

Ottawa Medical Physics Institute (OMPI)

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

physics.carleton.ca/ompi

Annual Report # 25

2012 September 1 – 2013 August 31

Submitted by Malcolm McEwen, PhD, OMPI Director.

Contents

1. Editorial
2. Membership
3. Graduate program
4. Seminars
5. OMPI Executive
6. OMPI Website
7. Tables



1. Editorial

Any conversation between two researchers in medical physics usually, within the first few minutes, has something like the following:

Q. "How are things?"

A. "Good, but very busy. I just don't know where the time goes."

This stereotypical anecdote is by way of an explanation for the delay in publishing the 2012/2013 OMPI Annual Report. OMPI is a voluntary organization, so administrative activities related to OMPI tend to get displaced by the more pressing needs of the participants' day jobs. As described below, the important activities of OMPI – promoting membership to provide a network to explore collaborative projects in the field of medical physics, and presenting a seminar series of student and expert presentations – have continued with great success. Indeed it was a very active year with a total of eleven graduate theses completed, two new members in OMPI, and hiring processes underway for new faculty in medical physics at Carleton.

2. Membership

OMPI welcomed **Patrick Saull** of NRC and **Ran Klein** of the University of Ottawa Heart Institute as members. Pat has helped teach a part of Phys 5208 (Radiation Protection) and does research related to beta and neutron standards. Ran is Cardiac Imaging Core Lab Manager at UOHI and an Adjunct Professor within the Department of Systems and Computer Engineering at Carleton University.

Lee Gerig retired from the Cancer Clinic in the spring of 2012 and has left OMPI. Lee had joined OMPI early in its existence (1989), taught in the graduate program, and over the years supervised several Carleton students including five PhD's. Lee was Chair of the Canadian Organization of Medical Physicists 1995-1996. **Cheng Ng**, another longstanding member (since 1991) and a key member of our radiobiology group, is now firmly retired and has not renewed to continue in OMPI. Cheng also taught in our program and supervised several MSc students. Finally, **Gabriel Sawakuchi** left Carleton and OMPI in January to work at the MD Anderson Cancer Center in Houston. Gabriel continues as an Adjunct Research Professor to complete supervising his graduate students who are enrolled here. Thank you Lee, Cheng, and Gabriel for your contributions to medical physics in Ottawa.

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, in the fall term Paul Johns gave our foundation course, *Medical Radiation Physics*, Bog Jarosz taught *Physical Applications of Fourier Analysis*, and *Computational Physics* was taught by Alain Bellerive. The *Medical Physics Practicum* was coordinated by Julia Wallace. This is a special course in which students do a small number of mini-projects off-campus in therapy, imaging, and radiobiology chosen from a list provided by clinical and research medical physicists in Ottawa. This is the most senior course taken by our doctorate students and is critical to our program. The fall of 2012 also saw the introduction of a new course on *Anatomy and Physiology* designed for our students and taught by Tim Willett, an MD with a masters in Medical Education. In the winter term, *Physics of Medical Imaging* was taught by Julia Wallace (coordinator), Paul Johns, Glenn Wells, Rob deKemp, Ian Cameron and Bog Jarosz, and *Radiobiology* was given by Ruth Wilkins (coordinator) and Gosia Niedbala. Also, the initial offering of *Advanced Topics in Medical Physics* was taught by Dave Rogers on the subject of Monte Carlo simulations with the EGSnrc code system. 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 (six M.Sc. plus five Ph.D.) completed in the academic year of this report. 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, two or three 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 2012-2013 medical physics component of the semi-regular weekly seminar series of the Carleton University Department of Physics. This year saw many medical physics seminars as part of the interview process associated with hiring two new faculty members.

5. OMPI Executive

I would like to thank the following for serving on the Executive in 2012-2013: Dave Rogers (Academic Officer), Rob deKemp (Past-Director), Rebecca Thornhill (Secretary), Claudiu Cojocaru (Seminar Organizer) and Tong Xu (Communications Officer). Thanks, finally, to Amir Pourmoghaddas for representing the students, and to our observers, Brenda Clark (TOHCC) and Ruth Wilkins (Health Canada).

6. OMPI Website

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

Table 1. OMPI Members, 2012-2013.

For details see <http://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	Rolf Clackdoyle	CNRS, St Etienne, France	Mathematics of imaging
4	Brenda Clark	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
5	Claudiu Cojocaru	Ionizing Radiation Standards, Institute for National Measurement Standards, NRC	Radiotherapy and radiation dosimetry
6	Greg Cron	Preclinical Imaging Centre, Ottawa Hospital Research Institute	MRI
7	Joanna Cygler	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
8	Rob deKemp	Cardiac PET Centre, Univ. of Ottawa Heart Institute	PET
9	Costel Fleuraru	Microstructural Sciences, NRC	Optical coherence tomography
10	Raphael Galea	Ionizing Radiation Standards, Institute for National Measurement Standards, NRC	Radioactivity metrology
11	Elizabeth Henderson	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
12	Bog Jarosz	Retired from Dept. of Physics, Carleton University	Ultrasound thermal therapy
13	Paul Johns	Department of Physics, Carleton University	X-ray imaging
14	Ran Klein	Cardiac PET Centre, Univ. of Ottawa Heart Institute	PET
15	Dmitry Y. Klokov	Radiological Protection Research and Instrumentation, Chalk River Laboratories, AECL	Radiobiology
16	Malcolm McEwen	Ionizing Radiation Standards, Institute for National Measurement Standards, NRC	Radiation dosimetry
17	Balazs Nyiri	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
18	Nicolas Ploquin	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
19	G. Peter Raaphorst	Retired from The Ottawa Hospital Cancer Centre; Consultant medical physicist.	Radiobiology and hyperthermia
20	Richard Richardson	Radiation Biology & Health Physics, Chalk River Laboratories, AECL	Radiation physics and radiation protection
21	David Rogers	Department of Physics, Carleton University	Radiotherapy and radiation dosimetry
22	Carl Ross	Ionizing Radiation Standards, Institute for National Measurement Standards, NRC	Radiation dosimetry
23	Patrick Saull	Ionizing Radiation Standards, Institute for National Measurement Standards, NRC	Radiation dosimetry
24	Gabriel Sawakuchi	Department of Physics, Carleton University	Radiotherapy
25	Laurel Sinclair §	Earth Sciences Sector, Natural Resources Canada	Detection of radiological threats

26	Trevor Stocki	Radiation Protection Bureau, Health Canada	Health physics
27	Janos Szanto	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
28	Frédéric Tessier	Ionizing Radiation Standards, Institute for National Measurement Standards, NRC	Radiation dosimetry
29	Rowan Thomson	Department of Physics, Carleton University	Radiotherapy and radiation dosimetry
30	Rebecca Thornhill	Diagnostic Imaging, The Ottawa Hospital	MRI
31	Eric Vandervoort	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
32	Julia Wallace	Department of Physics, Carleton University	MRI
33	Richard Wassenaar	Best Theratronics	Nuclear medicine imaging
34	Glenn Wells	University of Ottawa Heart Institute	Nuclear cardiology
35	David Wilkins	Department of Medical Physics, The Ottawa Hospital Cancer Centre	Radiotherapy
36	Ruth Wilkins	Consumer & Clinical Radiation Protection Bureau, Health Canada	Radiobiology
37	Tong Xu	Department of Physics, Carleton University	Positron emission tracking (PeTrack)

[§]Associate Member

Table 2. OMPI Executive, 2012-2013.

Position	Member	Position	Member
Director [§]	Malcolm McEwen	Student Representative [†]	Amir Pourmoghaddas
Past-Director [§]	Rob deKemp	Seminar Organizer	Claudiu Cojocaru
Academic Officer [§]	David Rogers	Observer – TOHCC	Brenda Clark
Secretary [§]	Rebecca Thornhill	Observer – Health Canada	Ruth Wilkins

[§]position elected by the members

[†]position elected by the medical physics graduate students

Table 3. Graduate Students in Medical Physics, 2012-2013.

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

	Student	Program	Supervisor	Project Area
1	Lindsay Beaton [¶]	Ph.D.	Ruth Wilkins	markers for radiosensitivity
2	Marc Chamberland	Ph.D.	Tong Xu	PeTrack algorithm development
3	Stéphanie Chiasson [¶]	M.Sc.	Glenn Wells	dual isotope SPECT corrections and clinical applications
4	Sarah Cuddy	Ph.D.	Glenn Wells	dedicated cardiac SPECT
5	Islam El Gamal [¶]	M.Sc.	Malcolm McEwen	Fricke dosimetry for HDR brachytherapy
6	Dal Granville	Ph.D.	Gabriel Sawakuchi	OSL/proton therapy
7	Chad Hunter	Ph.D.	Rob deKemp	dynamic PET motion correction
8	M. Shoaib Khan [¶]	M.Sc.	Laurel Sinclair	Compton camera for nuclear security
9	Michel Lalonde [¶]	Ph.D.	Richard Wassenaar & Glenn Wells	Nuclear medicine: cardiac dyssynchrony
10	Marielle Lespérance [¶]	M.Sc.	Rowan Thomson	eye plaque brachytherapy calculations
11	Leila Lukhumaidze	M.Sc.	Dave Rogers	accuracy of electron impact ionization in EGSnrc
12	Frank Marshall	M.Sc.	Laurel Sinclair	directional survey of dispersed radioactive contamination
13	Conor McFadden [¶]	M.Sc.	Gabriel Sawakuchi	fluorescence nuclear track detectors for microdosimetry
14	Nelson Miksys	Ph.D.	Rowan Thomson	Monte Carlo dose calculations for brachytherapy
15	Bryan Muir [¶]	Ph.D.	Dave Rogers	rad. dosimetry: calculating beam quality conversion factor k_Q
16	Elizabeth Orton	Ph.D.	Glenn Wells	reducing extra-cardiac interference for cardiac SPECT
17	Amir Pourmoghaddas	Ph.D.	Glenn Wells	scatter correction for quantitative cardiac SPECT

18	Paul Prior	M.Sc.	Glenn Wells	microSPECT
19	Simin Razavi	M.Sc.	Tong Xu	real-time tracking with PeTrack and x rays
20	Matthew Rodrigues	Ph.D.	Ruth Wilkins	novel methods for biological dosimetry
21	Hong Shen	M.Sc.	Carl Ross	wide-angle free air chamber for brachytherapy seeds
22	Jared Strydhorst [†]	Ph.D.	Glenn Wells	reconstruction algorithm for μ SPECT
23	Justin Sutherland [†]	Ph.D.	Dave Rogers & Rowan Thomson	Monte Carlo dose calculations for brachytherapy
24	Brandon Zanette [†]	M.Sc.	Ian Cameron	Dynamic Contrast Enhanced MRI of gliomas

[†] Degree completed during 2012 Fall, 2013 Winter or 2013 Summer. See Table 4.

Table 4. Theses Completed, 2012-2013. Ordered by date of defence.

Student	Degree	Supervisor	Thesis Title and Date of Defence
Lindsay Beaton	Ph.D.	R.Wilkins	Investigating chromosome damage and gammaH2AX response in human lymphocytes and lymphocyte subsets as potential biomarkers of radiation sensitivity Dec 10, 2012 External Examiner: Kai Rothkamm, UK Health Protection Agency
M. Shoaib Khan	M.Sc.	L.Sinclair	Source localization using a directional gamma ray spectrometer Dec 13, 2012
Stéphanie Chiasson	M.Sc.	Wells	Tc99m/Tl201 cross-talk corrections on a dedicated cardiac CZT SPECT camera May 1, 2013
Conor McFadden	M.Sc.	Sawakuchi	Performing radiation measurements at the sub-micrometer scale July 22, 2013
Marielle Lespérance	M.Sc.	Thomson	Model-based dose calculations for eye plaque brachytherapy Aug 12, 2013
Justin Sutherland	Ph.D.	Thomson & Rogers	Monte Carlo dose calculations for breast and lung permanent implant brachytherapy Aug 14, 2013 External Examiner: Indrin Chetty, Wayne State University
Islam El Gamal	M.Sc.	McEwen	An absorbed dose to water primary standard for Ir-192 brachytherapy Aug 29, 2013
Bryan Muir	Ph.D.	Rogers	Measurements and Monte Carlo simulations for reference dosimetry of external radiation therapy beams Aug 30, 2013 External Examiner: Jeff Siebers, University of Virginia
Jared Strydhorst	Ph.D.	Wells	Quantitative multiplexed multi-pinhole small-animal SPECT Sep 3, 2013 External Examiner: Benjamin Tsui, Johns Hopkins University
Michel Lalonde	Ph.D.	Wells & Wassenaar	Novel SPECT RNA quantification of mechanical dyssynchrony for the prediction of CRT response Sep 3, 2013 External Examiner: Edward Ficaro, University of Michigan
Brandon Zanette	M.Sc.	Cameron	Validation of the Bookend method in Dynamic Contrast Enhanced MRI Sep 4, 2013

Table 5. OMPI Seminars, 2012-2013.For details see <http://physics.carleton.ca/events/all/ottawa-medical-physics-institute>.

Date / Location	Speakers and Titles
Sept 27, 2012 Carleton University	Sarah Cuddy: High resolution detectors for Positron Emission Mammography Patrick Saull: A Compton Gamma Imager for safety and security Followed by an OMPI social event.
Oct 18, 2012 University of Ottawa Heart Institute	Islam El Gamal: Feasibility study of the determination of absorbed dose to water using a Fricke based system David Wilkins: Radiation safety then and now
Nov 15, 2012 TOHCC	Brandon Zanette: Validation of the Bookend method in Dynamic Contrast Enhanced MRI Rowan Thomson: Monte Carlo simulations on the cellular scale
Dec 20, 2012 Health Canada	Marielle Lespérance: Model-based dose calculations for ocular brachytherapy Costel FLueraru: Optical imaging modalities for medical application - Optical Tomography
Jan 17, 2013 University of Ottawa Heart Institute	Conor McFadden: Performing radiation measurements at the sub-micrometer scale Carl Ross: Making medical isotopes - Present status and future prospects Followed by an OMPI social event.
Feb 28, 2013 Carleton University	Amir Pourmoghaddas: Quantitative imaging for a dedicated cardiac SPECT camera Balazs Nyiri: Three self-referencing methods for the measurement of beam spot position
March 21, 2013 TOHCC	Bryan Muir: Measurements and Monte Carlo simulations for reference dosimetry of electron beams Trevor Stocki: Environmental transfer modelling to determine radiation dose to humans
April 18, 2013 Health Canada	Chad Hunter: Patient body motion affects myocardial blood flow quantification with rubidium-82 PET imaging Ran Klein: Myocardial blood flow quantification - ⁸² Rb PET is just the beginning
May 16, 2013 NRC/IRS	Dal Granville: Measurement of average LET of proton therapy beams using optically stimulated luminescence detectors Richard Richardson: Are α - and β -emitting bone-seeking radionuclides effective treatments against leukemia stem cells and bone metastases? Followed by the Annual BBQ.

Table 6. Carleton University Department of Physics Seminars in Medical Physics, 2012-2013.

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

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

Date	Speaker, Institution, and Title
Sept 11, 2012	Eugene Wong, Western University The past, present and future of radiation treatment of cancers in the liver: A physicist's perspective
Oct 2, 2012	Louis Archambault, CHUQ/Laval University A new generation of radiation dose detectors tailored for radiation treatment monitoring
Dec 12, 2012 OCIP Fall Graduate Student Seminars	Bryan Muir Beam quality conversion factors for photon beam reference dosimetry
Dec 14, 2012 OCIP December Symposium	Dave Rogers Monte Carlo simulation of radiation transport: From bombs to the clinic

Jan 15, 2013	Emily Heath, Ryerson University Modeling and compensating for geometrical and biological tumor variability in radiation therapy
Jan 22, 2013	Magdalena Bazalova, Stanford University School of Medicine Radiation therapy for the poor and the rich
Jan 29, 2013	Rajat Ghosh, University of Pennsylvania Application of singlet states to hyperpolarized imaging
Feb 12, 2013	Randall Stafford, University of Pennsylvania Non-contrast enhanced vascular assessment with MRI
March 7, 2013	Emilie Soisson, McGill University Ten years of experience with Tomotherapy
March 14, 2013	Sangeeta Murugkar, University of Ottawa Optical molecular imaging in biomedicine
March 26, 2013	Victor Yang, Ryerson University Artificial muscle actuated smart catheter
April 16, 2013	Devika Chithrani, Ryerson University Gold-based nanostructures for improved cancer therapeutics
April 23, 2013	T. Rock Mackie, University of Wisconsin Medical isotope production with a sub-critical assembly
April 30, 2013 OCIP Spring Graduate Seminars I	Conor McFadden Micrometer scale radiation measurements using Al ₂ O ₃ :C,Mg fluorescent nuclear track detectors Michel Lalonde Quantification of mechanical dyssynchrony using SPECT RNA for the prediction of cardiac resynchronization therapy outcome
May 6, 2013 OCIP Spring Graduate Seminars II	Marielle Lespérance Model-based dose calculations for ocular brachytherapy Islam El Gamal Development of an absorbed dose to water primary standard for HDR Ir-192 brachytherapy based on the Fricke dosimetry system Brandon Zanette Validation of the Bookend method in Dynamic Contrast Enhanced MRI