

Radiation Oncology

annual report



2009/10



Radiation Oncology
UNIVERSITY OF TORONTO

**VISION: EXCELLENCE AND LEADERSHIP IN
RADIATION MEDICINE RESEARCH EDUCATION
AND CLINICAL PRACTICE**

**MISSION: TO ADVANCE THE SCIENCE AND
PRACTICE OF RADIATION MEDICINE**

DEPARTMENT OF RADIATION ONCOLOGY
FACULTY OF MEDICINE
UNIVERSITY OF TORONTO
FITZGERALD BUILDING ROOM 106
150 COLLEGE STREET
TORONTO ON, CANADA
M5S 3E2
TEL: 416 978-6172
FAX: 416-971-2110
WWW.RADONC.UTORONTO.CA

Read our full-length 2009-10 Annual Report online at
www.radonc.utoronto.ca/about-dro/publications/annual-reports

ANNUAL REPORT 2009/10
EDITOR: DR. ANTHONY BRADE
WRITER: ALICIA BARKER
ART DIRECTION: A D MITCHELL
PHOTOGRAPHY: DONNA SANTOS



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Mary Gospodarowicz,
Professor and Chair

“new degree program

I am very pleased to present the University of Toronto, Department of Radiation Oncology 2009-2010 Annual Report. Our Department has continued to push the leading edge of radiation oncology research, education, and clinical practice while maintaining a keen eye on our future directions.

Over the past year, we have welcomed six new members to the UT DRO faculty, Dr. William Chu, Ms. Caitlin Gillan, Dr. Brian Keller, Ms. Winnie Li, Dr. Katharina Sixel, and Dr. Beibei Zhang. Professor Bradley Wouters was appointed UT DRO Associate Chair of Graduate Studies, a new post within the Department responsible for increasing the Department's engagement within the Institute for Medical Sciences, the primary venue for engagement in graduate programs.

Our faculty continues to contribute to research and education on an international level, securing funding from agencies worldwide and receiving honors for their work. This year, Professor Pamela Catton was awarded the Canadian Association of Medical Education (CAME) Certificate of Merit for her exceptional contribution to medical education. Ms. Amanda Bolderston was announced as the Canadian Association of Medical Radiation Technologist's (CAMRT) President-Elect for a two-year term beginning in 2011. Ms. Nicole Harnett was awarded the Welch Memorial Lecture through the CAMRT for her outstanding contribution to her profession at a national level through education, research, and administration.

I want to congratulate Dr. Kristy Brock and Ms. Tara Rosewall, who were promoted to the rank of Associate Professor, and Drs. Charles Catton, Laura Dawson, and Rebecca Wong, who were promoted to the rank of Professor. Tara Rosewall is Canada's first Radiation Therapist to reach the academic rank of Associate Professor. She is a great pioneer and a leader who has paved the path for radiation therapists seeking academic careers.

Chair's Welcome

... the first of its kind,

I am proud to announce that the first class of the new Master of Health Science in Medical Radiation Sciences began their studies in September of 2009. The new degree program, a joint partnership between the UT DRO and Institute of Medical Science, is the first of its kind in North America. The two-year full-time professional degree provides an avenue for radiation therapists seeking a more advanced practice role to develop and strengthen their leadership skills and knowledge-base.

Dr. Pamela Catton brought survivorship education and research to the forefront this year with the launch of the Electronic Living Laboratory for Interdisciplinary Cancer Survivorship Research (ELLICSR) program. ELLICSR, a novel academic survivorship program focused on research and innovation is located at the Toronto General Hospital - University Health Network and a virtual space online, connects survivors from across Ontario and teaches healthy living skills.

Our Department continues to provide excellent programs and events and this would not be possible without the help of our faculty and committees. During this economic tumultuous time, I congratulate the Continuing Education Director, Dr. David Wiljer for his success in key CE events. The IMRT Insights partnered with Cancer Care Ontario and attracted its biggest audience to date. RTi3 partnered with Sheffield Hallam University in the UK and provided insight to practice sharing methods across the pond.

We have made considerable progress defining our Department's future direction through the strategic planning process we've embarked upon over the past year. With the advice of faculty past and present, and of leaders in radiation oncology and medical education worldwide, we have identified key priorities moving forward. I look forward to working toward these common goals with the continued cooperation, feedback, and assistance of our outstanding faculty.

Finally, I would like to acknowledge the contributions made by Dr. Pamela Catton, who served as Acting Chair from June to October 2010 during my sabbatical leave and UT DRO Vice-Chairs Professor David Jaffray, Professor Shun Wong, and Professor Pamela Catton; their leadership and achievements are invaluable to the success of UT DRO.

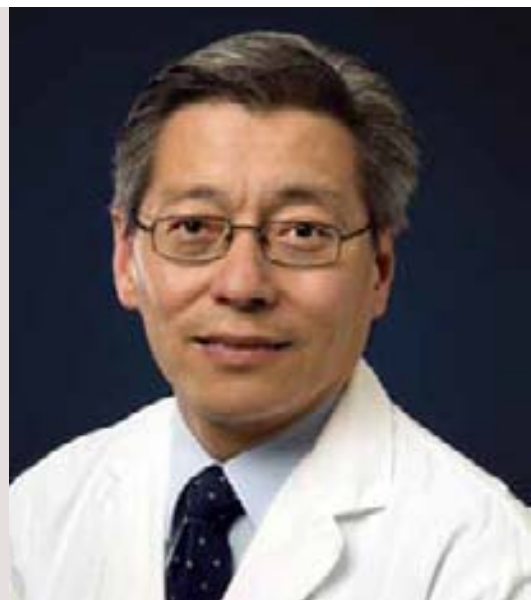
I am confident that, as you review this year's report, you will be impressed with the accomplishments, vision and direction of the department.

Mary Gospodarowicz
MD, FRCPC, FRCR (Hon)
Professor and Chair

Vice Chair Reports

Clinical Affairs

SHUN WONG
MD, FRCPC
Vice-Chair, Clinical Affairs



Academic Affairs

PAMELA CATTON
MD, FRCPC, MHPE
Vice-Chair, Academic Affairs



Academic Programs

DAVID JAFFRAY
BSc, PhD
Vice-Chair, Clinical Affairs



The Vice-Chair for Clinical Affairs is responsible for policy and program issues related to relations with clinical sites and faculty. This portfolio oversees the appointment, three-year review and academic promotions of members of the Department, and ensures that the recruitment and clinical manpower plan at the clinical sites is aligned with the academic plan of the University Department.

During the reporting period of July 1, 2009 to June 30, 2010:

Drs. Charles Catton, Laura Dawson, and Rebecca Wong were promoted to the rank of Professor, and Dr.

Kristy Brock and Ms. Tara Rosewall to the rank of Associate Professor.

Drs. William Chu, Brian Keller, Katharina Sixel, Beibei Zhang, and Ms. Caitlin Gillan were appointed to the rank of Assistant Professor and Ms. Winnie Li was appointed Lecturer.

We bid farewell to Dr. Allison Brown and Ms. Cynthia Eccles.

The Vice-Chair of Academic Affairs is responsible for overseeing the educational and financial activities of UT DRO and works to build strong educational programs that serve the professional and research training needs of all professional radiation disciplines in an environment of fiscal responsibility.

During the reporting period of July 1, 2009 to June 30, 2010:

Drs. Bradly Wouters was appointed UT DRO Associate Chair, Graduate Studies. This role was

developed to increase the department's involvement within the Institute for Medical Sciences, the primary venue for engagement in graduate programs.

A new professional Master of Health Science in Medical Radiation Sciences degree program was launched and accepted its first students in September of 2009.

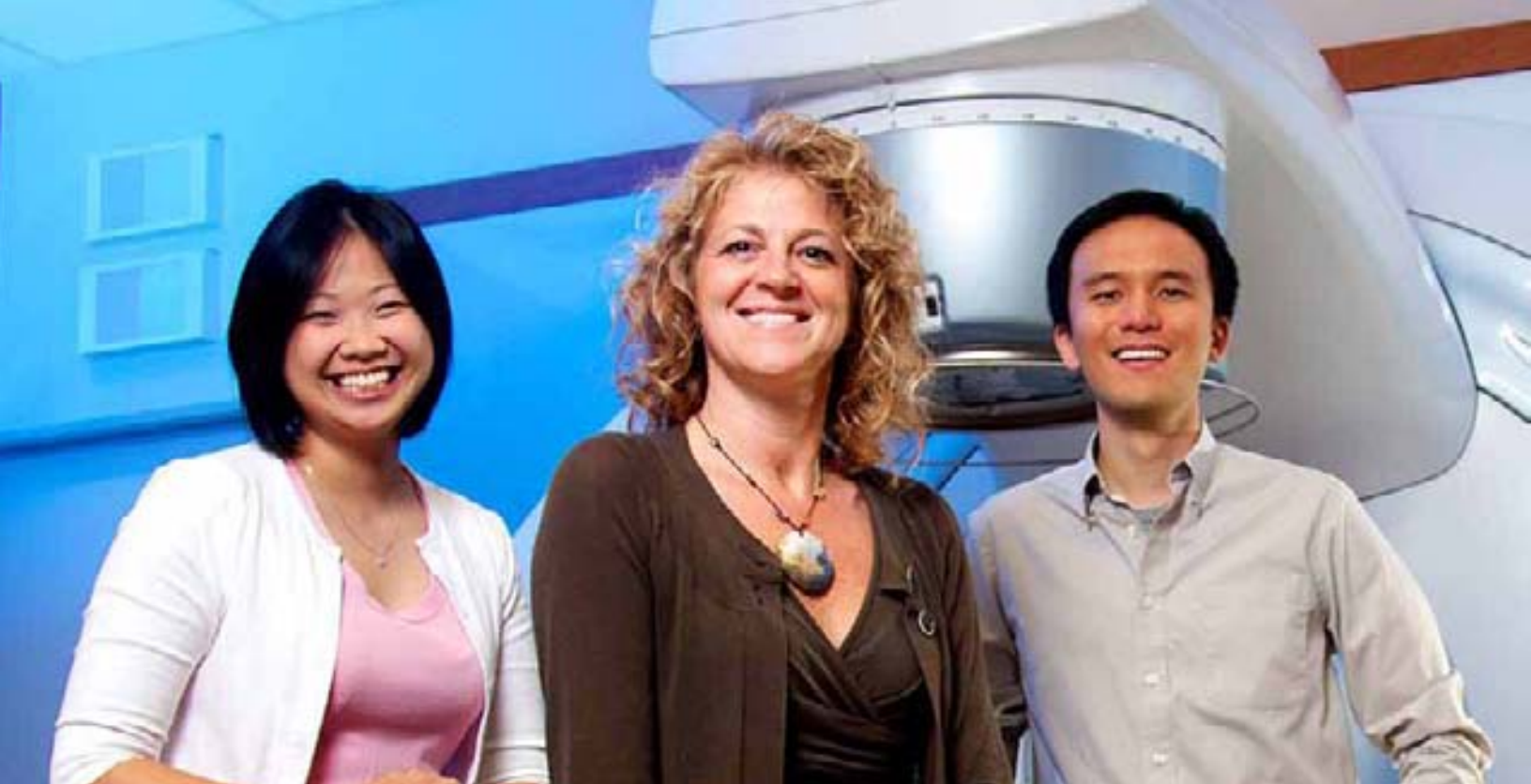
The Vice-Chair of Academic Programs is responsible for overseeing research activities and works to build academic pursuits that bridge the faculty, facilities, and programs of UT DRO. This year has seen us grow through our strategic planning process that identified many directions and desires for expansion as well as areas of consolidation. Our digging also brought three cultural elements into relief: a propensity for welcoming diversity, a respect for the data and its use in formulating our steps forward, and an indomitable responsibility to innovate – not just discover, not just teach, not just care – but truly innovate.

During the reporting period of July 1, 2009 to June 30, 2010:

Under the leadership of Dr. Greg Czarnota, the department has its second Terry Fox Program Project funded to explore the role of ultrasound in therapy.

We saw the grand opening of the CFI-funded ELLICSR facility under the direction of Dr. Pam Catton to investigate cancer survivorship issues

A growing number of faculty landed operating grants on diverse topics including: SPECT imaging in breast cancer, dynamic contrast enhanced CT, automated treatment planning, and advanced quality assurance methods.



Kitty Chan, Nicole Harnett, John Hsien

Educating Future Leaders in Radiation Therapy

MASTER OF HEALTH SCIENCE IN MEDICAL RADIATION SCIENCES

The UT DRO continues to break new ground in educational innovation. This year, a new two-year Master of Health Science degree in Medical Radiation Sciences joined the UT DRO portfolio. The degree program, which is administered through the Institute of Medical Sciences with course logistics, content, faculty assessment, and admissions management organized through the UT DRO, is the first program of its kind in North America. Program Director Nicole Harnett describes the new degree as an initiative that “was a long time coming. The UT DRO has had a long-standing belief that radiation therapists can contribute more, function on a higher level. This degree is designed to lead to a more academic career path for radiation therapists.”

The two inaugural students, John Hsien and Kitty Chan agree. John and Kitty applied to the program after Nicole mentioned the opportunity at a PMH staff meeting, where both are still working – John full-time, and Kitty part-time.

Pursuing this new degree seemed like a natural progression for Kitty, who had spent the year prior to registering working in a 50/50 role – half of her work clinical, and the other half research. She describes the work as critical in helping her

...ENQUIRY, INNOVATION, KNOWLEDGE TRANSLATION, AND EVIDENCE-BASED PRACTICE

After completing their Bachelor in Medical Radiation Sciences at UT/Michener, they started work at Princess Margaret Hospital, and were drawn to the new degree program because of what Kitty describes as an “aspiration for a more advanced practice role within radiation therapy”.

prepare for her degree studies. The degree program has been a lot of work, and John and Kitty agree that it’s been “a juggling act” to manage work and study. Although the program has its challenges, Kitty has found the coursework has helped to “develop a deeper understanding of the multidisciplinary nature of the field”; John adds, “it’s helped me



get a broader perspective of patient treatment.” Nicole explains that “the coursework is taught by 25 UT DRO faculty radiation oncologists, physicists, and radiation therapists” united with the goal of “deepening radiation medicine knowledge, expanding clinical reasoning skills, and further developing the skills of enquiry, innovation, knowledge translation and evidence-based practice” for their students.

One aspect that has made their new workload easier is the level of support they’ve received from professional supervisors; Kitty attests, “they have been very accommodating of our schedules when coursework interferes with work schedules.” John and Kitty are enthusiastic about the opportunities that will come with completion of their MHSC in MRS. Although the

advanced practice role is still being developed within the clinical milieu, John and Kitty are confident that this leadership role will have a place within the radiation oncology team. Kitty confirms, the “role ... depends on the tumor site, and its specific disease management” John adds, “... the goal is to be able to be a leader – to interpret research results for patients, take on new tasks as part of the team, and conduct research”.

Moving forward, Nicole sees the course moving to a more distributed-learning structure by September of 2011 – a step that would expand the reach of the program to radiation therapists working throughout the province, the country and beyond.

MHSc in MRS

In 2008 a new professional master’s degree program - MHSc Medical Radiation Sciences -received final approval at the University and successfully completed an external review by the Ontario Council of Graduate Studies. The inaugural intake for this unique new program was September 2009.

This unique professional program, the first of its kind in North America, is designed to foster the development of a new cohort of radiation therapists – those who will become academic thought leaders in radiation therapy practice and take responsibility for further advancing the contribution of radiation therapists in the cancer care jurisdiction. The Program promises to deliver a challenging curriculum to expert radiation therapy clinicians.

COMPLEX SYLLABUS INCLUDES:

- in-depth foundational courses in radiobiology, advanced physics, and radiation medicine frontiers
- clinical reasoning and decision making courses
- clinical research projects and extended internships in chosen areas of specialization

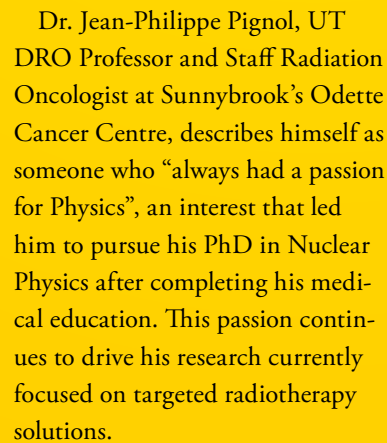
CURRICULUM CONSISTS OF

- required courses (Physics, Radiobiology, Oncology)
- electives (Leadership, Clinical decision making)
- and an 8-month clinical internship

PREREQUISITES

- Relevant certification in Radiation Therapy AND have completion of a recognized four-year Bachelor’s Degree in Medical Radiation Sciences or its equivalent with a minimum GPA of B+ in the final two years of fulltime undergraduate studies, and have performed a minimum of three years (5000 hours) of professional practice within five years of application

NANOPARTICLES REVEAL THE NEXT FRONTIER IN BRACHYTHERAPY



a \$2 million award from the Odette Family in 2008 to support his research on innovative brachytherapy techniques. Foremost among these is his work on gold nanoparticles. Once injected into the body and selectively targeted into the tumour, the minute pieces of metal act as radiosensitizers to increase the effect of radiation, hopefully making “treatment safer, less toxic, and

Dr. Pignol's primary clinical and research interest is the development of innovative radiotherapy techniques for breast cancer, for example permanent seed implant brachytherapy. Dr. Pignol received

more patient-friendly. The gold nanoparticle may be the ultimate innovation in brachytherapy – it would allow us either to reduce the dose and possibly reduce side effects, or to treat more efficiently patients with more aggressive disease.”



Dr. Pignol describes the gold nanoparticle research at the UT DRO as a very exciting emerging field in cancer research: “It’s a research field mixing the discoveries of the nanotechnology era and of the genome era. The genome era helped us define new targets for cancer leading to targeted therapies. Instead of killing the cell using targeted antibodies, the gold nanoparticles can be accumulated selectively into the cancer cell and then be ‘activated’ using low energy photons to produce a highly lethal spray of Auger electrons into the tumour.”

This work was initiated four years earlier when Dr. Pignol evaluated gold as a radiosensitizer in collaboration with Prof. Léon Sanche at the Université de Sherbrooke with funding from the Canadian Institute for Health Research. Most recently, in 2009, the Canadian Breast Cancer Research Alliance

(CBCRA) provided funding to Dr. Pignol’s group in collaboration with Prof. Ray Reilly at the Dan Leslie Faculty of Pharmacy, University of Toronto, to develop successfully a novel targeted nanoconstruct involving the binding of trastuzumab, a Health Canada Approved antibody used to target breast cancer cells overexpressing HER2, to gold nanoparticles. In addition, a close collaboration was established with Prof. Jean Gariepy in the Medical Biophysics Department, University of Toronto, to develop an aptamer-goldnanoparticle compound directed toward MUC1, an abnormal mucin found in the majority of epithelial cancers. Finally, Dr. Pignol is the leading investigator of the high risk component of the recently awarded Terry Fox grant “Ultrasound for Cancer Therapy” awarded to Dr. Czarnota, UT DRO, where microbubble-mediated sonoporation will be

used in an attempt to enhance gold nanoparticle targeting.

Gold nanoparticle radiosensitization is becoming a key research theme at the UT DRO where, for example, Dr. David Jaffray has also received major funding from the Canadian Institute for Health Research for a number of nanoparticle carrier design optimization studies.

Dr. Pignol moved from France ten years ago to join the UT DRO because of the exceptional research environment available here: “The UT DRO community is one though there are two physical locations where teaching and research are undertaken. It makes our whole Department one of the largest if not the largest on earth. There is a high likelihood that you will find the finest expert in your field next door, and this immensely facilitates research.”

FRONTIERS OF RADIATION MEDICINE COURSE TEACHES SKILLS FOR SUCCESS IN SCIENTIFIC WRITING



Dr. Patricia Lindsay, Dr. Anthony Fyles, Dr. Anne Koch

Taking Research to Print

As a researcher, the importance of knowing how to write successful papers and grants is paramount. The Frontiers of Radiation Medicine Research course, hosted through the Institute of Medical Science and administered by UT DRO faculty members Drs. Anthony Fyles, Anne Koch, and Patricia Lindsay, teaches the skills instrumental to producing quality research publications. Dr. Anthony Fyles describes the course as “a concentrated exposure to research planning in radiation medicine that you don’t get anywhere else.” The course, first implemented in the winter of 2005, currently has nine students from various backgrounds including those

in the Master of Health Science in Medical Radiation Science program, residents conducting research as part of the EIRR21 program, fellows, and IMS students.

The Frontiers of Radiation Medicine course is the only radiation-focused course of its kind in Canada, with coursework covering physics, translational research, and tumor biology. The course is divided into two-hour sessions with one-hour devoted to research presented by an invited speaker on the topic of their work in radiation medicine, followed by a discussion period facilitated by the course instructors analyzing the process and framework that underlie the work presented. Weekly assignments distributed at the end of each class culminate in the final project, a mini-grant based on the students’ own research. Dr. Fyles remarks that he sees a noticeable improvement in students’ writing skills from the beginning to the end of the course, meeting the course objective of “preparing the next generation of Medical Radiation Sciences researchers.”

**THE ONLY
RADIATION-FOCUSED
COURSE OF ITS KIND
IN CANADA**

Leading by Example

**TARA
ROSEWALL
CREATES A
NEW CAREER
PATH FOR
RADIATION
THERAPISTS
IN CANADA**

Curiosity and ambition have led Tara Rosewall down an unusual path for a radiation therapist. Throughout the duration of her career, she has led several studies, created new opportunities for radiation therapists to engage in research, and has most recently received a promotion to Associate Professor – the first Radiation Therapist in Canada to achieve this rank and one of only a few worldwide. None of Tara’s achievements were easily accomplished; her drive to succeed and desire to learn has kept her busy with full-time work, research, and formal schooling in her spare time: “I’ve been in school in my spare time since 2000 completing my Bachelors and Masters degrees, and am now working towards a PhD.”

Her inquisitive spirit steered her towards her first professional research position, as a GU research therapist in 1997. She describes this position as her “first defining role” and acknowledges Drs. Charles Catton and Padraig Warde for helping shape her attitude and



“The willingness of others to collaborate is not reproduced anywhere else. Of all the radiation therapy departments I’ve visited in the world, there are no others who have achieved this level of collaboration. This willingness to work together gives our research a different flavour - it’s well-rounded, covering all perspectives and giving a whole new meaningfulness to the work.”
Tara’s appreciation for the support received throughout

...RECENTLY ACHIEVED A PROMOTION TO ASSOCIATE PROFESSOR – THE FIRST RADIATION THERAPIST IN CANADA TO OBTAIN THIS RANK...

career path during that time: “They gave me opportunities to be involved in things beyond the level that had been given to anyone before and, even still, continue to mentor, advise, and provide me with opportunities.”

Tara describes her career path as one “difficult to mimic anywhere else.” Being a radiation therapist involved in research - an area traditionally dominated by physicists and radiation oncologists - was “never an issue at PMH and has become less of an issue externally over the years, both because of my previous research, and the movement of more radiation therapists into research-oriented roles.”

The collaborative, collegial environment in the UT DRO has helped Tara thrive. She attests that the UT DRO is truly a unique setting:

the years is clear. Of her colleagues, Tara adds “they helped me grow as a researcher more than any theoretical training.”

Tara has accomplished much and has no intention to slow down. She aspires to achieve full professorship before her retirement and envisions the creation of a self-sustaining radiation therapy research department. Armed with a strong desire to achieve, supportive colleagues, and undeniable intellect, it seems a certainty that Tara’s dreams will be fulfilled.

DR. ADRIAN ISHKANIAN

Composing a Career in Medicine



While Chief Resident Dr. Adrian Ishkanian's academic background is not what you would typically expect of a radiation oncology resident, he asserts that "the radiation oncology residency program seems to attract well-rounded individuals with diverse interests"; perhaps none quite as diverse as his own. A classically trained pianist, Dr. Ishkanian finished his studies with the Royal Conservatory to study Biology at Cornell University, later returning to his native Vancouver to pursue a Master of Science with the Department of Pathology and Laboratory Sciences at the University of British Columbia

He credits the foresight of Drs. Bristow and Milosevic to collect fresh-frozen prostate specimens, a collection that dates back to the early 1990s and exists as the largest of its kind in the world, as an excellent resource that has been essential to his research. Dr. Ishkanian's work in the Bristow Lab has been focused on locating DNA markers predicting sensitivity to radiotherapy. With markers identified, Dr. Ishkanian aims to

involved determination of the percentage of disruption in a patient's genome, finding that as the level of disruption increased, the patient's response to treatment and overall outcome worsened. His preliminary study focused solely on the percentage of the genome disrupted, and has now progressed to specifically locating the disruptions within the genome and identifying the genes involved. Adrian hopes that his current research will help create more novel therapies that will target disrupted pathways better. His work's promise has been recognized by The Canadian Urologic Oncology Group's Abbott Research Award for \$10,000 which was awarded to Adrian this year.

Although Adrian has an exceptional aptitude for and interest in research, it's not his only focus – he highly values the interaction he has with patients: "Radiation Oncology is a discipline that grants its practitioners the rich opportunity to do both clinical work and research. The ability to maintain relationships with patients from diagnosis through remission and for years afterwards is unique from other medical specialties. Having a lasting connection with patients is so important."

A CLASSICALLY TRAINED PIANIST, DR. ISHKANIAN FINISHED HIS STUDIES WITH THE ROYAL CONSERVATORY TO STUDY BIOLOGY AT CORNELL

(UBC). Under the mentorship of Drs. Ling and Lam, Dr. Ishkanian's interest in radiation oncology, specifically in the detection of markers for disease progression, strengthened and helped to crystallize his career path. Adrian moved on to complete his Medical Degree at UBC, aiming to move to Toronto for residency because of "the type of work being done [here], and the opportunity to be part of such a collaborative network that encourages intense growth." Dr. Ishkanian had been in communication with UT DRO's Dr. Rob Bristow during medical school and knew that working in Dr. Bristow's lab would be ideal: "Dr. Bristow's leading work in translational biology and successful clinical practice treating prostate cancer at PMH really attracted me."

create risk profiles to predict failure after treatment. In the future, Dr. Ishkanian expects that the identification of markers in cancer patients will assist Radiation Oncologists to stratify patients more easily and enable delivery of personalized treatment. Current treatment plans are based on standardized pathological parameters, but beyond this do not account for variation from patient to patient.

The research Dr. Ishkanian has conducted during his residency has led to several awards including, most recently, the Best Oral Presentation by a Resident at the 2009 Canadian Association of Radiation Oncology (CARO) Meeting. The work he presented



Learning From Each Other, Together

ELLICSR GRANT FUNDS DEVELOPMENT, EMPOWERMENT OF SURVIVOR COMMUNITY



The concept of developing and empowering the cancer survivor community is relatively new, with roots dating back to the mid 1980s. Dr. Pam Catton explains: “The whole notion of cancer survivorship is a North American construct. It started in the 1980s and was led by cancer patients in the United States who noticed that the cancer system dealt predominantly with their acute treatment and nothing else. With more survivors living longer and dealing with long-term consequences of their cancer diagnosis and treatment, it became clear that their needs – economic, spiritual, and physical – were unmet.”

The new 12,000 square foot Collaborative Centre for Health, Wellness and Cancer Survivorship, administered by Princess Margaret Hospital and housed in Toronto General Hospital, is designed to cover all aspects of survivor support and rehabilitation. The brainchild of Dr. Pamela Catton, Vice Chair and Professor in the Department of Radiation Oncology, the program is funded by a \$3.7 million research grant to ELLICSR – Electronic Living Laboratory for Interdisciplinary Cancer Survivorship Research - from the Canadian Foundation for Innovation and the Ontario Research Fund.

With a mandate of creating physical and virtual hubs and creating a community of practice, ELLICSR allows researchers to study an ever-growing population in the cancer community: survivors. Associate Director of the program Dr. David Wiljer attests, “Over the last ten years, we’ve recognized that a new model of care is necessary for patients as they continue to do better and live longer. Their treatment moves from acute care to care for a chronic condition.” Patients need to be rehabilitated, and this has significantly influenced the design of the Collaborative Centre for Health, Wellness and Cancer Survivorship. The facility includes



Dr. David Wiljer

an exercise room, a kitchen where survivors can take part in healthy cooking classes, a library, and areas for private and open discussions. Dr. Catton explains that each aspect of the program is designed to “empower patients to take a more participatory approach to their health.”

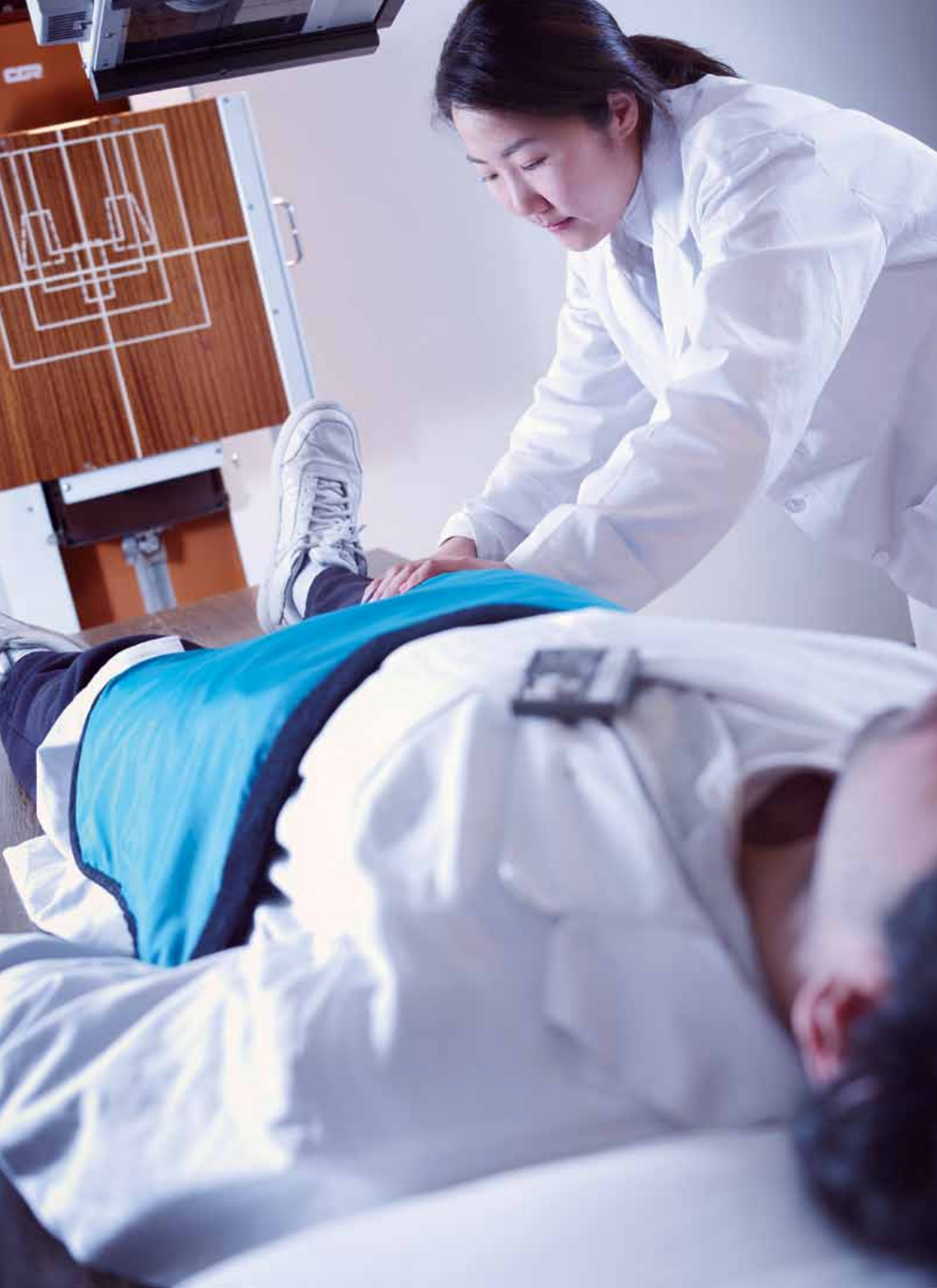
The virtual contingent of the program, known as the Survivorship Information Technology Infrastructure (SITI), is intended

to connect survivors from any location, while collecting research data. Both the physical and virtual space of ELLICSR offer excellent opportunities to gather data and support collaborations among researchers and survivors, explains Dr. Wiljer, “It’s a community where patients and researchers can interact and exchange ideas.”

The program, launched in June 2010, will be an important venue for advancements in survivorship

research, support, and education. Dr. Catton stresses the importance of encouraging survivors to develop confidence in their ability to take responsibility for their care: “We want to help survivors transition back to life in the community by empowering them with the education, information, support, and tools they need to provide self-care. We want to help them to live well with and without cancer for the rest of their lives.”

**WE WANT TO HELP SURVIVORS
TRANSITION BACK TO LIFE IN
THE COMMUNITY...”**



A Degree with a Destination

HOW THE BACHELOR OF MEDICAL RADIATION SCIENCES PROGRAM PREPARES ITS STUDENTS FOR THE WORKPLACE

Victoria Lee, a third-year Radiological Technology student, can trace her desire to work in healthcare to her own experience as a patient several years ago: “the staff was so nice and the experience

“THE DEGREE PROGRAM IS REALLY HANDS-ON AND SPECIFIC.”

made me want to enter the health-care field to have a positive effect on people.” After completing her BSc in Biology, Anthropology, and Biomedical Communications at U of T Mississauga, Victoria entered directly into the UT DRO Medical Radiation Sciences program. A self-proclaimed “technical person”,

Victoria felt that radiological technology was the right career path, and that the MRS program would help prepare her for this line of work: “The degree program is really hands-on and specific. It’s not like getting a BSc where you don’t have a clear career path lined up. This program directs you toward a specific job.”

Victoria is currently nearing the end of her eight-month clinical placement, undertaken at Toronto General and Western Hospitals. With week-long rotations in areas including Emergency, Operating Room, and Portables, Victoria has gained experience in a wide variety of areas including X-rays, CT scans,

and fluoroscopy among others. The opportunity to see many patients and work diagnostically has helped prepare a foundation for Victoria’s career. She sees herself translating her education and experience into a career as an MRI Technologist and, maybe one day, a clinical coordinator or instructor. With plans to stay in Toronto, Victoria hopes to secure permanent work at one of U of T’s teaching hospitals: “Working in Toronto gives you the opportunity to work in some of Canada’s top hospitals along with a diverse group of knowledgeable and expert staff. I hope to be able to practice here and be a part of this team one day.”

MEDICAL RADIATION SCIENCES PROGRAM

The undergraduate Medical Radiation Sciences (MRS) Program is a second-entry joint BSc/Diploma of health professional education program offered by UT DRO and the Michener Institute. This four year interprofessional degree is offered in three calendar years and is comprised of didactic, simulated and clinical courses. Three discipline specific streams are offered: Radiation Therapy, Radiological Technology, and Nuclear Medicine Technology. There were 376 students registered in 2009-2010. The MRS Program prepares students for tomorrow’s professional practice, for future leadership roles and to pursue advanced graduate degrees.

No Stone Left Unturned

UNDERSTANDING **HYPOXIA** FROM ALL ANGLES

Tumour hypoxia, a state of low oxygenation observed frequently in cancer that causes resistance to radiation and enhances the malignant potential of tumour cells, has been the subject of intensive investigation since the 1960s.

The foundation for the Hypoxia program at Princess Margaret Hospital began in the 1970s when Drs. Gordon Whitmore and Mike Rauth started studies on drugs that could sensitize hypoxic cells to irradiation. These studies lead eventually to a clinical trial involving Drs. Richard Hill, Ray Bush, Gillian Thomas, and Mike Rauth in the 1980s, working with drugs designed to sensitize hypoxic cells to radiation. At that time, the purpose of the group's research was to develop a method to identify hypoxic tumours and adjust patient treatment appropriately.

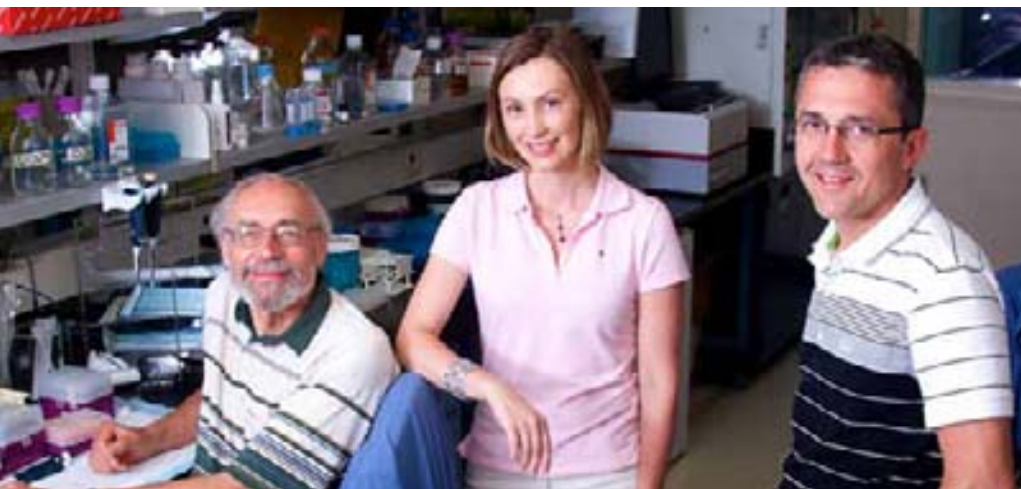
The Hypoxia program was formally established in 1996 through a grant from the NCIC and Terry Fox Foundation. At its inception

the program, which consisted of two experimental projects in the labs of Drs. Richard Hill and David Hedley, was focused on measuring hypoxia as well as interstitial fluid pressure, a related tumour microenvironmental phenomenon. The program's third project was a clinical study, led by Drs. Michael Milosevic and Anthony Fyles, focused on the measurement of hypoxia and interstitial fluid pressure in the tumours of cervix cancer patients. Through their studies, the group discovered that though hypoxia and interstitial fluid pressure both predict patient outcome, they do so independently.



Dr. Rob Bristow, Dr. David Jaffray, Dr. Michael Milosevic

Dr. Richard Hill, Dr. Marianne Koritzinsky, Dr. Bradly Wouters



In addition to linking hypoxia with an adverse outcome in cervical cancer, the hypoxia program's researchers also demonstrated similar findings in prostate cancer patients. Continued studies have revealed that hypoxic tumours are more likely to metastasize, and additionally that interstitial fluid pressure predicts patient response to chemotherapy.

Through his studies of hypoxia and prostate cancer, Dr. Mike Milosevic was able to demonstrate the quick recurrence of hypoxic tumours – a finding that has affected the use of hormone treatment for patients with this diagnosis. Dr. Hill offers, “a finding that came out of the prostate study was the observation that patients who were given hormones, a common procedure for prostate cancer patients, had improved oxygenation in their tumors. To generalize, patients who are given hormones do somewhat better if they respond to the hormone. One possible explanation for that is that there is a reduction in the level of hypoxia in the tumors.”

The program continues today and since inception has garnered over 15 million dollars in research funding. Currently it is co-led by Dr. Bradly Wouters and Dr. Rob Bristow. The program has diversified to include six projects, five basic/translational and one clinical. In 2004 it was first expanded to include a DNA repair

project headed by Dr. Rob Bristow, whose interest lies in understanding how hypoxia affects the ability of cells to repair radiation damage. A second imaging-related project, initially led by Dr. Ivan Yeung and currently co-directed by Dr. David Jaffray, was also included in the 2004 grant renewal.

Dr. Hill elaborates, “we were moving to the point where we really wanted to see if we could image what was happening directly in the patient.”

The 2009 renewal included an additional project led by Dr. Bradly Wouters who, along with Dr. Marianne Koritzinsky, is investigating the molecular response of cells to hypoxia *in vivo* to try to understand the molecular mechanisms of treatment response. Although the primary focus of the program since its inception has been cervix and prostate cancers, a project studying pancreatic cancer has also been introduced by Dr. David Hedley's group. In the clinic, Drs. Milosevic and Fyles are currently running a trial to monitor tumour function over time for patients treated with radiation and Sorafenib, an anti-vascular drug designed to prevent the development of tumour vasculature therefore depriving the tumour of nutrients necessary for its survival. Paradoxically, anti-vascular agents in this class may normalize tumour blood vessels and allow improved perfusion, hopefully improving response to therapy. The group is to test this hypothesis with the current trial.

The investigation of hypoxia-induced genes potentially involved in the metastatic behaviour of cervix cancer is underway by the group in Dr. Hill's lab. The team seeks to answer the questions of whether and how

hypoxia works in cervix cancer populations to potentially increase metastatic potential. The group has now identified a series of genes believed to be involved in the process and are, in an experimental setting, assessing whether blocking their activity can interfere with formation of metastases.

The imaging project, led by Drs. Jaffray and Yeung, is focused on imaging longitudinally in order to understand what happens to hypoxia and interstitial fluid pressure during the course of treatment. Dr. Hill states: “our focus is to try to move into the time dimension. We’ve made measurements before treatment started, and related the measurement to treatment outcome. What we want to do now is make measurements during the course of treatment and monitor what is happening. Being able to monitor what is happening during the course of treatment means we may be able to predict how to modify a patient’s treatment plan during the course of the treatment.”

The implications of discoveries made by this team are far-reaching, affecting patient treatment worldwide. The program, due for renewal in 2014, has demonstrated significant successes over the years with its group publishing 160 papers, and moving closer to understanding tumour behaviour than ever before. Dr. Anthony Fyles explains that the future of the program is “directed at continuing to develop hypoxia and interstitial fluid pressure imaging techniques, implementing the wide use of tissue biomarkers for hypoxia, and creating a robust marker capable of determining which patients may benefit from new drugs.” All of these objectives point towards one single goal: creating better, more effective and safer treatments for patients by personalizing how their treatment is delivered.

THE IMPLICATIONS OF DISCOVERIES MADE BY THIS TEAM ARE FAR-REACHING, AFFECTING PATIENT TREATMENT WORLDWIDE.

PUBLICATIONS:

160

FUNDING:

1996-1999: \$1,258,962

1999-2004: \$2,987,865

2004-2009: \$5,262,165

2009-2014: \$4,986,535

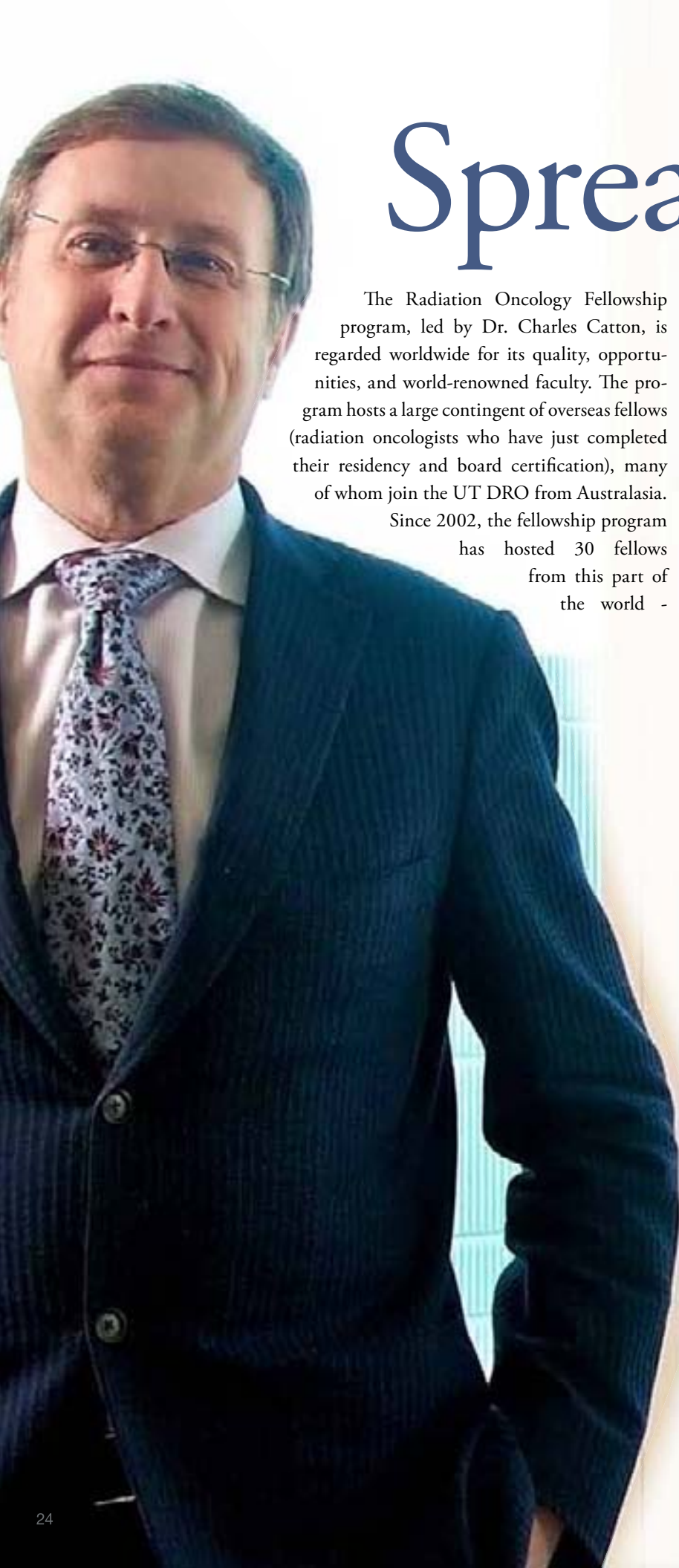
Total to Dec 2009: \$10,010,765

Total to June 2014 \$14,495,527

PROGRAMS:

- Metastases in cervix cancer (Dr. Richard Hill)
- Metastases and hypoxia in pancreatic cancer (Dr. David Hedley)
- Hypoxia and DNA repair (Dr. Rob Bristow)
- Cell response to hypoxia in-vivo (Drs. Bradley Wouters and Marianne Koritzinsky)
- Imaging hypoxia and interstitial fluid pressure longitudinally (Drs. David Jaffray and Ivan Yeung)
- Clinical program primarily focused on cervix and prostate damage and DNA repair (Drs. Anthony Fyles and Michael Milosevic)





Spreading the

The Radiation Oncology Fellowship program, led by Dr. Charles Catton, is regarded worldwide for its quality, opportunities, and world-renowned faculty. The program hosts a large contingent of overseas fellows (radiation oncologists who have just completed their residency and board certification), many of whom join the UT DRO from Australasia.

Since 2002, the fellowship program has hosted 30 fellows from this part of the world -

25 Australians and five New Zealanders. Although their experiences prior to and since their fellowships vary, their primary reason for coming to the UT DRO is largely similar: the quality of training and breadth of opportunities available. For many, this made the decision to come to Toronto easy, and the excellent referrals of mentors, supervisors, and colleagues, only made the decision easier: says Dr. Mark Lee, "I had been in contact with two of my previous supervisors who had performed a fellowship at Princess Margaret Hospital, both of whom had extremely high recommendations about performing a fellowship there."

With unbeatable opportunities for growth, the UT DRO Fellowship program encourages fellows to gain experience and expertise in areas not commonly available elsewhere. Current Fellow Dr. Douglas Iupati explains, "Personally, I was very interested in gaining experience in HDR brachytherapy, which isn't widely available in New Zealand." Dr. Philip Tran agrees, offering that the level of "involvement in technological research [available at PMH] would be difficult or impossible to undertake back in Australia."

It's not only the research and clinical practice that sets the UT DRO apart, but the innovative mindset linking the two domains. Dr. Douglas Iupati shares, "In regards to PMH, it's been quite an eye-opener for me with a very different philosophy of practice here compared to back home. The strong emphasis on and practice of research here is quite inspiring, as well as the academic teaching opportunities available." Dr. Andrew Potter describes

RADIATION ONCOLOGY FELLOWSHIP

The UT DRO Fellowship Program is one of the largest and most successful radiation oncology fellowship programs in North America, attracting excellent candidates from around the world. It has two streams: a one-year clinical research program and a two-year research program. During the one-year Clinical Research Program, fellows acquire clinical expertise in one or two radiation oncology disease

Word

FELLOWSHIP
PROGRAM MAKES A
NAME FOR ITSELF IN
AUSTRALASIA

PMH as “fertile ground – great for the gestation of new ideas and well-equipped to foster them.” He attests that his fellowship at UT DRO provided him “the unique opportunity to learn to think like a clinical researcher.”

It goes without saying that the UT DRO’s faculty provides the foundation of its success. Dr. Mark Lee explains, “the radiation oncologists working at the UT

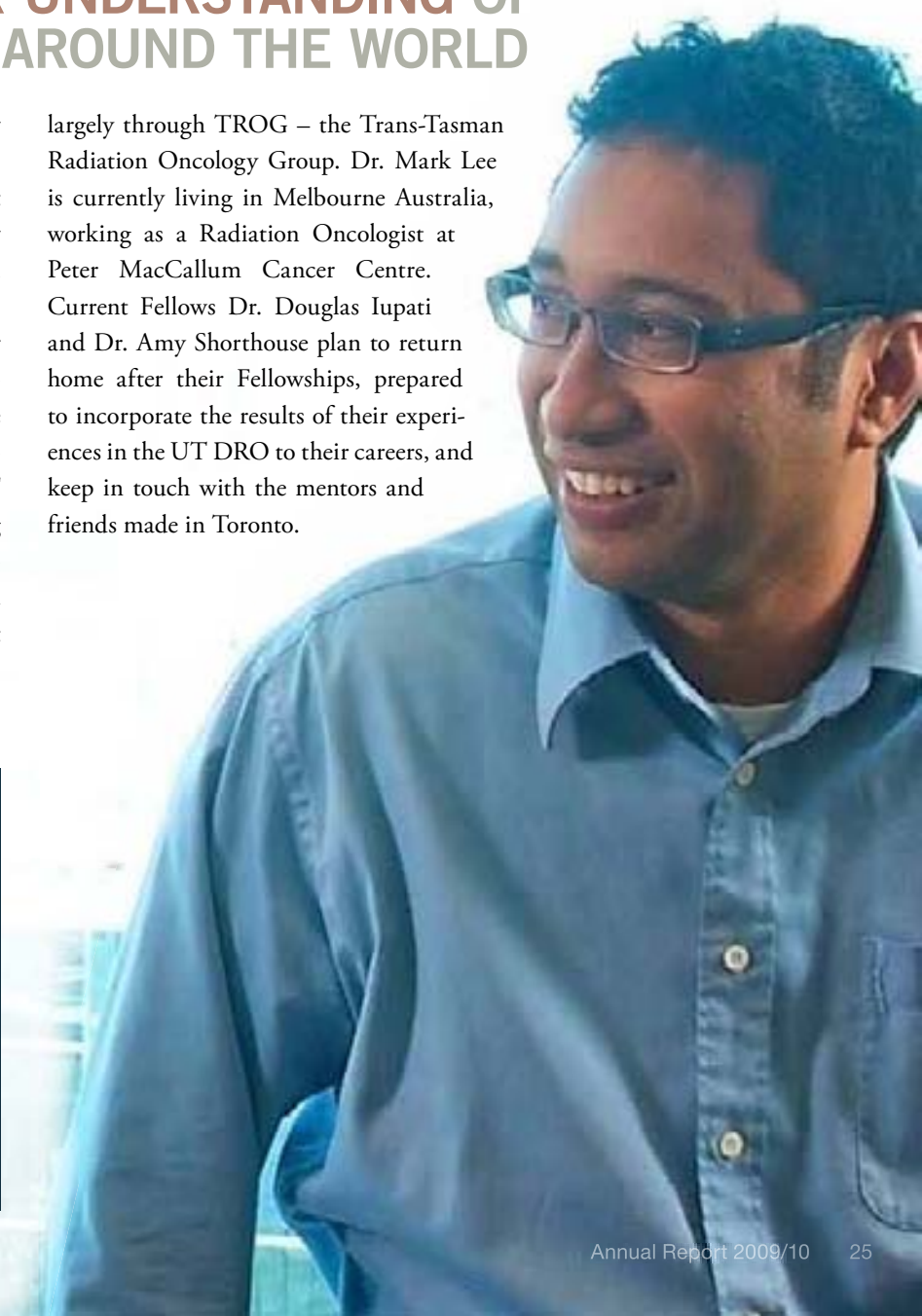
After returning home, UT DRO Fellows have the advantage of applying the knowledge gained in Toronto to their new workplaces and sharing practice with colleagues back home. Dr. Andrew Potter has returned to Adelaide where he is currently a Staff Specialist in Radiation Oncology at the Royal Adelaide Hospital, in addition to participating in multi-centre research trials,

FELLOWS WERE ALSO ABLE TO PROVIDE EACH OTHER WITH A **DEEPER UNDERSTANDING** OF RADIATION ONCOLOGY AROUND THE WORLD

DRO are well respected around the world with many considered to be global leaders in their area of specialty.” Dr. Andrew Potter considers the “biggest opportunity at PMH to be the ability to talk casually and informally with individuals who are recognized as world leaders in their field - the people who literally ‘wrote the book’ - to explore their ideas, seek their opinions and garner their suggestions and thoughts was pretty amazing.” In addition to UT DRO faculty, fellows are also able to provide each other with a deeper understanding of radiation oncology around the world: Dr. Mark Lee notes “the UT DRO has a very good reputation and is known for having a large contingent of overseas fellows [which] would allow me [to gain] exposure to radiation oncologists from all over the world and learn a bit more about the different practices performed there.”

largely through TROG – the Trans-Tasman Radiation Oncology Group. Dr. Mark Lee is currently living in Melbourne Australia, working as a Radiation Oncologist at Peter MacCallum Cancer Centre. Current Fellows Dr. Douglas Iupati and Dr. Amy Shorthouse plan to return home after their Fellowships, prepared to incorporate the results of their experiences in the UT DRO to their careers, and keep in touch with the mentors and friends made in Toronto.

sites and complete a research project. The two-year Research Fellowship Program emphasizes training in the principles and conduct of scientific research. Fellows earn advanced degrees in a relevant department at the School of Graduate Studies at UT. In January 2010 the program welcomed for the first time 4 fellows into a second, mid-year intake.



Perfecting Procedures,

PHYSICS RESIDENT DR. ANANTH RAVI FOCUSES ON THE DEVELOPMENT OF A NOVEL GUIDANCE SYSTEM FOR BREAST-CONSERVING SURGERY

First exposed to medical physics while an undergraduate engineering science student working in a scholarship-awarded position at Odette Cancer Centre, Dr. Ananth Ravi enthuses, “I came back to the position each summer; it sparked my interest in medical physics.”

Dr. Ravi, who completed his PhD in Medical Biophysics at U of T in 2008, is now a second-year resident in the UT DRO's Radiation Physics program. During

in improving the accuracy of breast conserving surgeries. The system would scan the entire surface of the excised tissue sample within two minutes, and detect the presence of tiny amounts of residual disease. This information would be in the form of an image, which could be used to direct the surgeon to the location of the residual cancerous deposits.” Since many breast cancers have extensive microscopic infiltration into the surrounding breast

than healthy tissue, the system can assist in locating cancerous cells by creating an image of the tissue surface.

Dr. Ravi acknowledges that although this type of process is quite novel and untested, such a system could “dramatically improve the accuracy of breast conserving surgery,” potentially sparing the 15-40% of women who currently require a secondary operation to eliminate the disease the stress, psychological upset, and inconvenience of additional surgery.

His recent grant application is aimed at securing the funding he needs to progress towards the creation of a working prototype, which he estimates will require about three and a half years of work. If the initial work is successful, clinical trials could then begin to test the effectiveness of the device for breast conserving surgeries.

Collaboration with colleagues in the Radiation Oncology, Surgery, and Pharmacy departments has guided Dr. Ravi's research, allowing him to tap into the vast expertise available in the U of T community. Dr. Ravi describes the community at Odette Cancer Centre as one consisting of “great people who are supportive regardless of your research focus. They help without expecting anything in return.”

POTENTIALLY SPARING THE 15-40% OF WOMEN WHO CURRENTLY REQUIRE A SECONDARY OPERATION

his PhD research, he discovered the vast opportunities that exist for improvement in the area of image guidance: “We can now deliver radiation precisely, but it is still difficult to see where we're delivering the radiation; it is still predominantly X-ray and CT-based. There are alternative imaging modalities that can be explored which could improve the process.”

With a specific interest in the development of a new guidance technique for breast conserving surgery Dr. Ravi, along with co-collaborators Drs. Geordi Pang, Curtis Caldwell, and Claire Holloway, is currently working towards developing a “novel intra-operative guidance system that will assist surgeons

tissue, it can be difficult to remove all cancerous tissue *en block* as the surgeon “cannot fully visualize the extent of a given tumour.”

This novel system, based on “imaging the distribution of positron (β^+) emitting radiotracers in tumour cells with high uptake,” will be constructed similar to a flatbed scanner detecting beta particles instead of visible light. Such imaging will be made possible by “injecting patients with a beta particle emitting pharmaceutical such as 2-Deoxy-2-18F-D-glucose (FDG)” prior to surgery. Because the injected pharmaceutical has a higher uptake in cancerous cells

Conserving Hope



PHYSICS RESIDENCY PROGRAM

The Toronto Residency Program in Radiation Oncology Physics is an intensive two-year practical training program that prepares students to become future leaders in medical physics. Through clinical rotations, a research project in clinical physics and educational components, students are equipped with fundamental knowledge of the disciplines of radiation oncology and radiation therapy. Physics Residents learn to recognize, understand, and address scientific and technical problems by working directly with experienced radiation oncologists, radiation therapists and medical physicists.

The program had ten Physics Residents in 2009-2010.



Making the grade

RESIDENT DR. MEREDITH GIULIANI EXPLORES NEW METHODS OF PERFORMANCE MEASUREMENT AND ASSESSMENT IN POSTGRADUATE EDUCATION.

PGY3 radiation oncology resident Dr. Meredith Giuliani has the unique opportunity to view her residency training from both the educator and student perspectives. The recent recipient of the 2010 W.J. Simpson Award for academic excellence in research by a resident, Dr. Giuliani's interest is primarily focused on the models and value of assessment in resident education. Dr. Giuliani explains her interest in this area being due to, "the frequency of important decisions being made based on antiquated measures of performance."

Dr. Giuliani's drive to contribute to the creation of relevant, updated assessment models is evident through her research and involvement in several education committees including the UT DRO Postgraduate Medical Education Committee, the University of Toronto's Internal Review Committee, the Royal College of Physicians and Surgeons of Canada's Evaluation Committee, and CARO's education committee. Her passion for education led her to pursue her Masters in Education through OISE/UT which she completed in January of 2010.



RADIATION ONCOLOGY RESIDENCY

In the 2009-2010 academic year, 25 residents were enrolled in the UT DRO Residency Training Program in radiation oncology, making it one of the largest programs in Canada. This five-year Canadian Resident Matching Service (CaRMS) entry program is structured to exceed the Royal College of Physicians and Surgeons of Canada (RCPSC) specialty requirements and to train the academic leaders of tomorrow.

THE PROGRAM OFFERS:

- Flexible, tailored education
- Multidisciplinary and inter-professional teaching faculty and clinical environment
- 100% pass rate on national RCPSC certification examinations for over a decade
- Leading international experts for teaching, mentoring, and career counseling
- Supportive educational environment and collegial peer group
- Great research opportunities and a variety of research training of options
- All the advantages of living in a large multicultural city

While attending medical school abroad at the University of London, England, Meredith became aware of the differences in training between the Canadian and British systems. She considers the undergraduate medical curriculum in the UK to be quite different from the Canadian curriculum, asserting, “there are a lot of

of study.” Originally leaning towards neurology, Dr. Giuliani’s interests swayed towards radiation oncology with the mentorship of Dr. Padraig Warde while a summer student at PMH.

With posters accepted at the 2009 and 2010 CARO annual meetings, and a well-received presentation at

MEREDITH HAS CLEAR PLANS FOR THE FUTURE AND SEES HERSELF CONTINUING TO FOCUS ON EDUCATION

strengths in clinical training abroad. It was interesting to work in a different health care system, to learn different ways of doing things and share approaches.”

Despite the opportunities she received during her medical training, Dr. Giuliani acknowledges the lack of a radiation oncology presence in the undergraduate curriculum “In medical school, radiation oncology has no structured presence and is not a significant area

of study.” Originally leaning towards neurology, Dr. Giuliani’s interests swayed towards radiation oncology with the mentorship of Dr. Padraig Warde while a summer student at PMH. With posters accepted at the 2009 and 2010 CARO annual meetings, and a well-received presentation at the 2009 Departmental Research Day, it is clear that Meredith has found her niche. Meredith has clear plans for the future and sees herself continuing to focus on education, specifically in the areas of postgraduate curriculum design and assessment, patient education initiatives designed to lessen the impact of diagnosis and treatment, as well as patient-reported data collection.

Offering Time, Support, & Expertise

RADIATION ONCOLOGIST EDUCATORS
AT ODETTE CANCER CENTRE
RECOGNIZED FOR CONTRIBUTIONS
TO RESIDENT TEACHING

Over the past 10 years, five radiation oncologist teachers at the Odette Cancer Centre have been recognized with resident teaching awards - a testament to the quality of training provided at Odette. Award recipients Drs. Ida Ackerman, Judith Balogh, Patrick Cheung, Gillian Thomas and May Tsao's commitment to resident education is apparent through the outstanding contributions each has made to the radiation oncology residency program. With a wealth of clinician-educators, resident training at Odette is characterized by dynamic and supportive teaching, and interdisciplinary collaboration.

With responsibilities ranging from ward-cover and inpatient management to acting as a direct consult to emergency, PGY3 residents develop patient management and treatment planning skills – an essential element of the third foundational year's curriculum. Residents are also exposed to a variety of treatment settings, accompanying supervisors to peripheral centres including North York General Hospital, and gaining a broader understanding of cancer care and treatment in community hospitals.



The core third year programming at Odette immerses residents in clinical practice, acting as first call for emergencies and spending a majority of time working hands-on in clinic and simulation.

Creating an open, supportive environment is essential to make residents feel like it's ok to ask for help or clarification. Dr. Patrick Cheung explains, "I've always found that speaking to residents in

time to residents – whether in weekly didactic teaching sessions, discussion of clinical cases, or in the design and development of structured courses. Dr. Cheung explains, "I think residents value

"I THINK RESIDENTS VALUE ANY TIME THE STAFF PHYSICIAN SPENDS WITH THEM FOR TEACHING."

PGY3 Resident Meredith Giuliani explains that a few key advantages of the year at OCC include the amount of "time spent in planning clinics and simulation, the opportunity to interact with other disciplines more through inpatient treatment and call, and the availability and quality of teachers."

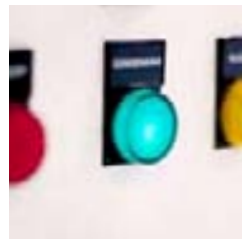
a non-intimidating way always puts the residents at ease so they can feel comfortable asking questions and admitting what they do and don't know."

Most importantly, clinician-educators at Odette Cancer Centre are always willing to offer their

any time the staff physician spends with them for teaching." With the recognition educators at OCC have received from residents over the past several years, it seems residents would agree.

Drs. Fazilat Mohammed, Meredith Giuliani, Patrick Cheung, Ida Ackerman, Eric Leung, Eve-Lyne Marchand





Clinical Report

The past twelve months have witnessed continuing growth of the clinical, research and educational activities of the Radiation Medicine Program at Sunnybrook Health Sciences Centre - Odette Cancer Centre and Princess Margaret Hospital.

Almost 6,500 new radiation oncology patients were seen in academic year 09-10, and about

100,000 fractions of radiation treatment were delivered. Upgrades to the existing clinical infrastructure continued.

Princess Margaret Hospital faculty provided consultations in many collaborating institutions including St Michael's and St. Joseph's Hospitals in Toronto and the Southlake Cancer Centre in Newmarket.

WE ARE PROUD OF THE MANY FACULTY WHO RECEIVED AWARDS DURING THE PAST YEAR AND WELCOME A GROUP OF OUTSTANDING NEW LEADERS TO THE DEPARTMENT.

FACULTY HIGHLIGHTS

- Drs. Brian Keller, William Chu, Katharina Sixel, Beibei Zhang, and Ms. Caitlin Gillan were appointed to the Department at the rank of Associate Professor. Ms. Winnie Li was appointed at the rank of Lecturer.
- Dr. Pamela Catton was awarded the Canadian Association of Medical Education (CAME) Certificate of Merit in recognition of her numerous contributions to medical education.
- Dr. Padraig Warde continues as Provincial Head, Radiation Treatment Program at Cancer Care Ontario.
- Ms. Amanda Bolderston was announced as incoming CAMRT President-Elect beginning January 2011.
- Dr. Bradley Wouters was appointed UT DRO Associate Chair of Graduate Studies.
- Dr. Marco Carlone continues as chair of Science and Education Council of the Canadian Organisation of Physicists in Medicine (COMP).
- Drs. Ivan Yeung and Miller MacPherson continue as the clinical physics leads in Southlake and Credit Valley Cancer Centres respectively.
- Dr. Jim Brierley continues as chair of the National Staging Advisory Committee of the Canadian Partnership against Cancer.
- Ms. Nicole Harnett was announced as the 2011 Welch Memorial Lecturer for the CAMRT Annual General Conference in Saskatoon in next June.
- Ms. Ruth Barker was appointed Director of Health Professions and Interprofessional Education/Care at Sunnybrook
- Ms. Lori Holden was a winner of the Sunnybrook Schulich award for clinical excellence.
- The Rapid Response Radiation Program received an Outstanding Leadership Award from the Ontario Palliative Care Association for its contribution to clinical services, research and education.
- The ongoing partnership with the Aviano Cancer Centre in Italy saw faculty from Italy visit PMH, as well as PMH staff visiting and presenting at the Aviano Cancer Centre.

2009/10

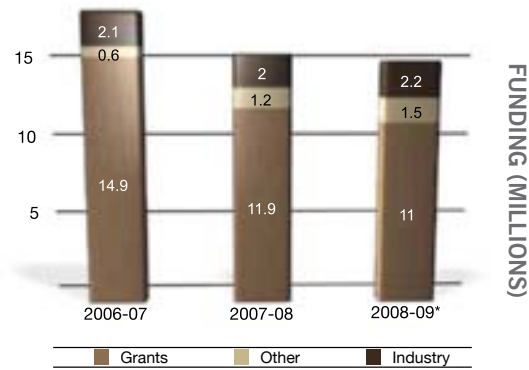
Research Highlights

The UT DRO faculty lead strong and diverse research programs that continue to grow in their productivity. This breadth and depth gives the department a profile as one of the pre-eminent multidisciplinary radiation medicine research programs in the world. Research in UT DRO is conducted in all domains of radiation medicine; including radiation therapy, biology, physics, oncology, and nursing. The scope includes clinical research, quality of life and health services and outcomes research, basic and translational studies related to radiation response, and advanced high-precision

radiation and imaging. The highly translational nature of the research is a reflection of the integration of scientifically-minded faculty that have a desire to impact clinical care. While recognizing the research drive and productivity is easy, assembling an accurate accounting is challenging since the research is performed in collaboration with a number of clinical and basic science departments, extra-departmental units including hospital research institutes, both within and outside of the University of Toronto.



ONE OF THE PRE-EMINENT MULTIDISCIPLINARY RADIATION MEDICINE RESEARCH PROGRAMS IN THE WORLD



- Dr. Greg Czarnota led (including DRO faculty Dr. Kristy Brock) was successful in leading a Terry Fox program project in ultrasound therapy.
- Dr. David Jaffray, in collaboration with investigators at the OCC (K. Mah, C. Caldwell) and across the province, led the Ontario Consortium for Adaptive Interventions in Radiation Oncology in the latest ORF-RE funding round. A total of \$7M of matching funds from the province brings the total budget to \$21M for translational research in adaptive radiation therapy.
- The ELLICSR Centre for Cancer Survivorship was launched under the leadership of Dr. Pam Catton. A globally-unique facility focused on research to support cancer survivors.
- The Canadian Foundation for Innovation (CFI) funded \$10M toward the creation of a dedicated MR-guided radiation therapy (MRgRT) facility (external beam and brachytherapy) at the Princess Margaret Hospital (Drs. Jaffray, Menard, Milosevic, Dawson, Breen, Carlone).

