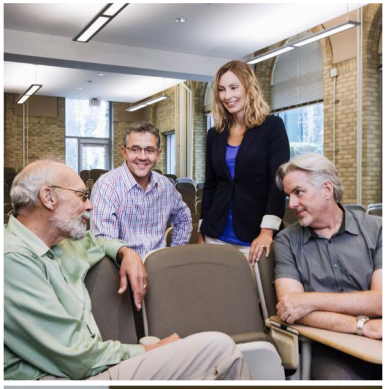
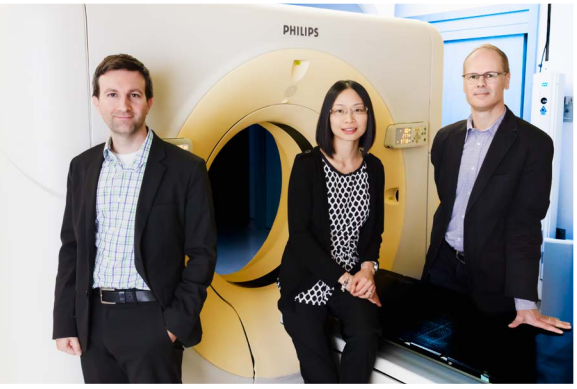
DEPARTMENT OF RADIATION ONCOLOGY
ANNUAL REPORT
2013 - 2014

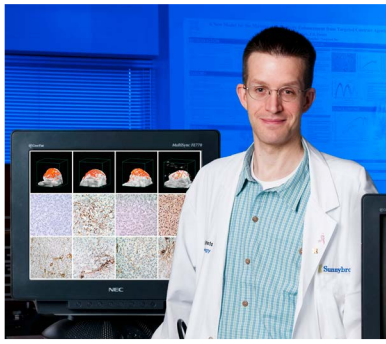










Radiation Oncology
UNIVERSITY OF TORONTO

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Images: Horst Herget Photography
Dr. Fei-Fei Liu Image: Donna Santos
Dr. Gregory Czarnota Image: Sunnybrook Health Sciences Centre
Writing: Sarah Khan

Read our full-length report online at www.uoft.me/annualreport

VISION

INTERNATIONAL LEADERSHIP IN RADIATION ONCOLOGY, RESEARCH, EDUCATION AND PRACTICE

MISSION

WE PREPARE FUTURE RADIATION ONCOLOGY LEADERS, CONTRIBUTE TO OUR COMMUNITIES AND IMPROVE THE HEALTH OF INDIVIDUALS AND POPULATIONS THROUGH DISCOVERY, APPLICATION AND COMMUNICATION OF KNOWLEDGE

CONTENTS

DR. FEI-FEI LIU
CHAIR'S WELCOME

BOUNDLESS LEADERSHIP

Welcome to the 2013 – 2014 Annual Report for the University of Toronto's Department of Radiation Oncology (UT DRO).

This has been a year of changes for UT DRO. I would like to thank our faculty members who have taken on leadership roles – Dr. William Song joined us as the lead of Medical Physics at Odette Cancer Centre, Dr. Rebecca Wong has taken on the position of Acting Vice-Chair for the Education portfolio, Dr. Patrick Chung took the lead for the Fellowship program, and Dr. Meredith Giuliani became the Director of the Undergraduate Medical Education program.

I would like to congratulate the faculty members who were successfully promoted this year – Dr. Andrew Loblaw was promoted to the rank of Professor, Dr. May Tsao was promoted to the rank of Associate Professor, and Dr. Patrick Cheung was promoted to the rank of Associate Professor. I would also like to welcome new faculty members to UT DRO – Dr. Lee Chin, Dr. Daria Comsa, Ms. Audrey Friedman, Ms. Rosanna Macri, Dr. Claire McCann, Ms. Raxa Sankreacha, Dr. Mojgan Taremi, Dr. Zahra Kassan, and Dr. Kathy Han.

The undergraduate Medical Radiation Sciences program welcomed its first cohort into the newly-redesigned Nuclear Medicine and Medical Imaging Technology program, and our Fellowship program welcomed its first shared fellow who will be spending his time at both the Princess Margaret and Odette Cancer Centres.

As always, our Knowledge Translation portfolio continues to excel. RTi3 celebrated its 10th anniversary this year with additional programming, and a team of our radiation therapists published their first book on research. Target Insight focused on proton therapy and welcomed speakers from around the world.

Last year, I announced our Alumni Engagement plan, and launched the Dr. BJ Cummings Award for Research Excellence by a UT DRO Trainee. I am pleased to announce that there is now $70,000 available for this Award, and we will be announcing its first recipient this winter. We hope that you will continue to support our awards and our trainees in the years to come.

This year, the Faculty of Medicine reached the half-way point in its strategic plan. Dean Whiteside invited us to present our growth and vision as part of the Faculty's plan. I am deeply grateful to our team who were instrumental in successfully highlighting UT DRO's achievements.

In addition, we completed our own strategic planning exercise this year. We examined our previous plan – The Transformative Agenda – and launched **The Road Map to 2017**, which will help guide us in our quest for ***"Global leadership in Radiation Oncology by transforming practice through innovation, and excellence in research and education."***

I am grateful to our Vice-Chairs: Dr. Shun Wong, Dr. David Jaffray, and Dr. Pamela Catton, as well as Acting Vice-Chair Dr. Rebecca Wong for all of their counsel, assistance, and commitment.

I hope you enjoy browsing through the 2014 Annual Report which highlights our Department's recent achievements as we continue to achieve excellence in radiation medicine research, education, and clinical practice.

Thank you,

Dr. Fei-Fei Liu, MD, FRCPC
Chair and Professor
Department of Radiation Oncology

VICE CHAIR REPORTS

CLINICAL AFFAIRS

DR. SHUN WONG
VICE CHAIR, CLINICAL AFFAIRS

EDUCATION

DR. PAMELA CATTON
VICE CHAIR, ACADEMIC AFFAIRS

DR. REBECCA WONG
ACTING VICE CHAIR, ACADEMIC AFFAIRS

RESEARCH

DR. DAVID JAFFRAY
VICE CHAIR, RESEARCH

Dr. Shun Wong completed his second term as Chief of Radiation Oncology at Sunnybrook and Dr. Gregory Czarnota became the new Chief as of July 1, 2013. Dr. William Song was recruited to lead Medical Physics at Odette in May 2014.

The clinical volumes at Princess Margaret and Odette remained stable in 2013-14, and met their respective provincial volume targets with over 10,000 and 7,000 treatment courses respectively. Both clinical sites continued upgrading the radiation planning and treatment units, and information and imaging systems.

UT DRO remained active in professional and teaching activities from our affiliated staff at Southlake Regional Health Care, Trillium Health Partners, Royal Victoria Hospital and Lakeridge Health.

In addition to Dr. William Song, other new appointments in 2013-14 included Dr. Lee Chin, Dr. Daria Comsa, Ms. Audrey Friedman, Dr. Kathy Han, Dr. Zahra Kassam, Ms. Rosanna Macri, Dr. Claire McCann, Ms. Raxa Sankreacha and Dr. Mojgan Taremi. Dr. Alexander Lightstone and Dr. Michael McLean retired after many years of service at Odette and Princess Margaret respectively. UT DRO also bid farewell to Dr. Jean-Phillipe Pignol who took on the position of Professor and Chair of Radiation Oncology at the Erasmus University Medical Center in Rotterdam, Netherlands.

UT DRO offered congratulations to Dr. Andrew Loblaw who was promoted to the rank of Professor, and Dr. Patrick Cheung and Dr. May Tsao to the rank of Associate Professor.

The Vice- Chair for Academic Affairs is responsible for the oversight of all education activities in the department. We offer a rich portfolio of activities that is dedicated to the training of future leaders in radiation oncology. From our highly successful training programs to educational initiatives for professionals in practice, we are committed to enable our community of learners to translate the state of the art into excellence in clinical care.

In 2013-2014, our undergraduate Medical Radiation Sciences Program is home to 316 students while our faculty provided over 3100 hours of undergraduate medical teaching to the next generation of physicians. Our residency program provides an enriched curriculum to 29 trainees, and 7 physics residents receive training across our 5 centers. One of the largest fellowship program globally, we provide subspecialized training to 27 of the best young radiation oncologists from 11 countries. Continuing Education is epitomized by RTi3 which celebrated its 10th anniversary while Target Insight led the community in exploring the future of proton therapy in Canada.

The external awards bestowed upon our trainees and faculty is one way of celebrating the quality of our learning culture. And so, special congratulations to Ali Ghiam (UT postgraduate medical trainee leadership awards 2014), Danielle Rodin (UICC Young Leader Award 2013), Lisa Di Prospero (U of T Outstanding Leadership in Advancing Interprofessional Education 2014), Sarah Rauth (THP Excellence in Medical Teaching 2014), and Pam Catton, Nicole Harnett & David Jaffray (UT Colin R Woolf Award 2012-2013).

The 2013-2014 academic year has been simply outstanding in terms of research growth. The combined research grant activity of the faculty (as measured by principal and co-principal grant funding) is $42.1 million. This is substantially higher than in previous years and reflects a growth in the faculty's ability to compete for peer-reviewed funding.

The total number of publications in the 2013-2014 academic year was 283 and the average publication rate per faculty was 1.8. This is a reduction from that reported in previous years and could be contributed to multiple of factors. A review of the percentage of publications in low (73% IF: 0-5), intermediate (11% IF: 5-10), and high (6% IF: >10) impact journals demonstrates a trend of continued reduction in the impact factor over the past few years. In 2010-2011 and 2011-2012 the intermediate IF rate fell from 19% to 15% and the high IF rate fell from 7.6 to 7.2.

Growth in translational research activities of our faculty is highlighted in the recent success of the two Terry Fox Team grants. Under the leadership of Dr. Greg Czarnota, the Odette Cancer Centre was funded for their program entitled "Ultrasound and MRI for cancer therapy" and Drs. Brad Wouters and Robert Bristow led the team developing "A research pipeline for hypoxia-directed precision cancer medicine" at the Princess Margaret representing $8.6M in new research support over the next five years. These two grants not only bring together a diverse portfolio of basic and clinical research with a focus on translation, they also serve to highlight the research profile of the UT DRO on the national stage.

BOUNDLESSVISION

Above: Claire McCann

CLAIRE McCANN

LEADING CLINICAL TRIALS AT ODETTE CANCER CENTRE

Dr. Claire McCann is an alumna of the Physics Residency program at University of Toronto's Department of Radiation Oncology (UT DRO), and a Medical Physicist and the Medical Director of Clinical Research at Sunnybrook's Odette Cancer Centre (OCC).

Claire first became interested in clinical trials during her PhD in Medical Biophysics when she was developing the RF Coil, a new technology to ablate solid tumours, and testing it on patients at University Health Network. "Through my research, I was first exposed to clinical trial activity," she recalled. "I knew that the research we do today defines the future standard of care. That is why when this position opened up at Sunnybrook, I thought it would be a good opportunity for me to learn about this type of clinical research because as a clinical physicist, it is sometimes difficult to be involved in phase I clinical research."

Claire explained that the clinical trials program at Sunnybrook went through some recent changes. The program became more

I WANT TO CREATE A NETWORK OF SHARING INFORMATION ABOUT CLINICAL TRIALS WITHIN UT DRO SO THAT WE CAN START MULTI-CENTRE ACADEMIC TRIALS

site-based and the site groups were given the responsibilities of running the trials. As the Medical Director of Clinical Research, Claire now oversees activities within each of the 10 site groups, funding opportunities, operations, and the clinical research program as a whole.

Currently, there are 113 active trials taking place at OCC in radiation oncology, surgical oncology, and medical oncology, in addition to cancer-related trials being led by investigators at the Sunnybrook Research Institute (SRI). Several UT DRO faculty members are involved in studies at Sunnybrook. Dr. Hans Chung is running a study looking at the efficacy of focal salvage HDR prostate brachytherapy. Dr. Danny Vesprini is running a multi-centre breast trial for the reduction of acute skin reaction in adjuvant breast radiation. Dr. Lisa Barbera is running a pilot study looking at dose distributions with conventional and MRI-guided brachytherapy treatments for cervical cancer patients.

> "Taking on this role has given me a very interesting perspective on traditional clinical research, specifically identifying opportunities to merge this type of research with novel emerging technologies and techniques in a truly multidisciplinary setting," Claire said. "I love being able to learn about how we can bring together research from surgical, medical, and radiation oncology, and other novel non-ionizing ablative technologies to define a new paradigm for multimodality cancer care."

Claire's vision for clinical trials at OCC involves collaboration – between investigators and between hospitals. "I want to create a network of sharing information about clinical trials within UT DRO so that we can start multi-centre academic trials. If we can engage the clinicians and investigators at each of the UT DRO sites, we can generate very powerful studies."

Claire notes that UT DRO already has the infrastructure to support sharing of information and collaboration between the six partner hospitals. "UT DRO is a very strong program. We should be collaborating and generating networks to facilitate studies that clinicians want to open up. I want to help bridge the gap between the sites, and even extend those networks beyond radiation oncology."

Claire explained that there is infrastructure funding available in Canada that is directed specifically towards multi-centre academic studies. She wants to leverage those funding opportunities to help facilitate clinical research within the Department. "Since we already have the infrastructure, we now need to define our goals for clinical research, and align them with Dr. Fei-Fei Liu's vision for the Department. Once these goals are established, we can start identifying which investigators and trials meet these goals, and create links between those investigators and centres."

It is well-known that clinical trials directly affect practice. In the case of OCC, a number of clinical studies are being led by researchers from SRI. "This allows us to connect traditional science and clinical research to define novel studies in radiation medicine," Claire explained. "One trial may combine non-standard thermal therapies with radiation medicine, and another trial may combine novel chemotherapeutic agents with radiation medicine. We are able to combine different modalities with radiation, and that's where the future of cancer therapy lies."

In addition to trials combining different modalities, many UT DRO faculty members are engaged in GU radiation oncology and SBRT studies. As their clinical research results in new standards-of-care, they become known as the leaders in those particular treatments. For example, High-Intensity Focused Ultrasound (HIFU) is a stand-alone treatment used to ablate tumours. UT DRO Professor Dr. Greg Czarnota has been collaborating on HIFU clinical trials for several years. Recently, it was established that HIFU can be used as a radiation sensitizer. This has not only created new treatment opportunities, it has also established Dr. Czarnota as a leader in this field.

Claire's vision for clinical trials at OCC will not only increase collaborations between UT DRO faculty members, it will also remove some of the challenges associated with clinical trials. "Multi-centre trials facilitate increased patient accruals. And since the studies will be done at different hospitals, it becomes much more powerful." She has applied for an infrastructure grant to help support multi-centre academic trials. If successful, she is looking forward to starting this process very soon.

CLINICAL AND EXPERIMENTAL RADIOBIOLOGY

FOSTERING A MULTIDISCIPLINARY APPROACH TO RADIATION ONCOLOGY

Normal tissues have a higher repair capacity than tumours.

This is just one of the many controversial statements that are discussed in radiobiology, the field that studies the effect of radiation on the human body.

Historically, educational opportunities in radiobiology for the 465 radiation oncologists and 454 medical physicists in Canada have been limited to a few classes in their training, learning on the job, or flying to Europe for dedicated courses. Since radiation medicine is moving towards more personalized treatments, radiobiology is an increasingly important aspect of training for radiation oncologists and medical physicists.

To fill this need, in 2009, University of Toronto's Department of Radiation Oncology (UT DRO) started offering a week-long intensive course called Clinical and Experimental Radiobiology. Now in its sixth year, this course has trained 250 residents and fellows from across Canada, and remains the only Canadian course focusing on radiobiology.

Dr. Brad Wouters, Professor at UT DRO and Senior Scientist and Interim Director of Research at Princess Margaret Cancer Centre, created this course with local colleagues, by modelling it on a similar course offered by ESTRO in Europe. "We based our course on a curriculum that has been tweaked and honed to provide the best and most relevant clinical education," said Brad. "We wanted to immerse the trainees into a course where they learn the language and science of radiobiology, as well as the application of radiobiology in the clinic."

Radiation oncology residents, medical physics residents, fellows, graduate students, and practicing oncologists from institutions across Canada have signed up for this course. One of the benefits of taking this course with trainees from different areas in radiation medicine is the multidisciplinary interaction between the students. The rich discussions that take place in the classroom help connect concepts and theories that stem from basic biology to other fields like imaging and physics. Faculty members from different fields also bring real-world clinical cases and examples to help the students connect theory to practice. Dr. Dick Hill, Professor at UT DRO, Senior Scientist at the Princess Margaret Cancer Centre, and one of the faculty for this course explained, "We bring controversial issues to discuss with the group and it has helped me develop an understanding of how radiobiology is relevant to clinical applications and how clinical groups can affect treatment outcomes."

Like many UT DRO residents, Jonathan Klein, a fifth year radiation oncology resident, also took this course twice: "In the first year, some of the concepts were difficult to grasp but it allowed me to form a basis for how radiotherapy works and how it develops into a clinical field. The second time around, I was better able to apply clinical issues to the basic science material, which helped solidify a lot of the decision making processes that we need to learn to become senior residents and staff physicians."

Most of the teachers for the course are UT DRO faculty, but it also invites radiation biology leaders from institutions in the United States and Europe. Brad explained:

> "We are very fortunate to have the strongest radiobiology faculty in the world. We take advantage of this as a majority of the course's faculty are from our own department. We are also lucky to have two of the editors of Basic Clinic Radiobiology – one of the main textbooks of the field – as well as the world-leader in statistical analysis of radiation oncology trials. This course is taught by not only leaders in radiation biology, but faculty members who work in this field every day and bring their real-world experiences to the course."

This course is training medical physicists and radiation oncologists to actively think about the biological aspects of treatment, and to bring new ideas to the table. Dr. Rob Bristow, faculty member of this course, Professor at UT DRO, and Clinician-Scientist at the Princess Margaret Cancer Centre, elaborated, "I am supervising a fellow who has taken this course. Since his course, our discussions regarding the biology of the disease and the radiation treatments have been very different as he brings new ideas to the table."

In addition to the students, the faculty members teaching this course also benefit from it. They attend the lectures, stimulate discussion, and reflect on the educational advances that have been made. "We have access to world experts in these fields," explained Brad. "My own understanding of the topics increases each year, but there is much more to learn."

Dr. Marianne Koritzinsky, Assistant Professor at UT DRO and Scientist at Princess Margaret Cancer Centre, also teaches this course. "As a scientist with a background in radiobiology, this course has helped me understand how radiobiology is applied in clinic and used in clinical consideration. I have gained a lot of insight as faculty of this course."

As more and more trainees are receiving radiobiology training and getting hired by the hospitals, it is having a positive effect on the field. Rob explained: "The types of clinical trials that we are doing are much more state-of-the-art with respect to biomarkers and bringing new agents in. This is one of the results of the Radiobiology course. People are becoming more interested and confident about doing trials that have more biology within them."

"But there are still a lot of questions we have not answered," added Brad. "Even though radiation oncology has been around in some form or another for a hundred years, we still don't fully understand why one tumour is more resistant than another and we still can't individualize treatments to our patients on a personal level. So we must continue to ask questions."

Left image (L to R): Marianne Koritzinsky, Rob Bristow, Brad Wouters, Anthony Brade
Right image (L to R): Dick Hill, Brad Wouters, Marianne Koritzinsky, Rob Bristow

BOUNDLESS INNOVATION

Above: Michael Milosevic and David Jaffray

MAGNETIC-RESONANCE GUIDED RADIATION THERAPY (MRgRT)

A PARADIGM SHIFT IN RADIATION MEDICINE

Nestled between Mount Sinai Hospital and Princess Margaret Cancer Centre, the Magnetic Resonance Guided Radiation Therapy (MRgRT) facility has been one of the most complex projects in Toronto for architecture firm NORR. After four years of engineering and construction, this treatment facility is almost ready to treat cancer patients.

Dr. David Jaffray, Professor and Vice-Chair of Research at University of Toronto's Department of Radiation Oncology (UT DRO) and Director of

THE ABILITY TO INTEGRATE DETAILED MR-IMAGING OF PATIENT ANATOMY WITH TREATMENT DELIVERY ACTUALLY CHANGES HOW WE THINK ABOUT PATIENT CARE AND RADIATION DELIVERY

the Techna Institute, is the lead physicist on this project. "This treatment facility has a magnetic resonance (MR) scanner that is mounted on ceiling rails," he explained. "It is able to move along the rails to perform MR-guided brachytherapy on one side, and external beam radiation therapy (RT) on the other side."

David has been working on the idea for this facility for several years. He has previously helped build imaging systems for linear accelerators, which deliver high radiation doses to small targets from various angles while avoiding normal tissue. Usually, these imaging capture take CT scans of the patient when they are in position but five years ago, physicists started to do MR-imaging to observe changes in the patient's anatomy over time. David realized that by combining MR with linear accelerators, he would be able to capture "very high-quality images which are acquired minutes before we treat the patient. This will allow us to examine whether the tissue has changed or the structures have moved moments before treatment, and thereby alter the dose pattern accordingly."

To build such a facility, David worked with a large team of medical physicists, radiation oncologists, radiation therapists, engineers, architects, and trainees. Dr. Michael Milosevic, Professor at UT DRO, is one of the radiation oncology leads on this project. "This will cause a paradigm shift in how patients are receiving treatment," he said. "The ability to integrate detailed MR-imaging of patient anatomy with treatment delivery actually changes how we think about patient care and radiation delivery."

The MRgRT team hopes that this will drastically improve radiation treatment for patients. MRgRT will allow doctors to be more precise with radiation placement and direction, and to shrink margins of error. Michael explained:

> "Currently, we are able to do certain things based on the CT-imaging systems, but when we integrate MR-imaging into the system, it is like turning on the light – we are able to see the anatomy in much greater detail. We can visualize things that we could never visualize before and see changes in the tumour over the course of the radiation treatment."

Designing the MRgRT facility presented some unique challenges to the team. The magnet in the MR component has a sensitive radio-frequency antenna that listens to tiny sounds in the body. The linear accelerator component has a loud radio-frequency power-based accelerator. These two components are inherently incompatible with each other. The team had to design mechanisms to isolate the linear accelerator when the magnet comes into the room, and to isolate the magnet from the radiation produced by the linear accelerator. They overcame this challenge by designing shielding systems. Michael added: "We were used to thinking about radiation safety systems or MR safety systems. But now, we have to put the two together as both components have to work in concert with each other, and we have to interact with the entire system in a safe manner."

After receiving funding from the Canadian Foundation for Innovation in 2010, the team began working on the plans for this facility with IMRIS and Varian. Other partners included the Princess Margaret Hospital Foundation, the Garron Family, and ORTF. Today, this 3,000 square foot facility is the first of its kind in the world. "We built it, and now it is our obligation to demonstrate its value in terms of clinical care," said Michael. The team at Princess Margaret has just begun treating patients on the brachytherapy side this fall.

Introducing this facility in an academic setting will allow David and his team to study its applications and value. "The connection between developing the technology, building this space, operationalizing it, and demonstrating clinical value for patients is very powerful," Michael added.

David appreciates the collaborative environment at UT DRO and credits the many members of the team who have worked on various aspects of creating MRgRT.

> "Not only do we have support for pursuing research interests, we have students and post-doctoral trainees to work on the problem with us, and clinical fellows who can help determine how we are going to use this technology in the future. We also have a great peer environment where we can ask questions and push each other to raise the bar in terms of science. At the end of the day, we all want to apply radiation as precisely as possible by extracting as much patient information as possible in order to deliver the most effective treatment with minimal toxicity."

MARY GOSPODAROWICZ

LEADING THE GLOBAL FIGHT AGAINST CANCER THROUGH UICC

Left: Mary Gospodarowicz

"To whom much has been given, much will be required."

This is a quote that Dr. Mary Gospodarowicz, Professor and previous Chair of University of Toronto's Department of Radiation Oncology (UT DRO), strongly believes in. As President of the Union for International Cancer Control (UICC), Mary feels that collectively, we have a responsibility to create a system that will accelerate the global fight against cancer.

UICC is a non-governmental organization with headquarters in Geneva, and more than 700 member organizations in 155 countries. Created in 1933, it is not only one of the oldest international cancer organizations, it is also the largest. UICC brings together different sectors of the cancer community – academia, professional organizations, research organizations, cancer institutes, ministries of health, advocacy groups, population-based cancer control centres, patient support groups, and patient specific organizations – who work together to reduce the global burden of cancer.

The purpose of UICC is to unite the world cancer community to lower the global burden of cancer, promote greater equity and access to cancer control, and ensure that cancer is represented in global health and development agendas.

Approaching the end of her term as President, Mary reflected on her journey at UICC. "My first exposure to UICC was when I started working with TMN, a cancer staging classification system, about 20 years ago. Since then, I have stayed connected with UICC, whether it was to serve on the executive committee, the board of directors, or as chair of the membership committee and the treasurer."

During her tenure as President, Mary has created the Global Task Force on Radiotherapy for Cancer Control (GTFRCC) to "draw global attention to the inadequate access to radiotherapy around the world." She explained that Canada is well-represented on the global cancer landscape. "Many of our Canadian colleagues are engaged in international projects. For example, Dr. Brierley chairs the UICC TNM Project, Dr. Brian O'Sullivan leads the Prognostic Factors Project, Dr. David Jaffray is the chair of the GTFRCC, and Dr. Danielle Rodin is leading a young-leaders program called GlobalRT."

Mary explains that working at UICC has given her a broader perspective on cancer control. "We tend to think that we are the only ones with problems in the world," Mary explained. "Unless we are engaged internationally, it is hard for us to understand how fortunate we are here in Toronto, and what amazing opportunities we have to help the cancer cause."

During her work at UICC, Mary realized that there were large gaps and shortages in cancer control globally. This realization

WE CAN HELP ACCELERATE PROGRESS IN CANCER CONTROL WORLDWIDE

pushed her to engage UT DRO to open more opportunities for postgraduate trainees from around the world to learn radiation oncology and medical physics in Toronto. Additionally, she feels that it is important to involve our residents and fellows in global initiatives. "We should be proactively engaged in sharing our knowledge and expertise with people around the world. There are many residents and fellows at U of T who are interested in global health. We must find ways to engage them in the larger cancer community, and beyond."

UT DRO resident Danielle Rodin has been involved in UICC for the past couple of years. She started GlobalRT, which is a young leaders group that is focusing its efforts on the access to radiotherapy globally. Through initiatives like GlobalRT, trainees are becoming more involved in global cancer care and control. Mary advises younger trainees to find such opportunities and become actively engaged in these intiatives. "The one advice I have for younger trainees is – 'Don't wait to be invited.' They have to go out and find ways to collaborate and volunteer. Our trainees have a lot of knowledge and can be wonderful role models to trainees in other countries."

In addition to trainees, Mary has advice for other institutions engaged in cancer care too:

> "Strategic initiatives are often focused internally – to do the best research here, offer the best education programs here. I think they should expand their reach internationally. They should include international collaboration programs on the agenda. We live in an interdependent globalized world. We have a huge amount of skills and knowledge, and with current information and communication technologies, we can share our expertise with the world and help accelerate progress in cancer control worldwide."

Mary recalls that several years ago, UT DRO made a commitment to strategically support the Canadian Association of Radiation Oncology in order to increase its national reach. "In the same way, I would like to see Canadian departments supporting international institutes and departments. I challenge our next generation of cancer leaders to develop such strategies to strengthen the cancer landscape."

BOUNDLESSRESEARCH

Above: David Hodgson

DAVID HODGSON

RESEARCHING LATE EFFECTS OF CANCER TREATMENT

Cancer survivors who have an increased risk of developing breast cancer can be effectively screened with MRI. According to Dr. David Hodgson, Associate Professor at UT DRO and Radiation Oncologist at Princess Margaret Cancer Centre, Magnetic Resonance Imaging (MRI) is more successful than mammography in detecting breast cancer in young women who received radiation therapy for lymphoma treatment as children.

After exploring all three disciplines of oncology – medical, surgical, and radiation – David trained in Radiation Oncology at U of T. During his medical training, he developed an interest in system trends in large cancer populations. While pursuing his fellowship at Harvard University, David focused on epidemiology and pediatrics. He continued his research in pediatric cancers upon returning to Toronto, as well as pursuing his career interest in lymphoma at the Princess Margaret Cancer Centre.

AAs a clinician, David is conscious of the fact that young cancer patients who are receiving radiotherapy can develop adverse long-term health outcomes, decades after treatment

WE ARE TRYING TO DEVELOP ROBUST MODELS THAT DESCRIBE THE RELATIONSHIP BETWEEN NORMAL TISSUE DOSE AND RISK, REGARDLESS OF THE TREATMENT OR TECHNOLOGY

completion. He has merged his interest in population-based health outcomes with a focus on reducing radiation toxicity in young cancer patients. He explains that the late effects of radiation in young patients can be reduced by adopting a multi-pronged approach:

- Selecting the right patients for treatment because not everyone benefits from radiotherapy;
- Reducing the normal tissue dose for patient who undergo radiotherapy;
- Improving our understanding of the relationship between normal tissue dose and toxicity; and
- Understanding how to optimize the follow-up of patients so that adverse events can be detected early, thereby reducing their impact.

As Vice-Chair of the Hodgkin Lymphoma Steering Committee in the Children's Oncology Group (COG) – the largest clinical trials group for pediatric cancers – David has been able to refine the use of radiation therapy so that patients are selected much more carefully. "We are working towards a time when we can better identify which young cancer patients are going to benefit from radiotherapy as opposed to treating everyone," he explained. "We are becoming better at describing the risks associated with the treatment, and we will be able to tailor the initial treatment to improve cure rates as high as possible while minimizing the late risks."

David is also working to create models for rational follow-up of patients to reduce any late toxicity they might experience. "Currently, there is a lot of educated guess work, and we are trying hard to eliminate the guess work." In a recent COG study examining young lymphoma patients, his team observed that children who were treated using the most recent COG dose recommendations had only 20% of the normal breast tissue dose, and 25% of the normal heart tissue dose when compared to children who had been treated in the past. This demonstrates that there has been a dramatic reduction in normal tissue dose, and late effects associated with radiation therapy.

At Princess Margaret, David has been researching late effects of radiation in pediatric patients for the last 14 years. His team examined cardiac-screening recommendations for patients who had childhood cancer, and confirmed that many survivors of childhood cancer were being over-screened for heart disease, and that they should be discharged from routine cardiac screening after ten years.

David and his collaborators from the Dana Farber Cancer Institute recently published the largest clinical study of breast cancer screening among female survivors of childhood Hodgkin Lymphoma. Early results indicated that MRI technologies are detecting invasive breast tumours in these patients sooner than mammography. "Out of all the patients who had breast cancers detected with MRI screening, none had lymph node involvement, whereas in past studies when mammography was used, about half of the patients had lymph node involvement at the time of breast cancer diagnosis. This indicates that MRI detected tumours at a much earlier stage, thereby facilitating easier and more successful treatments," he explained.

Researching late effects of radiotherapy comes with its challenges, especially the 20-year gap between the treatment and its associated side effects. By the time that researchers are noticing a side effect, the treatment they received is long outdated and no longer used. This can render their findings obsolete for current patients and treatments. Dr. Hodgson is collaborating with colleagues – radiobiologists from Columbia University in New York, and mathematicians from University of Waterloo in Waterloo, Ontario – to overcome this challenge. "We are trying to develop robust models that describe the relationship between normal tissue dose and risk, regardless of the treatment or technology. This way, the findings will be relevant and applicable to modern treatments."

During his time at UT DRO, David has enjoyed collaborating with peers from the Greater Toronto Area, as well as colleagues from cancer centres around the world.

"There are fantastic opportunities for interdisciplinary collaborations throughout U of T, UHN, and the academic hospital systems. This helps us find collaborators within Toronto. Also, the brand recognition of U of T allows us to go outside of this city and successfully attract collaborators, from large cancer centres worldwide."

Above: Danielle Rodin and Horia Vulpe

DANIELLE RODIN AND HORIA VULPE

CREATING A FRAMEWORK FOR GLOBAL HEALTH TRAINING

Cancer is the leading cause of death in low-income countries, but access to radiotherapy in these regions is often absent. Fortunately, this global health disparity has prompted advocacy within the radiation oncology community. At University of Toronto's Department of Radiation Oncology (UT DRO), PGY3 residents Drs. Danielle Rodin and Horia Vulpe are working on creating a global health framework for radiation oncology trainees.

"Historically, we have focused on infectious diseases, and now, we are recognizing that cancer and other non-communicable diseases like diabetes and heart disease are becoming important causes of mortality in the developing world," said Horia.

Danielle was first exposed to global health as an undergraduate student during an internship at the McGill Institute for Health

and Social Policy and then later through her work at the World Health Organization. In addition to her residency at UT DRO, she is enrolled in her final year of the Master of Public Health program at Harvard University. "These experiences have helped me understand the problems of disease and of health care delivery from a global perspective," said Danielle. "UT DRO has been exceptionally supportive of these initiatives; I have had wonderful mentors who have supported and encouraged me in this work."

Danielle, meanwhile, is working with the Global Task Force on Radiotherapy for Cancer Control (GTFRCC) that was initiated by Dr. Mary Gospodarowicz as part of UICC. "We want to identify the gap in access to radiotherapy and to quantify the investment needed to provide equitable access to this essential technology," explained Danielle. "We are now using a systems-level approach to demonstrate the health and economic return on a global investment in radiotherapy."

WE ARE NOW USING A SYSTEMS-LEVEL APPROACH TO DEMONSTRATE THE HEALTH AND ECONOMIC RETURN ON A GLOBAL INVESTMENT IN RADIOTHERAPY

Horia's interest in global health started with a personal experience he had during medical school at McGill University. "My roommate in medical school came back very excited from her global health elective in rural Ghana," he explained. "She convinced me to take that same trip, and it was a life-changing experience for me." Since that trip, Horia has been interested in connecting radiation oncology with his new-found interest in global health. During the Canadian Association of Radiation Oncology (CARO) annual conference that year, Horia attended a meeting of the CARO International Communications working group (CIC) where he met several oncologists who shared his interest in global health.

Surveys of Canadian radiation oncology residents show that many of them are interested in pursuing global health electives during their training, but very few have done so. Horia explained that biggest barriers for residents to pursue these electives are the costs associated with international electives and the lack of precedents. The CIC working group, of which Horia and Danielle are resident co-heads, is focusing on a scholarship program to support Canadian radiation oncology residents wanting to go on global health electives. "We want to encourage residents to go on these electives, and support them," he said. "This is why we are launching the CIC Global Health Scholarship."

Horia has returned to Ghana this November for his own global health elective. He spent four weeks at the radiotherapy centre in Accra with their medical director, Dr. Joel Yarney. "I connected with Joel when he was doing his fellowship at UT DRO," Horia explained. "I have met several radiation oncologists through UT DRO who have provided me with ideas, connections, and encouragement."

Danielle added that in order to create a global health movement around radiotherapy, they need to engage people from different sectors. "We hope they will understand that global health is a shared responsibility, and that radiation oncology is an important part of cancer care. To ensure access to radiotherapy, we must translate technical messaging into a language that everyone understands."

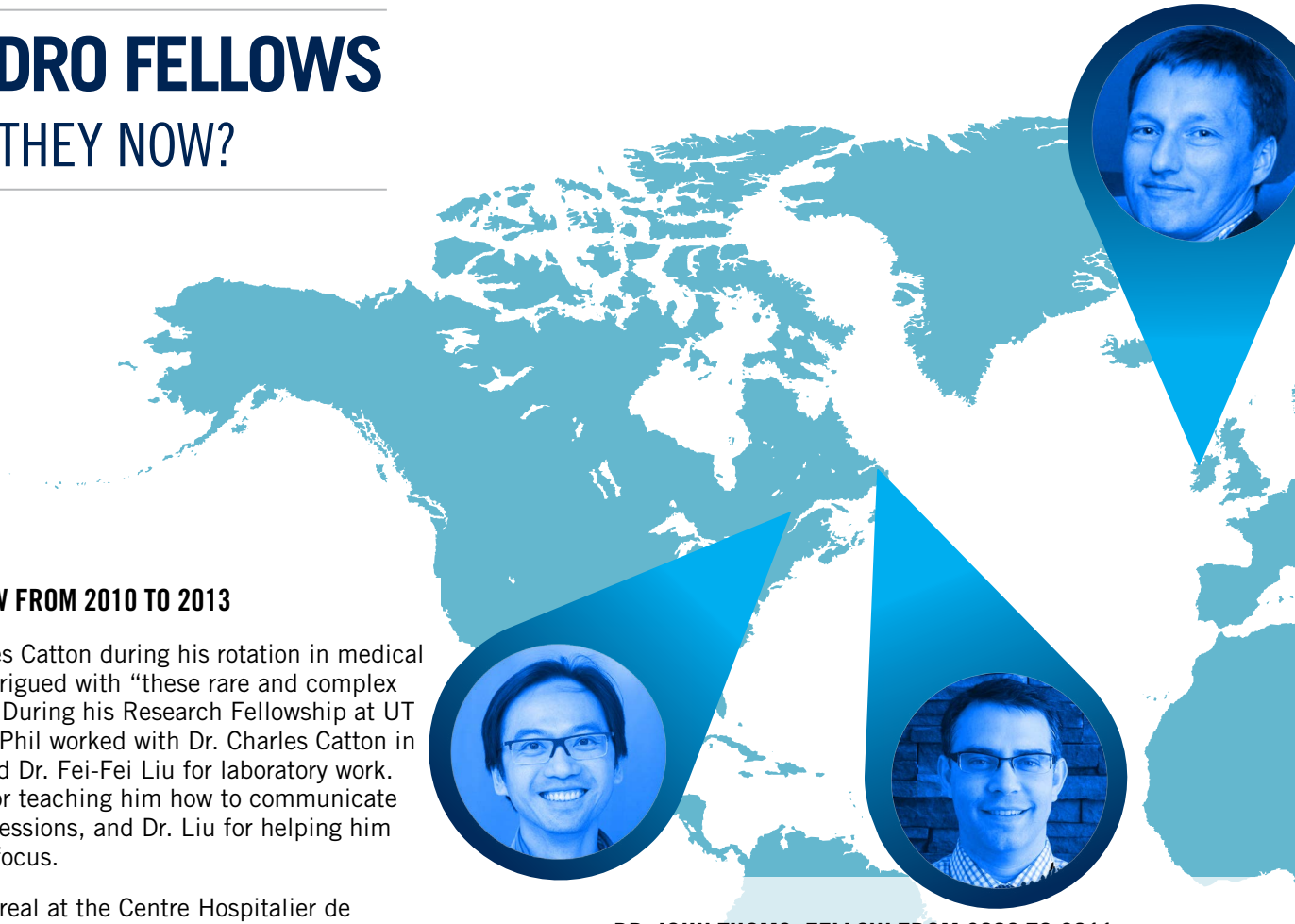
This desire to enhance communication has driven Danielle and trainees from other centres around the world to create GlobalRT – an online community to bring global health and radiation oncology information to the broader community. It includes a film clip on the experience of radiation therapy in Peru, infographics, a blog, and a database mapping global health initiative around the world. Horia is helping to create an electives database for GlobalRT that will document past electives, serve as a resource for new residents, and connect trainees with experts who can provide guidance through the electives process.

Horia is also creating electives guidelines for radiation oncology residents at UT DRO. With these guidelines, the CIC Global Health Scholarship, and GlobalRT, both Horia and Danielle are hoping to involve residents in global health issues. "The global health space within radiation oncology is uncharted, and we hope that these initiatives will stimulate engagement for other residents," said Danielle.

"I would love to see an increase in conversations, partnerships, and collaborations between the centres here and in low-resource countries," said Horia. "If we start with the residents today, they are the leaders of tomorrow and if we foster their interest in global health now, they may devote more time to this in the future."

PAST UT DRO FELLOWS

WHERE ARE THEY NOW?



DR. PHIL WONG, FELLOW FROM 2010 TO 2013

Phil followed Dr. Charles Catton during his rotation in medical school, and became intrigued with "these rare and complex diseases" of sarcomas. During his Research Fellowship at UT DRO, Phil worked with Phil worked with Dr. Charles Catton in the clinical domain, and Dr. Fei-Fei Liu for laboratory work. He credits Dr. Catton for teaching him how to communicate with other medical professions, and Dr. Liu for helping him improve his laboratory focus.

Phil now works in Montreal at the Centre Hospitalier de l'Université de Montréal (CHUM) as a Radiation Oncologist–Clinician-Scientist. He is the Director of the Palliative Radiation Medicine Program at CHUM and is busy creating new inter-disciplinary palliative clinics and working with micro-RNAs in sarcomas.

DR. JOHN THOMS, FELLOW FROM 2009 TO 2011

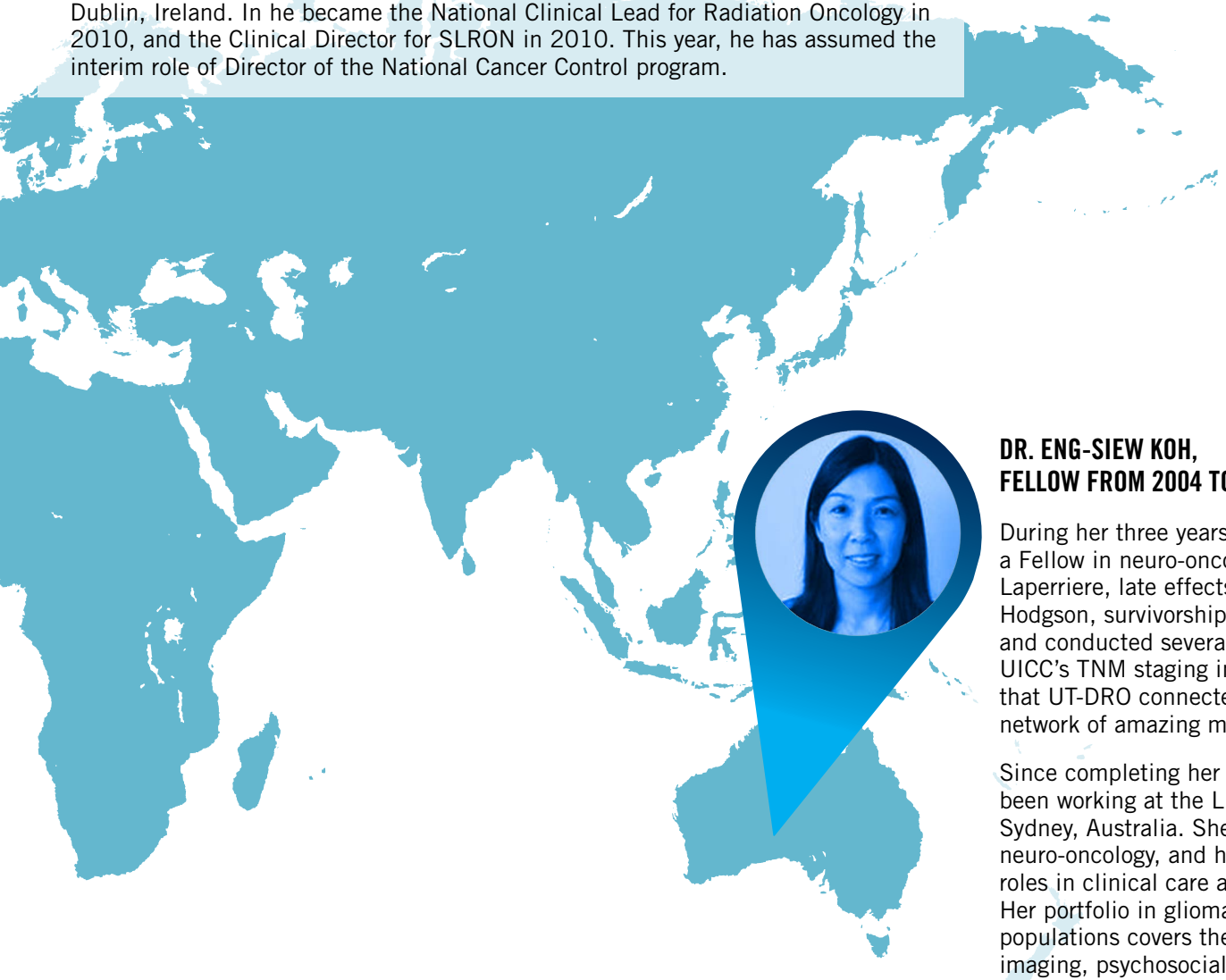
As a Research Fellow, John worked under the supervision of Dr. Robert Bristow on several projects related to novel biomarkers for prostate cancer. He received the Campbell Family Prostate Cancer Research Clinical Fellowship Award, and developed a Phase II clinical trial for pre-operative radiation therapy for locally-advanced prostate cancer. He fondly remembers the energy of UT DRO's vibrant research environment, and the "enthusiasm and passion for discovery that was evident in every interaction with the multidisciplinary team."

John is now working in St. John's, Newfoundland as a Radiation Oncologist-Clinician Scientist at the Dr. H. Bliss Murphy Cancer Centre, and is an Assistant Professor at Memorial University. His clinical practice focuses on GU and GI malignancies, and his research initiatives are focused on novel prostate cancer biomarkers of radiotherapy response.

DR. JEROME COFFEY, FELLOW FROM 2001 TO 2003

During his time at UT DRO, JJerome was a Head & Neck and Sarcoma Fellow under Dr. Brian O'Sullivan's supervision, as well as the GU and Lymphoma Fellow with Drs. Mary Gospodarowicz and Richard Tsang. He credits UT DRO for teaching him the importance of organization and scale, as well as providing him with a "formative postgraduate educational and research experience."

Jerome is now working at the St. Luke's Radiation Oncology Network (SLRON) in Dublin, Ireland. In he became the National Clinical Lead for Radiation Oncology in 2010, and the Clinical Director for SLRON in 2010. This year, he has assumed the interim role of Director of the National Cancer Control program.



DR. ENG-SIEW KOH, FELLOW FROM 2004 TO 2007

During her three years at UT DRO, Siew was a Fellow in neuro-oncology with Dr. Normand Laperriere, late effects with Dr. David Hodgson, survivorship with Dr. Pamela Catton, and conducted several projects related to UICC's TNM staging initiative. She appreciated that UT-DRO connected her to a professional network of amazing mentors and peers.

Since completing her Fellowship, Siew has been working at the Liverpool Hospital in Sydney, Australia. She continues to work in neuro-oncology, and holds national leadership roles in clinical care and trials research. Her portfolio in glioma and brain metastasis populations covers the spectrum of neuro-imaging, psychosocial and supportive care, developing exercise interventions for glioma patients, and clinical trials of novel drug therapies in high grade glioma.

GREGORY CZARNOTA

DEVELOPING NEW TECHNOLOGIES FOR BREAST CANCER PATIENTS

Why should breast cancer patients wait six months to find out if chemotherapy is working when they can find out next week? This is the question that Dr. Gregory Czarnota has been working on for the last two decades in collaboration with Dr. Michael Kolios.

Dr. Gregory Czarnota is an Associate Professor at University of Toronto's Department of Radiation Oncology (UT DRO), Clinician-Scientist at Sunnybrook Research Institute, and Chief of the Department of Radiation Oncology at Sunnybrook's Odette Cancer Centre (OCC). In graduate school at U of T, he met Dr. Michael Kolios who is now a Professor of Physics and an Associate Dean in the Faculty of Science at Ryerson University in Toronto.

During a class debate two decades ago, Greg and Michael bet a fellow student that ultrasound technologies can be used to detect cell death. This was the beginning of several projects that they have worked on together.

Their latest project, Quantitative Ultrasound Spectroscopy (QUS), is a software package that works with an ultrasound machine to test if cancer treatment is working. QUS uses traditional ultrasound, the same technology that is used to monitor pregnancy, to remove the guess work from chemotherapy treatment.

Currently, women have to wait four to six months to find out if their chemotherapy treatment is successful, but with QUS, this time is cut down to between one and four weeks. "This allows us to tailor the treatment early on based on whether the tumour is responding or not," said Greg. "It allows the patient to be involved in the treatment plan, and avoid unnecessary side-effects from ineffective chemotherapy."

The technology is able to detect apoptosis, a form of programmed cell death. When cancer cells die, they leave behind traces which QUS's ultrasound is able to detect. The ultrasound gives instantaneous results; if the image is yellow, the chemotherapy is working and if the image is red, the chemotherapy is not having an effect on the cancer cells.

This allows doctors to alter treatment in the early stages, instead of having to wait months to find out that the treatment did not work. This non-invasive and painless technology speeds up treatment times and allows patients to receive more accurate and personalized treatment.

Breast cancer is the second leading cause of death from cancer among Canadian women. The Canadian Breast Cancer Foundation estimates that one in nine Canadian women will develop breast cancer during their lifetime, and 5,000 women and 60 men will die from breast cancer in Canada in 2014. QUS's potential impact is large, especially because majority of the chemotherapy treatments for breast cancer are not successful. "60 to 70% of breast cancer treatments can fail," said Greg. "In addition, cancer tumours can be as unique as the people who develop them. A one-size-fits-all treatment does not always work."

Classic diagnostic imaging technologies detect changes in tumour size, which can take months to occur. "With QUS, doctors know sooner if they need to switch their patient to a different type of drug or treatment method," explained Greg. "This move potentially stands to change the outcome for women with locally advanced breast cancer."

Sue was a breast cancer patient who took part in QUS's first round of trials at OCC. "To be able to tell early on if treatment is working is truly amazing," she told Sunnybrook. "In my case, they could see it was working and that it reinforced what the oncologist's physical exams were saying – the tumour was shrinking."

With initial funding from the Terry Fox Foundation, 100 breast cancer patients took part in a clinical trial at Odette Cancer Centre to confirm that QUS is consistently successful at detecting apoptosis. The results from this study have been published in Clinical Cancer Research and Translational Oncology, and confirm that quantitative ultrasound, QUS's underlying technology, does successfully monitor cancer cell damage resulting from chemotherapy.

WITH QUS, DOCTORS KNOW SOONER IF THEY NEED TO SWITCH THEIR PATIENT TO A DIFFERENT TYPE OF DRUG OR TREATMENT METHOD

Above: Gregory Czarnota

However, Greg and his team need more funds for multi-site validation studies at four cancer centres in Canada and the United States. After MaRS Innovation funded the project for $250,000, QUS still needed $687,950 to complete trials and commercially license QUS.

In order to raise funds fast and spread awareness about the product, the QUS team turned to an unconventional mechanism: crowd-funding. They created a seven-week campaign on Indiegogo with the goal of raising $96,987 for QUS, which is also known as WaveCheck. In its first day, the campaign had raised $20,000. By the end of the seven weeks, they had raised $53,390. The Globe and Mail featured WaveCheck (QUS) in its Top 10 Crowdfunding List twice, a list that features top Canadian crowdfunding projects from various industries.

The next steps for QUS are a wide clinical study with three cancer centres in addition to OCC: MD Anderson Cancer Center in Houston, and St. Michael's Hospital and Princess Margaret Cancer Centre in Toronto. Greg explained that they have REB approval for three centres, and expect to start treating patients in January 2015. This April, Greg and the team received a $100,000 catalyst grant from the Ontario Institute for Cancer Research (OICR) which will help 20 women in Canada and 20 women in the US participate in clinical studies at OCC and MD Anderson.

"We are developing this technology further," Greg added. "We are starting to use QUS to personalize breast cancer chemotherapy. Essentially, we will replace ineffective chemotherapy with effective chemotherapy." This study will begin at Sunnybrook in 2015, and expand to other centres in the coming year.

BOUNDLESSOPPORTUNITY

Above: Lisa Di Prospero

LISA DI PROSPERO

LEADING INTER-PROFESSIONAL PRACTICE AND EDUCATION

When the Canadian Association of Medical Radiation Technologists (CAMRT) presented Lisa Di Prospero with the 2014 Steward of the Profession Award, she was delighted. "I felt honoured to be recognized by my peers for what I am doing for the profession," she said. "It has been one of the most humbling moments of my professional career."

In the 18 years since she completed school, Lisa's career has spanned both clinical and academic practice. She is the Manager of Research and Education in Radiation Therapy at Sunnybrook's Odette Cancer Centre (OCC), an Assistant Professor at University of Toronto's Department of Radiation Oncology (UT DRO), the Editor-in-Chief of the Journal of Medical Imaging and Radiation Sciences (JMIRS), and co-chair of

Canada's largest radiation therapy conference, RTi3. She is also involved in inter-professional practice and education initiatives in radiation therapy as well as other health professions.

While Lisa was working at Sunnybrook in 2001, one of her previous instructors, Nicole Harnett, invited her to join the newly -developed Medical Radiation Sciences (MRS) joint-program at the Michener Institute and U of T. "I met Lisa 20 years ago during program orientation at Sunnybrook," said Nicole. "I could tell she had a lot to offer. She was bright, capable, confident and determined. These qualities have served her, and our profession, extremely well." In the decade after joining the MRS program, Lisa was involved in curriculum planning, leading courses, and teaching hundreds of radiation therapy students, many of whom are now her peers and colleagues at Sunnybrook.

At the Michener Institute, Lisa co-developed, facilitated and taught the inter-professional curriculum for the health professions program, and at U of T, she became involved early on with the integration of inter-professional education (IPE) in existing programming. "I became very interested in IPE as I read the mounting evidence on how 'learning about, from and with each other' led to better patient outcomes and care," she recalled. "The MRS position was a perfect blend of everything that I loved: leadership, education and research. Of course, coaching and mentoring were integral components too."

Lisa added that she values her teaching awards: "These are from my students and are evidence of my impact on their learning. As an educator, the impact you have on your students as they grow and reach full potential is priceless – a transformational moment seen in learners at all levels."

These days, Lisa's role has evolved to reach well beyond radiation therapy. Lisa has been working with other health professions at Sunnybrook to coach, mentor and encourage their work in the pillars of education, research, and leadership. She received the Ivey Oandason Leadership Award from the Centre for Inter-professional Education at the University of Toronto in recognition of her passion and dedication in this area.

Lisa has also been co-leading smoking cessation programs at Sunnybrook and Cancer Care Ontario, and the Falls Risk Prevention program at Sunnybrook. "I was having conversations with colleagues who agreed that we need to establish an inter-professional framework for each of these programs to build capacity, sustainability and improved quality of care," she explained.

As a U of T faculty member, Lisa has been part of the academic leadership for many years. She has been a part of the organizing committee for RTi3 since its inception and helped grow it to what it is today. "It has evolved from being a conference where we invited doctors and physicists to teach us about our profession, to what it is today – a conference that is driven by us [radiation therapists] building our own body of knowledge."

I BECAME INTERESTED IN IPE AS I READ THE MOUNTING EVIDENCE ON HOW 'LEARNING ABOUT, FROM AND WITH EACH OTHER' LED TO BETTER PATIENT OUTCOMES AND CARE

She has seen the quality and quantity of research led by radiation therapists grow in the last ten years. "This would not have been possible without the support from UT DRO. The department offers many opportunities for therapists to help develop their careers, encouraging them to pursue different opportunities, giving them academic appointments, and bringing them into the decision-making process at all levels – all allowing therapists to flourish."

Lisa explained that the culture for therapists has been changing for many years. She noted that the medical system still has remnants of the old paternalistic model that was siloed and hierarchical. "It takes time to break down those barriers," she said. "But people are realizing that there are experts around the table, and that everyone can share in the decision-making process. We are slowly changing the culture from a uni-professional practice to a collaborative practice."

> "Therapists have evolved – they are working with the team instead of taking direction from the team. Education has also changed. Radiation therapy has moved from a diploma-apprentice program to a competitive undergraduate program that includes a wide and deep curriculum. In research, therapists are successful in securing grants and conducting their own research. It is very encouraging to see them initiate, develop and create their own research portfolios. Even more remarkable is seeing therapists in leadership roles beyond radiation therapy transferring their skills, knowledge and judgement to all facets of healthcare."

Above: MRS students

REDESIGNED CURRICULUM
NUCLEAR MEDICINE AND MOLECULAR IMAGING TECHNOLOGY

The Nuclear Medicine and Molecular Imaging Technology program (NMMIT), one stream of the Medical Radiation Sciences (MRS) program, is returning after a two year hiatus. During that time, the NMMIT curriculum was completely redesigned. This fall, 16 students will join this hybrid program as its first cohort.

The new hybrid delivery model combines asynchronous and synchronous learning environments including online video lectures, online tutorials, live simulations, and lab work. The course is using existing educational technologies at U of T, including BlackBoard Collaborate, to deliver course materials which the students can access at their own pace. “The benefit of this model is that they can learn the materials at their own pace and schedule,” explained Cate Palmer, Director of the MRS Program. “Their learning is reinforced when they come to the online tutorial, and they are then able to develop their skills in the lab setting as they work on group projects. It helps the students study in a way that suits their needs.”

The redesigned program has common content threads and competencies which are interwoven across courses and learning environments. The program redesign team mapped out the competencies across the three years, and introduced common

threads so that the students are able to apply what they learn across various areas. Cate explained this curriculum model:

> "Instead of siloed courses, there are four integrated courses that span the first two years of the program. Students are able to apply the different topic threads like patient care, anatomy, pharmacology, radiopharmacy, instrumentation, and methodology across the various body systems and pathologies of NMMIT practice. This will ensure that these students have a deeper and well-rounded understanding of the materials."

Another important feature in the new program is that students are able to experience clinical care earlier. In their fourth and fifth semester, they will spend a short amount of time in the clinical environment to prepare them for a full year of clinical training starting in their sixth semester. They will also be introduced to case-based learning where they will be able to work on real cases. "All together, this will help these students become well-rounded technologists with critical inquiry and problem-solving abilities. TThey will be more flexible and have translatable skills due across the various sub-specialties of MRI, informatics, and clinical management."

Cate hopes that as personalized medicine at the molecular level increases in practice, and that the anticipated uptake of Positron Emission Tomography (PET) as a mainstream imaging modality starts to increase, the students from the Nuclear Medicine and Molecular Imaging Technology program will be at the forefront of diagnostic imaging.

ENHANCING TRAINING FOR RADIATON THERAPISTS **MHScMRS**

The Master of Health Science in Medical Radiation Sciences (MHScMRS) program launched at University of Toronto's Department of Radiation Oncology (UT DRO) in 2009. UT DRO, in collaboration with the Institute of Medical Science (IMS) at U of T created this program to enhance the training of radiation therapists, the largest professional group within radiation medicine. To date, seven radiation therapists have graduated from the MHScMRS program, and three others are set to graduate in 2015.

"Our alumni are taking on leadership positions at the cancer centres they work at," said Nicole Harnett, UT DRO Assistant Professor and MHScMRS Program Director. "They are also involved in research and innovation at the front lines of clinical care in the radiation treatment domain."

This program is using a new curriculum delivery model – a blended format that allows students to do the majority of their learning online on their own schedule. "The benefit of this blended model is that students outside the GTA are in a position to consider this program," explained Nicole.

In addition to the MHScMRS academic program, UT DRO has also been involved in a province-wide project to enhance the functioning and contribution of radiation therapists. In collaboration with Cancer Care Ontario and with funding from the Ministry of Health and Long Term Care, UT DRO participated in the Clinical Specialist Radiation Therapist (CSRT) Project. The result of this collaboration has been the development of a new health care provider role: the Advanced Practice Radiation Therapist – who has advanced knowledge, and can assume a higher level of responsibility in clinical, technical, and professional activities.

Nicole explained that "while national certification for this new category of therapist will require some form of graduate education, it is not automatic that graduates of the MHScMRS program will be advanced practitioners. Conversely, it is not necessary that advanced practice therapists will have completed a master's degree at this time. The two entities are separate and represent different undertakings. One is academic in nature, and the other is professionally-related."

Although these two programs are separate, several MHScMRS graduates have secured CSRT positions. Amongst the 15 CSRT positions available at UT DRO's partner hospitals, five have been filled by MHScMRS alumni. "They are contributing to the evolution of radiation therapy, and are adding to the knowledge-base at many levels. We expect to be seeing great things from these graduates, and will continue to track their work."

ANNE KOCH AND MARIANNE KORITZINSKY

BUILDING BETTER RESEARCHERS THROUGH EIRR21

BOUNDLESSMENTORSHIP

Fellows who are accepted to train at the University of Toronto's Department of Radiation Oncology (UT DRO) consider themselves lucky. They find that UT DRO is one of the best places in the world to train in radiation oncology, conduct research, and build their skills in a multidisciplinary environment.

Each year, a handful of fellows, residents, post-doctoral researchers, and graduate students are able to further enhance their training at UT DRO by participating in a training program called EIRR21. Dr. Anne Koch, Clinician-Scientist and Assistant Professor at UT DRO and at U of T's Department of Medical Biophysics, and Dr. Marianne Koritzinsky, Assistant Professor at UT DRO and Scientist at the Ontario Cancer Institute, are co-chairs of EIRR21. Anne gave an overview of the program:

> "EIRR21, or Excellence in Radiation Research for the 21st Century, is a research training program that provides graduate students, clinical fellows, physics residents, and radiation oncology residents with skills that they cannot acquire in regular training programs. They develop skills like leadership and communication, and are brought together in a trans-disciplinary group to discuss ideas and learn from each other."

EIRR21 was created in 2003 by Dr. Fei-Fei Liu with funding from the Canadian Institute of Health Research (CIHR). It is just one of the 52 strategic trans-disciplinary training programs that CIHR has funded across Canada.

It brings together postgraduate trainees from within UT DRO as well as other universities across the world, and allows them to train with mentors who are experts in their fields. Marianne noted that this program is an important addition to traditional training programs:

> "In traditional training models, we immerse our trainees in one field. This is very important to become good clinicians, researchers, and scientists. But a lot of research happens in teams and across disciplines. So it is important to enhance training in these other areas in addition to the immersion models that our trainees are already exposed to. This trans-disciplinary training is even more important in radiation oncology which is inherently a trans-disciplinary field. It has physicists, clinicians, biologists working with therapists. So it is essential that we train radiation oncology trainees in communications, team dynamics, leadership, and working with other disciplines."

Left: Anne Koch and Marianne Koritzinsky

IT IS ESSENTIAL THAT WE TRAIN RADIATION ONCOLOGY TRAINEES IN COMMUNICATIONS, TEAM DYNAMICS, LEADERSHIP, AND WORKING WITH OTHER DISCIPLINES

Marianne and Anne assumed leadership for the EIRR21 program in 2012, and have since then implemented several changes. They opened up a resident stream that allows upper-year physics and radiation oncology residents to enroll in the program. "Senior residents do research projects, but they are often siloed in their residency programs," Marianne notes. "We try to encourage them and introduce them to other students in different disciplines." They also started accepting students from U of T's Institute of Medical Science.

85 TRAINEES

72 GRADUATES

40 MENTORS

12 TRAINING CENTRES

In addition to programmatic changes, Marianne and Anne have been networking with other cancer centres around the world to expand their national network which now includes mentors from University of Alberta, University of British Columbia, and McGill University. Outside of Canada, the EIRR21 network includes mentors and trainees from the University of Oxford and Stanford University.

For trainees, enrolling in EIRR21 is a competitive process. They have to demonstrate strong research skills as well as interest and talent for leadership and trans-disciplinary research. Upon graduating from the program, they have the option to return as alumni and help train the next group. "It is a testament to the success of the program that many of our alumni come back and give sessions," Marianne noted. "In turn, our trainees value the input from the alumni and the chance to network with researchers in other disciplines."

Alejandro Berlin, who is completing his fellowship at UT DRO, speaks highly of his experience as an EIRR21 scholar. "As a scholar, I thoroughly enjoyed the talks. They really open up your mind to the breadth of opportunities in radiation oncology-related research. In addition to that, I have gotten the chance to work, think, talk, and interact with incredible scholars and mentors. It has been an enriching experience for me."

Trainees are not the only ones who benefit from this program. Mentors are invited to join the program based on their research interests, and they appreciate the opportunity to be involved in a trans-disciplinary training program which allows them to network with colleagues from various disciplines and centres around the world.

Eleven years since its launch, the EIRR21 program now includes scholars from ten different U of T programs including medical biophysics, medical genetics, pharmacy, and biochemistry.

Despite funding challenges, both Anne and Marianne feel that EIRR21 has proven its success, and should continue to provide added value and enhanced skills to future researchers. "Ultimately, our goal is to build a better researcher, a better scientist, and a better leader in radiation medicine," said Marianne.

BOUNDLESSEXPERIENCE

Above: Jure Murgic

JURE MURGIC

ONE FELLOW - TWO CENTRES

It was -25 degrees centigrade on New Year's Day 2014 when Dr. Jure Murgic moved his family to Toronto. Six months later, he has settled into the city, made some friends, and worked at not one, but two world-renowned cancer centres.

Ten years ago, when Jure was working with diabetic patients in Zagreb, Croatia, he could not have imagined how his career would evolve. With an interest in technology, he pursued his residency in oncology at the Sisters of Charity University Hospital in Zagreb. In 2011 – 2012, he spent time in Ann Arbor, Michigan as a Josip Matovinovic Endowed Clinical Fellow, and in 2013, he completed another Fellowship in Vienna, Austria.

Jure is currently completing a Joint-Fellowship at the University of Toronto's Department of Radiation Oncology (UT DRO). He

is the first fellow to be enrolled in UT DRO's joint-fellowship model that allows fellows to divide their time between two cancer centres. This way, fellows can gain valuable experience at two different sites, and are able to conduct research with different investigators at each site.

Jure began his Fellowship in January 2014 at the Odette Cancer Centre (OCC) under Dr. Hans Chung's supervision, where he started his research on brachytherapy for prostate cancers. As a clinical researcher, Jure started research on brachytherapy for prostate cancers. "I am very grateful to Dr. Chung," Jure said. "He has taught me everything I know about prostate brachytherapy."

Dr. Chung, an Assistant Professor at UT DRO, also enjoyed working with Jure. "Jure is absolutely one of the best fellows that anyone can have. He is an engaging, curious, committed, responsible, and intellectual individual, who is an absolute joy to work with. I look forward to watching his career flourish in the years to come."

Halfway through the year, Jure transferred to Princess Margaret Cancer Centre to join their genitourinary (GU) site group. At Princess Margaret, Jure has been working with threee UT DRO faculty members: Drs. Cynthia Ménard, Peter Chung, and Saibishkumar Elantholi Parameswaran.

The timing of this Joint-Fellowship has been ideal for Jure. Recently, cancer centres in Croatia switched from 2-D to 3-D brachytherapy, and introduced interstitial brachytherapy treatments. Croatia's Sisters of Charity University Hospital, where Jure was working, is planning to introduce a brachytherapy program for prostate cancer. "I am very lucky that I am receiving hands-on training in brachytherapy at U of T," Jure explained. "It is one of the best places in the world to learn brachytherapy, and I have the benefit of learning two different approaches,as OCC and Princess Margaret have different technologies and processes."

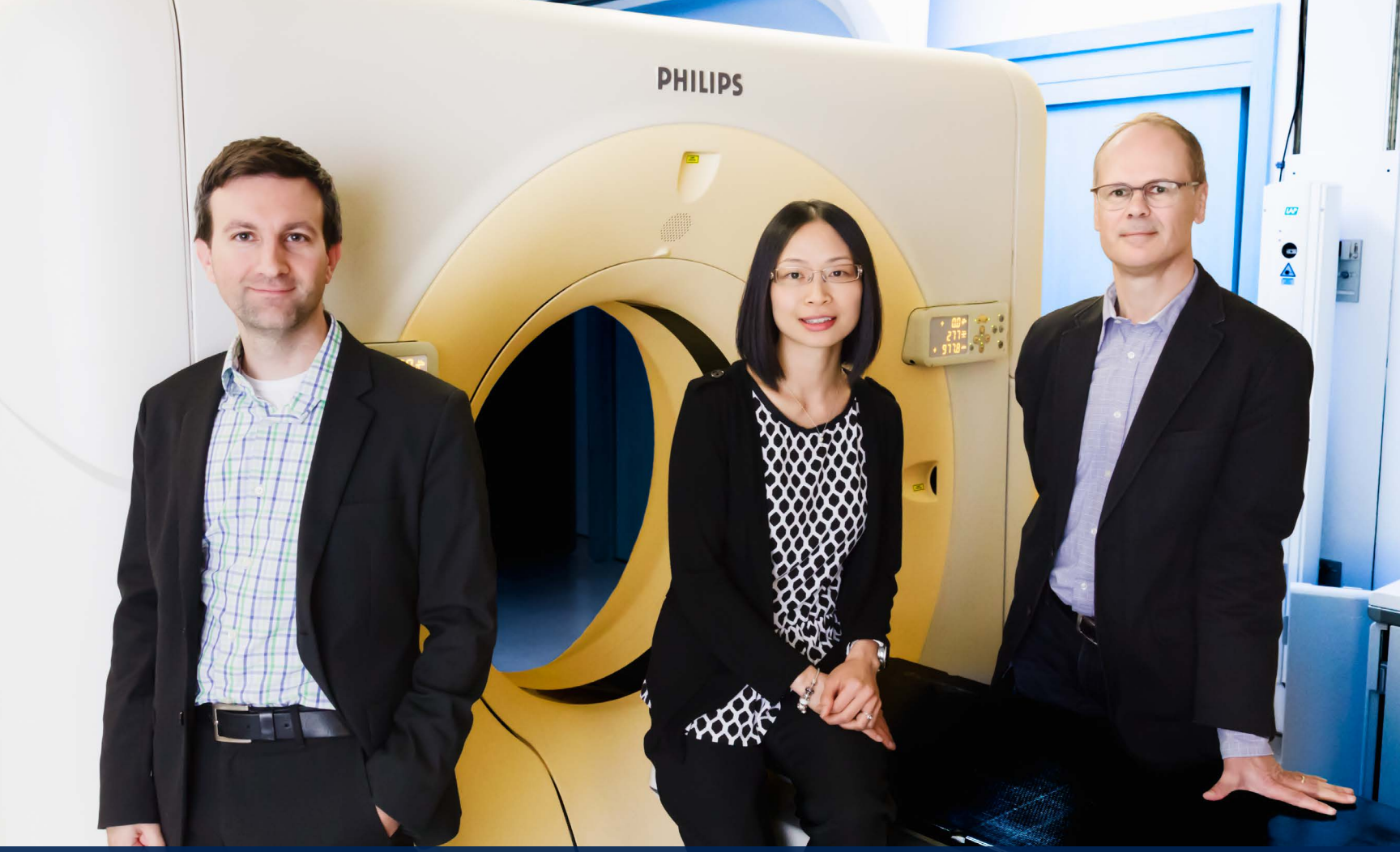
He further explains that his research focus in prostate brachytherapy has been shaped by novel imaging and medical technologies. There are two main forms of delivering brachytherapy – low-dose-rate (LDR) and high-dose-rate (HDR) – which can be performed using different imaging modalities. Jure has practiced using ultrasound at OCC and MRI at Princess Margaret. "I am very grateful for the opportunity to do a joint-fellowship," Jure added. "Both institutions are leaders in North America, and have a strong prostate brachytherapy program, but each institution approaches it differently."

Although the joint-fellowship program has been rewarding for Jure, it has presented some challenges too. "The time I am

BOTH INSTITUTIONS ARE LEADERS IN NORTH AMERICA, AND HAVE A STRONG PROSTATE BRACHYTHERAPY PROGRAM, BUT EACH INSTITUTION APPROACHES IT DIFFERENTLY

able to spend on my research is very limited," he said. "I am afraid that it may compromise the research. There is a lot of time pressure to finish all the things that I have started." Compared with other fellows who spend one or two years at one site, Jure has had to not only learn his way around a new centre, he has also had to develop relationships with faculty and staff at a second centre in half the time. "While other fellows go through adaptation and adjustment only once, I went through it twice," he added. "That being said, I get to work with amazing staff and meet cancer leaders from both hospitals. I get to see the different models of patient care and research, and that is extremely enriching."

For oncologists interested in a fellowship at UT DRO, Jure recommends the joint program. "I strongly recommend this program to every motivated oncologist who wants to gain new clinical skills and work hand-in-hand with some of the world's leaders in radiation oncology." He also advises them to establish their goals before applying. He notes that having a list of clinical research ideas and objectives beforehand, and sharing them with the supervisors early in the program helps to save time. "Time will go by so fast – when you turn around, one year will have gone by."



BOUNDLESS POSSIBILITIES

Above: Tom Purdie, Grace Lee, Anthony Fyles

QUICKSTART

RECOVERING LOST TIME FOR BREAST CANCER PATIENTS

Patients with early stage breast cancer often spend weeks navigating through the healthcare system. “We noticed that 31 per cent of our early-stage breast cancer patients in this program have experienced some form of delay in their treatment before coming for radiation,” said Grace Lee, a radiation therapist at the Princess Margaret Cancer Centre. “Whether it was from their chemotherapy consult, or extended recovery from surgery, they feel that they have lost valuable time before they see their radiation oncologist.” In addition to the wait times prior to radiation therapy, they often wait two weeks after seeing their radiation oncologist before the treatment itself can start.

This is where the QuickStart program at Princess Margaret comes in. Launched in 2010, it is a rapid, streamlined radiation therapy process for early-stage breast cancer patients.

QuickStart uses automated treatment planning software to decrease the time required to build treatment plans from two hours to six minutes, thereby allowing the patient to be treated within three hours on the same daym instead of the one to two weeks they would have normally had to wait.

The QuickStart program has three key ingredients: the automated software that was designed by Dr. Tom Purdie, Assistant Professor at University of Toronto's Department of Radiation Oncology (UT DRO) and Medical Physicist at Princess Margaret; the multi-disciplinary team including a Clinical Specialist Radiation Therapist (CSRT) such as Grace; and the vision of Dr. Anthony Fyles, a Professor at UT DRO and Radiation Oncologist at Princess Margaret. "It is great to see all three disciplines working so harmoniously," explained Grace. "Together, we are able to expedite the process to just three hours, and maintain the same quality and safety for treatment which would otherwise have taken one to two weeks."

Tom's automated software analyzes the structures visualized on the diagnostic images, including the tumour, and creates a treatment plan in minutes instead of hours. Previously, planners needed to go through a time-consuming manual process to create customized treatment plans. "Our radiotherapy planners can now generate complete clinical radiotherapy treatment plans in just six minutes," Anthony added. "Previously this would have taken two hours per patient."

Grace's role is one of the most integral elements of this process, and one of the hardest to replicate at other locations. As a CSRT in QuickStart, Grace applies her advanced practice abilities to expedite the treatment process. She coordinates patient care and accelerates the process by collecting all of the information that is necessary to schedule and facilitate the steps in the process. She also assumes some of the responsibilities that had traditionally been undertaken by the radiation oncologist.

The third component of QuickStart was the vision of the lead radiation oncologist, Anthony Fyles. It is challenging to bring change into an area where people follow a standard set of instructions and processes based on their training, but "the collaborative environment at UT DRO and the great team at Princess Margaret has helped make it happen," Anthony said. "Our success is due to persistence, teamwork, collaboration, and shared goals."

Although QuickStart expedites the entire planning and treatment process, it is actually no different from the traditional radiation therapy process. Tom explained:

> "One of the strengths of this program is that it is the exact same process – we did not cut any pieces out of the process in terms of how we assess quality or how good the plans are. We compressed the time, but nothing else has changed. The patients are receiving the exact same treatment and care they would have otherwise received two weeks from now."

WE ARE ABLE TO EXPEDITE THE PROCESS TO JUST THREE HOURS, AND MAINTAIN THE SAME QUALITY AND SAFETY

For patients, QuickStart has been a great improvement. In general, the patients are treated within three hours after their CT simulation, which equates to roughly 11 days of time saved for the patient. Anthony noted: "Patients wait for so many things. They wait for their surgery appointment and to start chemotherapy. With QuickStart, we are able to recover some of the lost time for them; and that makes a huge difference."

"They can return to work 11 days sooner," Tom added. "We are giving them the chance to return to their lives sooner."

After a successful pilot study, Princess Margaret is expanding QuickStart to be able to treat more patients. To date, 140 breast cancer patients have received expedited treatment through the QuickStart process. Anthony hopes that other hospitals will be able to implement this program at their locations. "As it is becoming a standard of care for patients with early-stage breast cancer at Princess Margaret, this model will be available for any breast cancer site to use."

Tom's software is commercially available in Canada, Europe, and the United States. In 2012, Tom won UHN's Inventor of the Year Award for the development of the software. The QuickStart program also received an Innovation Award - Honourable Mention from the Cancer Quality Council of Ontario earlier this year.

Despite the wide success of his software, Tom feels that the collaboration between the different disciplines is the most important component of QuickStart: "The multi-disciplinary collaboration and integration is very important. The team has to put in a lot of effort to follow this process for each patient. Our team persisted and addressed the challenges to get it to the point where QuickStart has become routine."

CLINICAL REPORT

DR. GREGORY CZARNOTA, ODETTE CANCER CENTRE

The clinical, research and educational activities of the Radiation Treatment Program at Odette Cancer Centre (Odette), Sunnybrook Health Sciences Centre (Sunnybrook) continued to thrive and expand in 2013-2014. Odette continued to see high clinical volumes in fiscal year 13-14, with over 6600 new radiation oncology consultations seen. Over 7000 courses of radiation treatment were delivered (97,550 fractions). Upgrades to the existing clinical infrastructure continued, with the upgrading of our HDR unit to a new flexitron unit as well as the introduction of 2 Elekta Agility units (1 Hexapod). Stereotactic radiation therapy (body and head) continued to expand with close to 500 patient treated with SBRT and over 300 patients treated with CNS SRS. Our brachytherapy program continues to expand, with a total of 415 courses delivered, representing the highest brachytherapy volume centre in the country.

Dr. Gregory Czarnota started in his role as the new Department Chief on July 2013. The search for a new Head of Medical Physics successfully recruited Dr. William Song from San Diego State University. Dr. Eric Leung was recruited from the London Regional Cancer Centre to replace Dr. Gillian Thomas who will retire in January 2015. Dr. Jean-Philippe Pignol left Odette for a major leadership position as Chair of the University Department and Radiation Oncology Department at Erasmus MC; University Medical Centre Rotterdam. Ms. Shiela Robson, Manager and Head of Radiotherapy retired after 31 years at Odette, being in a leadership role since 1992.

Members of the Radiation Treatment Program at Sunnybrook garnered a number of prestigious awards and recognitions including Ms. Lisa Di Prospero, Manager of Research and Education in Radiation Therapy who was awarded the Steward of the Profession Award for 2014 by the CAMRT board of directors. Dr. Gillian Thomas was awarded the Dutch Gynecological Group's inaugural Boudwdijk Bastiaanse Award given for lifetime contribution and achievement in Gynecological oncology. Dr. Stanley Liu was awarded one of Prostate Cancer Canada's Rising Star positions. Several of our members were promoted at the university level as outlined in the Vice Chair's report.

The Program continued to foster its regional leadership role in cancer care, and continued to provide partnership and support for the radiation treatment facility at the Royal Victoria Hospital (RVH). Dr. Gerard Morton continued as the Head of Radiation Treatment at RVH. Radiation Oncologists continued to participate in radiation oncology clinics and multidisciplinary cancer conferences at a large number of academic and community hospitals including the North York General Hospital, MacKenzie Health, Royal Victoria Hospital, The Scarborough Hospital, Rouge Valley Hospital (Centenary Site), Humber River Regional Hospital, Toronto East General Hospital and St. Michael's Hospital.

Despite the very competitive grant funding climate, faculty members secured over $6 million in external peer-reviewed and industry supported grants. Faculty at Sunnybrook published 176 peer-reviewed scholarly articles in 2013, with 94 as primary or senior responsible author. These research grants and publications are detailed elsewhere in the annual report.

CLINICAL REPORT

DR. ANDREA BEZJAK, PRINCESS MARGARET CANCER CENTRE

Princess Margaret Cancer Centre's Radiation Medicine Program (RMP) is the largest single-site radiation program in the world with 36 radiation oncologists, 33 physicists, and 160 radiation therapists. We have five advanced practice radiation therapists, 80 support staff, and numerous residents, clinical and research fellows, and undergraduate and graduate students in all disciplines.

In 2013, we saw over 8,000 new patients and delivered over 10,000 courses of radiation therapy. Our site-based and team-based approach takes patients from clinical decision-making to simulation (using one of 4 CT simulators, a PET and a MRI simulator), planning utilizing Pinnacle treatment planning system, with IMRT and increasingly VMAT for many sites, and delivery of image-guided RT on one of the 16 linear accelerators. The past year saw a major upgrade of all of the equipment so that all units are VMAT, IMRT and CBCT enabled. Other equipment includes a TruBeam unit, two Gamma Knife Perfexion units (one of which, at Toronto Western Hospital, is reserved for benign conditions), orthovoltage , HDR and PDR brachytherapy facilities and an MR-guided RT facility (MRgRT), with MRI integrated into a linear accelerator. The latter has become clinically operational, with the first patient treated in the MRgRT suite in June 2014.

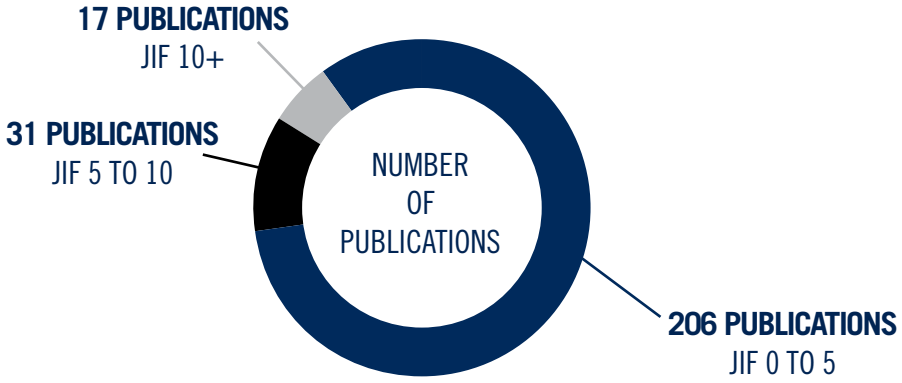
In addition to large and strong multidisciplinary and multi-professional clinical programs in all cancer sites, we are unique in our large volume image-guided brachytherapy, sarcoma, ocular and pediatric programs, and have recognized expertise in management of locally advanced and complex tumors, including rare tumor types. We have specialized stereotactic RT programs for brain metastases, spine, lung and liver, and other sites of oligometastases. All clinical site groups have regular weekly quality assurance (QA) case review RT rounds, and new this year are palliative RT QA rounds and oligometastases QA rounds which provide a forum to discuss the unique clinical and technical issues specific to management of metastatic disease. Multidisciplinary cancer conferences occur for multiple clinical sites and sub-sites, both at our center and in our partner hospitals.

RMP staff continues to be involved in a broad range of research activities. The four areas of focus from the perspective of personalized cancer medicine are adaptive radiotherapy, oligometastases, CNS oncology program and regenerative medicine. Achievements in the past academic year include obtaining $45M in peer-reviewed funding, publishing 239 peer-reviewed publications, having 194 prospective research protocols open, and accruing 13.5% of new patients onto prospective clinical research studies.

RESEARCH HIGHLIGHTS

REPORTING PERIOD: JULY 1, 2013 TO JUNE 30, 2014

PUBLICATIONS



283
TOTAL PUBLICATIONS

1.76
PUBLICATIONS PER INVESTIGATOR

4.89
AVERAGE JOURNAL IMPACT FACTOR

FUNDING

$42.1M
TOTAL FUNDING

Note: This total funding includes funding for Principle Investigators and Co-Principle Investigators only and excludes large infrastructure grants.

RESEARCH HIGHLIGHTS

REPORTING PERIOD: JULY 1, 2013 TO JUNE 30, 2014

The 2013-2014 academic year has been simply outstanding in terms of research growth. The combined research grant activity of the faculty (as measured by principal and co-principal grant funding) is $42.1 million. This is higher than in previous years and reflects a growth in the faculty's ability to compete for peer-reviewed funding. With the addition of many new young investigators over the past 10 years, we can see a progressive growth in grants held, as well as, the amount of funding per grant. This is somewhat expected as young investigators mature in their research careers. In addition, the more senior investigators are engaging in larger, multi-institutional grants that bring significant funds to the UT DRO's research programs. These large-scale 'team' grants can substantially influence the funding totals reported here, despite the fact the work is being performed at multiple locations across the country. Regardless, they are important and exciting initiatives led by UT DRO faculty.

In terms of the impact of the UT DRO's research activities, one metric that can be compared year-over-year is the number of publications and their impact factors. The total number of publications in the 2013-2014 academic year was 283 and the average publication rate per faculty was 1.8. This is a reduction from that reported in previous years and could be contributed to multiple of factors. These include changes in the method of counting publications (i.e. PubMed method vs WebCV methods) and the addition of several junior faculty that are still working to build their academic productivity. A review of the percentage of publications in low (73% IF: 0-5), intermediate (11% IF: 5-10), and high (6% IF: >10) impact journals demonstrates a trend of continued reduction in the impact factor over the past few years. In 2010-2011 and 2011-2012 the intermediate IF rate fell from 19% to 15% and the high IF rate fell from 7.6 to 7.2. Given the gradual increases in the IF of the core journals of our field, including the Red, Green, and Medical Physics Journal, this is likely due to growing competition in these journals and the expansion in the number of lower-tier journals.

While impact factor is one metric of performance, a much stronger metric is the growing translational research activities of the UT DRO faculty. This is highlighted in the recent success of the two Terry Fox Team grants led by UT DRO faculty. Under the leadership of Dr. Greg Czarnota, the Odette Centre was funded for their program entitled "Ultrasound and MRI for cancer therapy" and Drs. Brad Wouters and Robert Bristow led the team developing "A research pipeline for hypoxia-directed precision cancer medicine" at the Princess Margaret representing $8.6M in new research support over the next five years. These two grants not only bring together a diverse portfolio of basic and clinical research with a focus on translation that is the essence of UT DRO's research enterprise, they also serve to highlight the research profile of the UT DRO on the national stage.

UT DRO FACULTY MEMBERS 2013 - 2014 (As of June 30, 2014)

PROFESSORS

Alex Vitkin
Andrea Bezjak
Andrew Loblaw
Andrew Michael Rauth
Anthony Fyles
Bernard Cummings
Bradly Wouters
Brian O'Sullivan
Claire McCann
Chong Shun Wong
David Jaffray
Edward Chow
Fei-Fei Liu
Gillian Thomas
Hany Soliman
James Brierley
Jean-Phillipe Pignol
John Rowlands
Jolie Ringash
Laura Dawson
Maria Gospodarowicz
Masoon Haider
Michael Milosevic
Normand Laperriere
Padraig Warde
Pamela Catton
Rebecca Wong
Richard Hill
Richard Tsang
Robert Glen Bristow

ASSOCIATE PROFESSORS

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Charles Hayter
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Cyril Danjoux
David Hodgson
David Payne
Eileen Rakovitch
Ewa Szumacher
Gerard Morton
Gregory Czarnota
Ida Ackerman
Jean-Pierre Bissonnette
Kristy Brock
Lawrence Paszat
Lisa Barbera
May Tsao
Michael Sharpe
Patrick Cheung
Robert Mackenzie
Tara Rosewall
William Song
Yee Ung

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Carol Gillies
Caroline Chung
Catherine Coolens
Cathryne Palmer
Claire McCann
Colleen Dickie
Collins Yeboah
Daniel Letourneau
Danny Vesprini
Douglas Moseley
Douglass Vines
Elizabeth Barnes
Eric Leung
Geordi Pang
Hamideh Alasti
Hans Chung
Hany Soliman
Harald Keller
Howard Michaels
Ian Poon
Ivan Yeung
J Alan Rawlinson
James Chow
John Cho
John Kim
John Radwan
John Waldron
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Justin Wann-Yee Lee
Katharina Sixel
Kathy Han
Kathy Mah
Lee Chin
Lee Manchul
Lori Holden
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Marianne Koritzinsky
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Mary Ann Doherty
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Meredith Giuliani
Michael Mclean
Miller MacPherson
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Tim Craig
Warren Donald Foltz
Wilfred Levin
William Chu
Woodrow Wells
Young-Bin Cho
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LECTURERS

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Audrey Friedman
Christiaan Stevens
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Jane Higgins
Jasper Yuen
Jidong Lian
Jonathan Tsao
Juhu Kamra
Karen Moline
Kari Osmar
Kieng Tan
Laura D'Alimonte
Lisa Di Prospero
Marisa Finlay
Neil D'Souza
Raxa Sankreacha
Robert Heaton
Rosanna Macri
Sarah Jane Rauth
Senti Senthelal
Valerie Kelly
Winnie Tsz Yan Li
Yongjin Wang

INSTRUCTORS

Aisha Sheikh
Angela Cashell
Carina Feuz
Florencia Jon
Marc Potvin
Martin Chai
Patricia Charman
Renata Bradley
Ruth Barker
Wendy Flanagan

UT DRO TRAINEES 2013 - 2014 (As of June 30, 2014)

FELLOWS

Abdul Dayyat
Alejandro Berlin
Ali Hosni
Andrew Chiang
Carol Haddad
Eman Al Duhaiby
Eric Tran
Eve-Lyne Marchand
Hima Bindu Musunuru
Inge Avis
Inigo San Miguel Arregui
Irene Karam
Isabelle Thibault
Issa Mohamad
Jennifer Croke
Joelle Helou
Joshua Sappiatzer
Jure Murgic
Kim Ann Ung
Luluel Khan
Matthew Mason
Nicola Nasser
Penny Mackenzie
Qurrat Mehmood
Roger Huang
Sara Samiee
Tatiana Conrad
Tim Lymberiou
Tomas Merino
Trish Pulvirenti

PHYSICS RESIDENTS

Christine Ren
Cindy Tam
Congwu Cui
Lisa Glass
Manuel Rodriguez
Marcus Sonier
Mohammad Rezaee
Moti Paudel
Steve Bartolac
Tania Karan

RADIATION ONCOLOGY RESIDENTS

Adam Gladwish
Ahmad Bushehri
Alireza FotouhiGhiam
Chia-Lin (Eric) Tseng
Daniel Glick
Danielle Rodin
Derek Tsang
Ezra Hahn
Fatimah Alfaraj
Goldie Kurtz
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Horia Vulpe
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Mohammed Aldehaim
Nafisha Lalani
Negin Shahid
Robert Thompson
Salman (Muhammad) Faruqi
Srinivas Raman
Vivian Yau
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Yasir Alayed

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