution	(8,441,173)	(9,414,593)
Decrease in deferred lease expense	72,830	124,848
Equity income in Fight Against Cancer Innovation Trust	(772,190)	(3,945,318)
	\$ 403,560	\$ 298,332
Changes in non-cash balances related to operations		
Decrease (increase) in accounts receivable	1,095,314	(579,788)
(Increase) decrease in supplies	(590,947)	187,590
(Increase) decrease in prepaid expenses	156,637	(319,665)
Decrease in accounts payable and accrued liabilities	(29,727)	(20,704)
Increase (decrease) in unearned rental revenue	103,482	(94,179)
(Decrease) increase in deferred contributions	6,704,835	3,612,128
Cash provided by operating activities	\$ 7,843,154	\$ 3,083,714
Investing Activities		
Purchase of capital assets, net	(4,174,666)	(2,632,409)
Repayment of note receivable	68,064	77,347
Cash used in investing activities	\$ (4,106,602)	\$ (2,555,062)
Financing Activities		
Repayment of term loan	(70,000)	 (80,000)
Cash used in financing activities	\$ (70,000)	\$ (80,000)
Net increase in cash during the year	3,666,552	448,652
Cash, beginning of year	17,319,423	 16,870,771
Cash, end of year	\$ 20,985,975	\$ 17,319,423

Board of Directors, Scientific Advisory Board and Senior Management

(as of March 31, 2016)

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Nicole Onetto, MD Deputy Director and Chief Scientific Officer

Jane van Alphen Vice-President, Operations

Jeanette Dias D'Souza Chief Financial Officer

Michele Noble Corporate Secretary

OICR Program Leadership

(as of March 31, 2016)

Innovation Programs	Translation Programs
Cancer Stem Cell	Health Services Research
John Dick	Craig Earle
Program Director	Program Director
Innovation in Target Validation	Immuno- and Bio-therapies
Robert Rottapel	John Bell
Program Director	Program Director
Smarter Imaging	Translational Research Initiatives
Martin Yaffe	PanCuRx
Co-Program Director	Steven Gallinger
Aaron Fenster	Program Director
Co-Program Director	Incompany of Management of Facility
Technology Programs	Cancers
Drug Discovery	John Bartlett
D i A i	Program Director
Rima Al-awar Program Director	
Genome Technologies	
Tom Hudson Interim Program Director	
Informatics and Bio-computing	

Lincoln Stein Program Director

Imaging Translation

Aaron Fenster Co-Program Director

Martin Yaffe Co-Program Director

Transformative Pathology

John Bartlett Program Director





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