

Ottawa Medical Physics Institute (OMPI)

*A Carleton University Research Centre
based in the Department of Physics,
Carleton University, Ottawa, Canada*

www.physics.carleton.ca/ompi

Annual Report # 23

2010 September 1 – 2011 August 31

Submitted by Malcolm McEwen, PhD, OMPI Director.

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1. Editorial

Recently, I received a request from a senior administrator to visit the Ottawa Medical Physics Institute. I had to reply that there is nothing physical that one can point to and say, “Here it is”, no 21st century laboratories or state-of-the-art equipment to show off. OMPI may have “Institute” in its title but it is a virtual organization, having no assets, no employees and no programs. Is it just a name then, a cheap way of double-counting work done elsewhere? By no means! One just has to attend an OMPI seminar to see that OMPI is real, but it is a people-based organization. At its heart are the members and graduate students, many of who are listed and have their work described below, but it stretches to cover the several hundred people in Ottawa and beyond who receive the notices of upcoming seminars (and attend on a regular basis). OMPI is a very effective network that brings together those working in the field of medical physics in the National Capital Region: people at The Ottawa Hospital and Cancer Centre, the University of Ottawa Heart Institute, Health Canada, the National Research Council of Canada (NRC), the Canadian Nuclear Safety Commission, BEST Theratronics, Atomic Energy of Canada Limited (AECL) Chalk River Laboratories as well as at Carleton University. The Ottawa medical physics community has one of the most diverse spectra of research and service activities in Canada and OMPI has successfully tapped into this “rich seam”. It is testament to its effectiveness and relevance that more than 20 years after its inception it continues to attract new members and volunteer positions are easily filled. People want to be part of OMPI and I am confident that this will continue well into the future.

This Annual Report summarizes our activities during the 2010-2011 academic year.

2. Membership

Table 1 summarizes our membership, which at year's end numbers 35, and Table 2 lists the Executive of the organisation. Our members' activities span the field of medical physics, including cancer therapy physics (19 members), imaging (10), and radiobiology and health physics (6). Complete profiles are given on the website. Five new members were welcomed into OMPI this year:

Gabriel Sawakuchi joined the faculty of the Department of Physics at Carleton in 2010. Gabriel's research interests include Optically-Stimulated Luminescent Dosimeters (OSLDs) and the dosimetry and treatment planning of proton radiation therapy.

Rebecca Thornhill is an MRI physicist at The Ottawa Hospital and has an interest in using the technique to diagnose cardiovascular disease.

Eric Vandervoort is a medical physicist at The Ottawa Hospital Cancer Centre. His recent research has focussed on the implementation of Monte Carlo-based treatment planning for electron beam radiation therapy.

Dmitry Klovok is a researcher at the AECL Chalk River Laboratories. He is a radiobiologist with an interest in how cells can modify their response to ionizing radiation.

Nicolas Ploquin is also a medical physicist at The Ottawa Hospital Cancer Centre. He is involved with the development of new IMRT (intensity modulated radiation therapy) techniques for the treatment of breast cancer.

3. Graduate Program

One of the prime activities of OMPI members is to coordinate and deliver the MSc and PhD programs in medical physics within the Physics Department at Carleton University.

This academic year, Paul Johns gave our foundation course, *Medical Radiation Physics*, in the fall term, and Julia Wallace co-ordinated the *Medical Physics Practicum*, which involves students carrying out a number of mini-projects. Many OMPI members are involved in this course so that students can carry out a wide range of activities from optimizing IMRT treatment plans to measuring radiation-induced chromosomal damage. In the winter term, *Physics of Medical Imaging* was taught by Tong Xu (coordinator), Ian Cameron, Rob deKemp, Bog Jarosz, Richard Wassenaar, and Glenn Wells, *Medical Radiotherapy Physics* was taught by David Rogers and *Radiobiology* by Ruth Wilkins and Gosia Niedebala. Thank you to all those who taught in our program, especially those from outside Carleton who made the time available to benefit our students.

Table 3 lists the graduate students in the program, and Table 4 the graduate theses (two M.Sc. plus two Ph.D.) completed in the 12 month period of this report. Sorina Truica is now a postdoctoral fellow at the University of Lethbridge in the Canadian Centre for Behavioural Neuroscience with Albert Cross' group (who also has Carleton history, having worked in Giles Santyr's lab as a postdoc some years ago). Ernesto Mainegra-Hing continues with the NRC Ionizing Radiation Standards group, who had supported him to complete his PhD part-time. A hearty “well done” to all!

4. Seminars

The monthly OMPI seminars (Table 5) continue to be well attended. Students are expected to give regular presentations during their program (at least once for M.Sc. students, 2 or 3 times for Ph.D.'s). This is excellent practice for both conference presentations and career development. Members give seminars on a rolling schedule, typically every three years or so. Thank you to all speakers and attendees.

Table 6 lists the 2010-2011 medical physics component of the regular weekly seminar series of the Carleton University Department of Physics.

5. OMPI News and Events

External teaching activities

Carleton faculty continued outreach activities to the general public in 2010/11. **Tong Xu** gave an open lecture entitled, "Physicists do it in the Hospital" in October 2010, while **Gabriel Sawakuchi** and **Rowan Thomson** gave informal presentations within the "Science Café" series, which aims to take science out from the classroom and into the high street.

Monte Carlo radiation transport training courses are still very much in demand worldwide and David Rogers lectured at a one week course on the BEAMnrc code, sponsored by the Bhabha Atomic Research Centre in Mumbai, India, December 2010. Several OMPI members and associates are currently (Oct 2011) presenting a two-week course on Monte Carlo techniques at the International Centre for Theoretical Physics in Trieste, Italy.

From Vancouver to St. John's, and even across the ocean, OMPI members were in demand as invited speakers at conferences. Invitees included: **Ruth Wilkins** (Biodosimetry Research Symposium, Bethesda, April 2011), **Rowan Thomson** (ESTRO Anniversary Congress, May 2011), **David Rogers** (CAP annual meeting, St John's, June 2011), **Malcolm McEwen** (Joint COMP/AAPM meeting, Vancouver, July 2011).

The Ionizing Radiation Standards group at NRC followed up their 1-day workshop on "Primary Standards, Calibration Services and Research Capabilities" held in June 2010 with a second workshop May 13 2011 targeting medical physics graduate students. **Claudiu Cojocaru** was the organizer and twenty Masters and PhD students from Ottawa, Kingston and Montreal signed up. The success of both these workshops means that it is likely that this will become a regular offering.

In August the imagers in OMPI were treated to a special lecture series on *Image Reconstruction from Projections*. The series was the brainchild of **Rolf Clackdoyle**, who is visiting us from C.N.R.S. Université Jean Monnet, Saint Etienne, France. Rolf gave six 3-hour sessions over 3 weeks and the series closed with a one-day visit and lectures by **Andrew Reader** from the Montreal Neurological Institute. Topics included analytic reconstruction (2D, 3D) and statistical methods (MLEM, OSEM, others). About 15 students, alumni, and faculty attended. Our thanks go to Rolf and Andrew for sharing their expertise. These lectures were more proof that classic blackboard teaching can be the best! And Andrew's IDL simulations were the perfect complement to the theory of iterative techniques.

In addition to the Carleton medical physics program, a number of our OMPI members – including **Ian Cameron** and **Richard Wassenaar** – are regularly involved in teaching courses for Radiology, Oncology and Diagnostic Imaging Residents at The Ottawa Hospital and Cancer Centre.

People

Rowan Thomson was appointed an Assistant Professor in the Physics Department, starting 1-Sep-2010. She is already an OMPI member, having previously worked as a post-doc within the Carleton Laboratory for Radiotherapy Physics under David Rogers.

Richard Wassenaar joined Best Theratronics from The Ottawa Hospital. Best Theratronics is based in Kanata and under its previous ownership built a long history in the field of medical physics, producing Co-60 irradiators for radiation therapy and other applications.

The future complement of OMPI was added to in the last year:

Charlotte (Malcolm McEwen, March 2011)

Lucas (Gabriel Sawakuchi, July 2011)

It was a triple whammy at the joint COMP/AAPM meeting in Vancouver in July 2011. **Bryan Muir** and **Dave Rogers** won the AAPM's Farrington Daniels prize (best paper on dosimetry) for "*Monte Carlo calculations of k_Q the beam quality conversion factor*", and **Greg Cron**, an MRI physicist at the Ottawa Hospital, was a co-author on the paper that won the Sylvia Sorkin Greenfield Award for the best paper (other than radiation dosimetry), entitled, "*Noninvasive mapping of spontaneous fluctuations in tumor oxygenation using ^{19}F MRI*" (both published in Medical Physics in 2010). Finally, **Frédéric Tessier** was awarded COMP's Sylvia Fedoruk prize for the paper, "*Effective point of measurement of thimble ion chambers in megavoltage photon beams*"

(Tessier and Kawrakow, *Med. Phys.* 2010). This clearly demonstrates the high quality of research carried out within the OMPI network.

Carl Ross, along with NRC colleagues Raphael Galea and Walter Davidson, were awarded an NRC Outstanding Achievement Award for their work on the production of Tc-99m. The citation reads:

“Quickly responding to the medical isotopes crisis due to the unexpected shutdown of the NRU reactor in Chalk River, this trio demonstrated an alternative method of producing medical isotopes in a secure and economical method, and built a national partnership to scale up the process and transfer the technology.”

This award is worthy recognition of the work Carl and his colleagues at NRC have put into this project.

Grants, Facilities and Equipment

In October 2010, the NRC group led by **Carl Ross** were part of a successful collaboration to receive funding totaling \$12M from Natural Resources Canada's (NRCan) Non-reactor-based Isotope Supply Contribution Program (NISP). A linear accelerator-based system to produce the medical imaging isotope Tc-99m is now being installed on the campus of the Canadian Light Source in Saskatoon with completion due by March 2012. The NRC group have already shown that the process works (a presentation was given at the COMP Annual Meeting in June 2010 in Ottawa) and this demonstrator is the next step to a commercial system. The NRC share of the grant will allow crucial updates to be made to the research accelerator maintained by the Ionizing Radiation Standards group. This linac is regularly used by Carleton medical physics graduates for their research and the improvements should ensure the operation of the facility for many years to come.

Ruth Wilkins' group at Health Canada installed an Imaging Cytometer, only the 4th such instrument in Canada. This device should aid in significantly increasing the speed of post-irradiation bio-dosimetry analyses and is an important step in developing bio-dosimetry capability within Canada and the US.

In April 2011 **Rowan Thomson** was awarded a 5 year NSERC Discovery Grant for “Computational techniques for studying interactions of radiation with matter and applications in radiotherapy physics”. Rowan has seamlessly moved from post-doc to faculty in the last year and is rapidly acquiring an internationally-recognized reputation in the field of computational radiation dosimetry.

National and International Activities

During the past academic year many OMPI members served on various national and international committees. A small selection is listed below:

CCPM (Canadian College of Physicists in Medicine) Board members: **David Wilkins** continued as President in 2011, and **Glenn Wells** continued on the Board.

AAPM Science Council - **David Rogers**

AAPM Calibration Laboratory Accreditation Sub-committee – **Malcolm McEwen** (Chair)

AAPM TG-191 "AAPM Recommendations on the Clinical Use of Luminescent Dosimeters" – **Gabriel Sawakuchi**

ICRU (International Commission on Radiation Units) report committee on “Key data for measurement standards in the dosimetry of ionizing radiation” – **Carl Ross**

Editorial Advisory Board, *Physics in Medicine and Biology* – **Carl Ross, David Rogers**

CAMPEP (Commission on Accreditation of Medical Physics Educational Programs) Graduate Education Program Review Committee – **Brenda Clark**

Editorial Board and Deputy Editor (radiotherapy) of *Medical Physics* – **David Rogers**

International Association of Biological and EPR Radiation Dosimetry (IABERD) – **Ruth Wilkins** (Secretary)

CLS BMIT (Canadian LightSource, BioMedical Imaging & Therapy) beamline Executive – **Paul Johns**

6. OMPI Executive

I would like to thank the following for serving on the Executive in 2010-2011: Paul Johns (Academic Officer for 2010) and Dave Rogers (Academic Officer for 2011), Rob deKemp (Past-Director), and Richard Wassenaar (Secretary). In February 2011 Tong Xu passed the baton for organizing the OMPI seminar series to Claudiu Cojocaru. Tong will continue to be OMPI's webmaster. Thanks, finally, to Bryan Muir for representing the students, and to our observers, Brenda Clark (TOHCC) and Trevor Stocki (Health Canada).

7. OMPI Website

The OMPI maintains a website with detailed information on the organization, its members, students and alumni, seminars and research areas. Please visit www.physics.carleton.ca/ompi.

Table 1. OMPI Members, 2010-2011.For details see <http://www.physics.carleton.ca/ompi> and select Members/Students.

	Member	Institution and Unit	Specialization within Medical Physics
1	Lesley Buckley	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
2	Ian Cameron	Diagnostic Imaging, The Ottawa Hospital	MRI
3	Brenda Clark	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
4	Claudiu Cojocaru	Ionizing Radiation Standards, Institute for National Measurement Standards, NRC	Radiotherapy and radiation dosimetry
5	Joanna Cygler	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
6	Rob deKemp	Cardiac PET Centre, Univ. of Ottawa Heart Institute	PET
7	Costel Fleuraru	Institute for Microstructural Sciences, NRC	Optical coherence tomography
8	Lee Gerig	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
9	Elizabeth Henderson	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
10	Bog Jarosz	Retired from Dept. of Physics, Carleton University	Ultrasound thermal therapy
11	Paul Johns	Department of Physics, Carleton University	X-ray imaging
12	Dmitry Y. Klokov	Radiological Protection Research and Instrumentation, AECL, Chalk River Laboratories	Radiobiology
13	Iwan Kawrakow	Ionizing Radiation Standards, Institute for National Measurement Standards, NRC	Radiotherapy and radiation dosimetry
14	Malcolm McEwen	Ionizing Radiation Standards, Institute for National Measurement Standards, NRC	Radiation dosimetry
15	Cheng Ng	Retired from Ottawa Hospital Research Institute	Radiobiology and hyperthermia
16	Balazs Nyiri	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
17	Nicolas Ploquin	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
18	G. Peter Raaphorst	Retired from The Ottawa Hospital Cancer Centre; Consultant medical physicist.	Radiobiology and hyperthermia
19	Richard Richardson	Radiation Biology & Health Physics, Chalk River Laboratories, AECL	Radiation physics and radiation protection
20	David Rogers	Department of Physics, Carleton University	Radiotherapy and radiation dosimetry
21	Carl Ross	Ionizing Radiation Standards, Institute for National Measurement Standards, NRC	Radiation dosimetry
22	Gabriel Sawakuchi	Department of Physics, Carleton University	Radiotherapy
23	Laurel Sinclair [§]	Earth Sciences Sector, Natural Resources Canada	Detection of radiological threats
24	Trevor Stocki	Radiation Protection Bureau, Health Canada	Health physics
25	Janos Szanto	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
26	Frédéric Tessier	Ionizing Radiation Standards, Institute for National Measurement Standards, NRC	Radiation dosimetry
27	Rebecca Thornhill	Diagnostic Imaging, The Ottawa Hospital	MRI
28	Rowan Thomson	Department of Physics, Carleton University	Radiotherapy and radiation dosimetry
29	Eric Vandervoort	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
30	Julia Wallace	Department of Physics, Carleton University	MRI
31	Richard Wassenaar	Best Theratronics	Nuclear medicine imaging
32	Glenn Wells	University of Ottawa Heart Institute	Nuclear cardiology
33	David Wilkins	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
34	Ruth Wilkins	Consumer & Clinical Radiation Protection Bureau, Health Canada	Radiobiology
35	Tong Xu	Department of Physics, Carleton University	Positron emission tracking (PeTrack)

[§]Associate Member

Table 2. OMPI Executive, 2010-2011.

Position	Member	Position	Member
Director [§]	Malcolm McEwen	Student Representative [†]	Bryan Muir
Past-Director [§]	Rob deKemp	Seminar Organizer	Tong Xu / Claudiu Cojocaru
Academic Officer [§]	Paul Johns (to Dec 31) David Rogers (from Jan 1)	Observer – TOHCC	Brenda Clark
Secretary [§]	Richard Wassenaar	Observer – Health Canada	Trevor Stocki

[§]position elected by the members

[†]position elected by the medical physics graduate students

Table 3. Graduate Students in Medical Physics, 2010-2011.

For details see <http://www.physics.carleton.ca/ompi> and select Members/Students. A list of Past Graduates is also available.

	Student	Program	Supervisor	Project Area
1	Elsayed Ali	Ph.D.	Dave Rogers	linac spectral measurements
2	Patrick Assouad	M.Sc. [¶]	John Armitage	fibre evanescent wave spectroscopy for cancer detection
3	Lindsay Beaton	Ph.D.	Ruth Wilkins	markers for radiosensitivity
4	Jason Belec	Ph.D.	Brenda Clark	Elekta radiotherapy
5	Marc Chamberland	Ph.D.	Tong Xu	PeTrack algorithm development
6	Amanda Cherpak	Ph.D.	Joanna Cygler	radiation dosimetry applications of RADPOS
7	Stephanie Chiasson	M.Sc.	Glenn Wells	dual isotope SPECT corrections and clinical applications
8	Tyler Dumouchel	Ph.D.	Rob deKemp	small-animal PET
9	Matthew Efseaff	M.Sc.	Rob deKemp	precision of myocardial blood flow measurement with ⁸² Rb PET
10	Chad Hunter	Ph.D.	Rob deKemp	dynamic PET motion correction
11	M. Shoab Khan	M.Sc.	Laurel Sinclair	Compton camera for nuclear security
12	Michel Lalonde	Ph.D.	Richard Wassenaar & Glenn Wells	Nuclear medicine: cardiac dyssynchrony
13	Karl Landheer	M.Sc.	Paul Johns	collimation design optimization for x-ray scatter imaging
14	Ernesto Mainegra-Hing	Ph.D. [¶]	Iwan Kawrakow	MC corrections for x-ray standards
15	Bryan Muir	Ph.D.	Dave Rogers	rad. dosimetry: calculating beam quality conversion factor k _Q
16	Munira Fardous-Nahin	M.Sc. [¶]	Glenn Wells	²⁰¹ Tl small animal SPECT myocardial perfusion reproducibility
17	Azeez Omotayo	M.Sc.	Gabriel Sawakuchi	in-vivo dosimetry using OSLD's
18	Elizabeth Orton	Ph.D.	Glenn Wells	motion correction for cardiac SPECT
19	Amir Pourmoghaddas	Ph.D.	Glenn Wells	absolute flow measurement in clinical cardiac SPECT
20	Matthew Rodrigues	Ph.D.	Joanna Cygler	clinical applications of RADPOS to IMRT
21	Hong Shen	M.Sc.	Carl Ross	wide-angle free air chamber for brachytherapy seeds
22	Benjamin Spencer	M.Sc.	Tong Xu	coregistration of PeTrack with x ray
23	Jared Strydorst	Ph.D.	Glenn Wells	Reconstruction algorithm for μ SPECT
24	Justin Sutherland	Ph.D.	Dave Rogers & Rowan Thomson	MC dose calculations for brachytherapy
25	Rachel Timmins	M.Sc.	Glenn Wells	small-animal dual-isotope SPECT
26	Sorina Truica	Ph.D. [¶]	Ian Cameron	Diffusion-weighted mri: blood flow abdominal microvasculature

[¶]Degree completed between 2010 September 1 and 2011 August 31; see Table 4.

Table 4. Theses Completed, 2010-2011. Ordered by date of defence.

Student	Degree	Supervisor	Thesis Title and Date of Defence
Sorina Truica	Ph.D.	Cameron	Diffusion-weighted magnetic resonance imaging assessment of blood flow in the microvasculature of abdominal organs Nov 16, 2010 External Examiner: Mike Noseworthy, McMaster University
Patrick Assouad	M.Sc.	Armitage	A study of silver halide fibers using fiber evanescent wave spectroscopy to assess the potential for <i>in vivo</i> diagnosis of malignant cervical tissue Jan 4, 2011
Ernesto Mainegra-Hing	Ph.D.	Kawrakow	Efficient Monte Carlo simulations in kilovoltage x-ray beams Jan 7, 2011 External Examiner: Paul Bergstrom, NIST, Gaithersburg, Maryland
Munira Fardous Nahin	M.Sc.	Wells	Reproducibility of Thallium-201 myocardial perfusion study in rat model with microSPECT April 29, 2011

Table 5. OMPI Seminars, 2010-2011.For details see <http://www.physics.carleton.ca/ompi/news/seminars/archives>.

Date / Location	Speakers and Titles
Sept 30, 2010 Carleton University	Patrick Assouad: Mid-infrared fiber evanescent wave spectroscopy for in-vivo diagnostic of malignant tissue Gabriel Sawakuchi: LET determination using the optically stimulated luminescence of Al ₂ O ₃ :C Followed by an OMPI social on Bank Street.
Oct 21, 2010 Health Canada	Ernesto Mainegra-Hing: Free air chamber attenuation corrections for low-energy x-ray beams Rebecca Thornhill: Magnetic resonance tools for the evaluation of cardiovascular disease and metabolic disorders
Nov 18, 2010 The Ottawa Hospital, General Campus	Tyler Dumouchel: A partial volume correction strategy for cardiac mouse PET imaging Eric Vandervoort: Evaluation of a new commercial Monte Carlo treatment planning system for electrons
Dec 16, 2010 University of Ottawa Heart Institute	Jared Strydhorst: Modeling photon attenuation in the reconstruction of small animal pinhole SPECT images Dmitry Klovov: Radiobiological studies at Chalk River Laboratories: radioadaptive response and DNA repair
Jan 27, 2011 Carleton University	Lindsay Beaton: Biomarkers of radiation sensitivity in human lymphocytes Malcolm McEwen: OMPI – A year in review
Feb 24, 2011 Carleton University	Jason Belec: Monte Carlo calculation of photon beam treatment dose distributions delivered using Tomotherapy and VMAT Glenn Wells: Dedicated cardiac SPECT: Changing how we look at the heart
March 24, 2011 NRC/IRS	Bryan Muir: Characterization of plane-parallel ion chambers for reference dosimetry of MV photon beams Nicolas Ploquin: Locoregional left breast cancer irradiation: From TomoTherapy to VMAT
May 19, 2011 The Ottawa Hospital, General Campus	The seminars were preceded by a tour of the Cyberknife facility. Elizabeth Henderson: Cyberknife in Ottawa Michel Lalonde: Development of SPECT RNA methodologies for quantifying cardiac wall motion
June 23, 2011 NRC/IRS	Elsayed Ali: Unfolding linac photon spectra from simple depth-dose measurements Ruth Wilkins: New approaches to high throughput biological dosimetry Followed by the Annual BBQ.

Table 6. Carleton University Department of Physics Seminars in Medical Physics, 2010-2011.

Departmental seminars on medical physics topics. For a complete list, see

<http://www.physics.carleton.ca/colloquium>.

Date	Speaker, Institution, and Title
Nov 17, 2010	Mike Noseworthy, Depts. Elec. & Computer Eng., Med. Phys., Radiology, McMaster Univ. New approaches to mri evaluation of microvasculature
Dec 9, 2010 OCIP Fall Graduate Student Seminars	Patrick Assouad Fiber evanescent wave mid-infrared spectroscopy for <i>in-vivo</i> cervical cancer diagnostics
Dec 14, 2010 OCIP Christmas Symposium	Ian Cameron, The Ottawa Hospital Can water diffusion measured with mri be used to probe tissue properties in humans? Gabriel Sawakuchi, Carleton University Improving particle therapy dosimetry using Monte Carlo simulations and novel detectors
Jan 25, 2011	Nancy Ford, Dept. Physics, Ryerson University Preclinical lung imaging using micro-computed tomography
March 1, 2011	Steve Davis, Medical Physics Resident, McGill University Health Centre Monte Carlo calculations and measurements of photon spectra from a miniature x-ray source used for brachytherapy applications
March 22, 2011	Emily Heath, Dept. Physics, Ryerson University Quantifying and compensating for uncertainties in 4D radiotherapy of lung cancer
April 5, 2011	Lucia Florescu, Dept. Radiation Oncology, Columbia University, New York Optical tomography of mesoscopic systems
April 13, 2011	Sangeeta Murugkar, Senior Scientist, Dept. Physics, University of Ottawa <i>In vivo</i> optical molecular imaging in biomedicine
April 19, 2011	Todd Stevens, Dept. Chemistry, Univ. of California at Berkeley Molecular mri with hyperpolarized xenon biosensors
April 27, 2011	Dan Popescu, Inst. Biodiagnostics, NRC, Winnipeg The O(ptical)ther Imaging: Optical coherence tomography and microscopy
April 29, 2011 OCIP Spring Graduate Seminars I	Tyler Dumouchel A three-dimensional partial volume correction strategy for cardiac mouse PET imaging
May 5, 2011 OCIP Spring Graduate Seminars II	Elsayed Ali Unfolding photon spectra of clinical linear accelerators Amanda Cherpak Evaluation of a novel 4D <i>in vivo</i> dosimetry system
May 10, 2011	Costel Fluearu, Inst. Microstructural Sciences, NRC Bio-medical optics: Spectroscopic optical coherence tomography
May 16, 2011	Laurel Sinclair, Geological Survey of Canada, Natural Resources Canada Characterization of radiation in the environment