

**MSc in Clinical Medical Biophysics**  
**Accredited by the Commission on Accreditation of Medical Physics Educational Programs**  
**(CAMPEP)**

**INTRODUCTION**

**Overview of the New Program**

**Major Objectives:** This program proposal is directed at graduate students interested in clinical physics careers. Professional certification for Clinical Physicists is obtained from the American Board of Radiology (ABR) in the US, and the Canadian College of Physicists in Medicine (CCPM) in Canada. Clinical physics training is comprised of PhD graduate training, followed by a two-year Residency. Over the next decade, ABR and CCPM are phasing in accreditation requirements for graduate school and residencies, and setting policies to allow only graduates from accredited training programs to write College membership exams. Ultimately, many American states (and perhaps Canadian provinces) will require by law that only College-certified Clinical Physicists be hired in the hospital sector. To oversee the accreditation process, the professional colleges created the Commission for the Accreditation of Medical Physics Education Programs (CAMPEP. See [www.campep.org](http://www.campep.org)).

Western and the London hospitals have trained over two generations of Clinical Physicists and run one of the largest training programs in North America. In the past five years, 10 PhD graduates have followed this career path to clinical physics. To maintain this training capability, strategic decisions were made to obtain CAMPEP accreditation of the Residency program at London Regional Cancer Program (LRCP) (accredited in 2006), followed by the Medical Biophysics Graduate Program. Accreditation consists of an external peer-review by an international panel of Clinical Physicists and includes reviewing curriculum and a site visit. The site visit included meetings with UWO Faculty (including Schulich Leadership), and tours of the medical-imaging resources at St Joseph's Health Care/Lawson Research, Robarts Research, and the radiation oncology resources at LRCP. We are pleased to say that the Medical Biophysics graduate program received accreditation in August 2010. Accreditation was based on both the breadth of didactic courses developed (See Section 2.3 / Current and Recent Teaching Assignments) and the strength of the relationship between Western and the London hospitals who employ Clinical Physicists.

The proposed MSc in Clinical Medical Biophysics is course-intensive and does not include a research-based thesis.

**Course Curriculum:** The MSc in Clinical Medical Biophysics course curriculum conforms to the American Association of Physicists in Medicine (AAPM) Report 79 "Academic Program Recommendations for Graduate Degrees in Medical Physics." Students enrolled in the CAMPEP program will be required to take a total of 6.0 course credits, mostly taught by the Department of Medical Biophysics (extra-departmental courses are Anatomy and Physiology). Students also participate in hospital-based training, where they "shadow" a medical physicist (hospital employee) to observe the operation of a radiology, nuclear medicine, or radiation oncology department, and participate in activities such as radiation dose planning and equipment/procedure quality control.

**Goals and Objectives of the program in relation to the Graduate Degree-Level Expectations**

**a) Depth and Breadth of Knowledge**

The course content is designed to comply with the requirements set out in AAPM Report 79 – Academic Program Recommendations for Graduate Degrees in Medical Physics. (AAPM = American Association of Physics in Medicine). This curriculum allows program graduates to qualify for admission to clinical physics residency programs (including the CAMPEP-accredited residency program at LRCP). The curriculum includes broad knowledge of medical imaging and radiation therapy.

**b) Research and Scholarship (as appropriate for a professional master's degree)**

This program is course-based, and not designed to further research capabilities of students. However, all students seeking entrance to a clinical residency will have to complete a PhD at some point, which will develop their research capabilities. The program can also be delivered as a combined [PhD + MSc in Clinical Medical Biophysics], where the PhD component is the standard Medical Biophysics PhD already approved by Western.

**c) Level of Application of Knowledge**

The course content described by AAPM 79 (See Section 1.2 (a) Depth and Breadth of Knowledge) is taught at the graduate level only. Preparation for these courses requires a solid undergraduate foundation in physics (which is also a CAMPEP requirement). In addition to the solid course work and assessment plans, students will consolidate their training with practical applications in clinical settings arranged through a Clinical Exposure rotation. This is a 10-hour hospital-based opportunity for students to get hands-on training and apply their knowledge to clinical practice under the supervision of a Clinical Physicist. This multi-pronged approach will provide a powerful training package.

**d) Professional Capacity/Autonomy**

The curriculum includes a course on ethics, tailored to the needs of medical physicists, which also includes a section on the basics of setting up and running clinical trials. Technical knowledge specific to the requirements of entering a clinical physics residency is provided through the entire course-based curriculum. The 10-hour Clinical Exposure rotation will give students an opportunity to participate in the complex environment of clinical care. Students' technical knowledge and clinical exposure are evaluated in a final (written and oral) Clinical Exam, administered by a panel of Clinical Physicists (See Section 4 / Degree Requirements). It is expected that students will develop an advanced knowledge of clinical physics, as well as skills in clinical reasoning and professionalism.

**e) Level of Communication Skills**

The curriculum includes a scientific communications course which provides formal training in writing scientific abstracts, preparing scholarship applications and research grant proposals, and making both oral and poster presentations. Further communication skills will be honed via lectures in management, negotiation and conflict resolution through a planned relationship with Western's Ivey School of Business (see Section 3/Professional Development Resources). Professional communication will be assessed in the students' final (oral) Clinical Exam.

**f) Awareness of Limits of Knowledge**

Students will be exposed to the complexities of professional medical physics and its role in helping delivering multi-disciplinary healthcare through several avenues: (i) their Clinical Exposure rotation, (ii) a guest lecture series wherein guest speakers will include leaders in the medical physics profession, (iii) attending clinical rounds (radiology, nuclear medicine, or radiation oncology), and (iv) attending medical biophysics graduate student seminars.

**PROGRAM REGULATIONS AND COURSES**

**Recruitment Methods:** Presently, the accreditation of the Medical Biophysics program is indicated on the CAMPEP website ([www.campep.org](http://www.campep.org)). This website lists contact information for the program. Future plans include advertising at national meetings (Canadian Organization of Medical Physicists – [www.medphys.ca](http://www.medphys.ca)).

**Application:** The program follows the standards set by the School of Graduate and Postdoctoral Studies (SGPS). In addition to submitting the online application form and arranging for two letters of reference and for transcripts of the academic record as required by the School of Graduate and Postdoctoral Studies, candidates are asked in the online application to describe why they wish to undertake graduate work in clinical physics. The application is then reviewed by the CAMPEP Program Co-Directors, who make the final decision for admission.

**Application Deadline:** June 1

**Admission:** To be admitted a student must possess as a minimum an average of 78% over the last two years of an honors program, and have completed a BSc in physics, the physical sciences, or engineering; or have completed a third or fourth-year traditional physics course (such as quantum physics, electromagnetic theory, classical mechanics, etc...).

**Initial Registration:** All students in this program will be registered as MSc students. Students in the combined [PhD + MSc in Clinical Medical Biophysics] program will be registered as PhD students for the research-thesis training, and as MSc in Clinical Medical Biophysics students for one year (during their course-based training). For students already enrolled in a PhD who wish to enter into the combined [PhD + MSc in Clinical Medical Biophysics]: Candidates must select the CAMPEP Option no later than the start of their second year in the PhD program, provided that the student has the physics pre-requisites. In this case, the candidate's request is evaluated first by his or her advisory committee. If the advisory

committee approves, the request and letter of support from the advisory committee are then transferred to the CAMPEP program director.

The decision to accept the student into the CAMPEP Option is based upon whether: (i) the current supervisor and advisory committee believe the candidate can maintain significant research productivity despite an increased clinical and course workload, (ii) adequate resources (e.g., clinical supervision, space, equipment) are available, as determined by the CAMPEP program director, and (iii) the candidate can realistically make up for missed graduate courses or Clinical Exposure opportunities. Students selecting the CAMPEP Option after 1-3 terms in the graduate program will have their initial time counted as part of the five years allowed to complete a [PhD + MSc in Clinical Medical Biophysics]. MSc students selecting the CAMPEP Option will need to reclassify successfully to the PhD if they select a combined [PhD + MSc in Clinical Medical Biophysics]. A candidate may drop the CAMPEP Option, but this must be done in consultation with the candidate's advisory committee and the CAMPEP program's leadership.

### **Degree Requirements**

**Course Requirements:** MSc in Clinical Medical Biophysics students are required to complete courses worth a total of 6.0 weights. The content of these courses meets the requirements of AAPM Report 79 (see Section 1.2 / Depth and Breadth of Knowledge). AAPM Report 79 specifies total technical content, but does not specify how that content should be divided among courses at a particular university. For Western's program, the distribution of the content into specific courses was done during the CAMPEP accreditation process, in consultation with the external reviewers and the Medical Biophysics faculty. In most cases, the required technical content was already present across the courses. However, a few courses needed some augmentation of content to which course instructors have agreed.

**Clinical Exam:** The candidate is examined using a written and oral exam based on the CCPM Membership examination. Candidates will have gained the necessary knowledge through didactic courses in their Clinical Exposure Rotation and are free to consult with CAMPEP faculty and other students in preparing for this exam. The oral component of the exam will be approximately one hour in length and will be conducted by a panel of Clinical Physicists (who are Medical Biophysics faculty members) assigned on an ad hoc basis. The written component will also be one hour in length. Combined [PhD + MSc in Clinical Medical Biophysics] students must also fulfil the requirements of the Medical Biophysics PhD program, as approved by Western.

**Language Requirements:** Since graduate students most often work as a member of a research team, language skills are essential. Foreign students are required to have a TOEFL iBT score of at least 92. Exceptional students who do not meet this requirement may be given the opportunity to volunteer in a research laboratory prior to enrolment while taking English language instruction.

**Progression Requirements:** Performance in individual courses is assessed by course instructors. Performance in the Clinical Experience rotations is assessed by the Clinical Physicist to whom the student is assigned. Performance in the Clinical Exams is evaluated by a panel of Clinical Physicists. To complete the program, the student must pass all course work, complete the Clinical Exposure Rotation, and pass the Clinical Exam.

The MSc in Clinical Medical Biophysics program is not available to students in part-time studies.

### **All graduate courses offered in the program:**

In the table below: all students must take the compulsory core courses and then select either the imaging sciences or radiation therapy in which to specialize. These two specialties were designated during the CAMPEP accreditation process (external peer-review).

<b>Graduate Courses to be Offered by the Program</b>			
<b>Weight</b>	<b>Course</b>	<b>Faculty member(s) expected to teach the course</b>	<b>Frequency of course</b>
<b>COMPULSORY CORE (All students)</b>			
N/A	Radiation and Lab Safety Orientation	University, Hospitals, Institutes	Annually
0.5	Radiological Physics and Dosimetry (P9655A)	Eugene Wong FCCPM	Bi-Annually
0.5	Radiation Biology (9567B)	Jerry Battista FCCPM	Annually
0.5	Basic Anatomy (e.g., ACB 3319)	External	Annually
0.5	Basic Physiology (e.g., Phys 2130)	External	Annually
0.5	Inferencing from Data Analysis (9522)	Yves Bureau	Annually
0.5	Research Ethics & Biostatistics (Web course)	External (J Williams)	Annually
0.5	Medical Imaging Biophysics (9515A)	Maria Drangova	Annually
0.5	Scientific Communication (9513Y)	Terry Thompson	Annually
<b>IMAGING SCIENCES – COMPULSORY ELECTIVES (Select a weight of 2.0 from the following)</b>			
0.5	Introductory Medical Imaging (9503)	Jim Lacefield, David Holdsworth, Paula Foster, Greg Marsh	Annually
0.5	Practical Medical Physics Lab (9520Y)	David Holdsworth	Annually
0.5	Imaging Principles (9516Y)	Ian Cunningham FCCPM & Ting Lee FCCPM	Annually
0.5	MRI Physics 9663	Robert Bartha	Annually
0.5	Conceptual MRI 9650	Charles McKenzie	Annually
0.5	Nuclear Magnetic Resonance 9662	Blaine Chronik	Annually
0.5	Advanced MRI Physics 9665*	Jean Theberge MCCPM	Annually
1.0	Practical Nuclear Medicine Physics (9570/80*)	Robert Stodilka MCCPM	Annually
<b>RADIATION THERAPY – COMPULSORY ELECTIVES (Select a weight of 2.0 from the following)</b>			
1.0	Practical Radiotherapy Physics (9570/80*)	LRCP Clinical Physicists F/MCCPM	Annually
1.0	To be chosen from Imaging Sciences Electives (above)		

\* Indicates course in development