Medical Physics Residencies - 101: The What's, Where's, and How's

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Outline

- Autobiographical Sketch
- Medical Physics – the what and the why
- Medical Physics Residency Programs
- Structural Example of a Residency Program
- CAMPEP
- ABR/CCPM
- Applying to a Residency Program
- Medical Physics Resources

About Me

- Former Laurentian University undergraduate and graduate student
- Graduated with B.Sc. (Hon.) Applied Physics in 2006
- Graduated with M.Sc. Physics in 2009
- Medical Physics Resident: 2010-2012
  - Baylor Health Care System
- Research Physicist: 2012-2014
  - Sunnybrook Health Sciences Centre
- Physicist: March 2014 – present
  - Xspect Inc.

What is Medical Physics?

- Simply put: the application of physics to medicine.
- More formally: the applications of physical energy, concepts, and methods to the diagnosis and treatment of human disease
- Three main avenues:
  - Diagnostic physics
  - Nuclear Medicine
  - Radiotherapy

What do Medical Physicists do?

- Clinical Services and Consultations
  - Dx Imaging/Rad Therapy/NM Imaging
    - Equipment Performance
    - Shielding Considerations
    - Imaging Problems
    - Patient Consultations

What do Medical Physicists do?

- Research and Development
  - Radiobiology
  - Application of new high-energy machines for patient treatment
  - New techniques for accurate measurements of radiation
  - Digital Imaging Methods

- Teaching
  - Post-secondary appointments to medical physicists, resident physicians, medical students, and radiographic technologists

Medical Physics Residency Programs

- Objective
  - To educate and train medical physicists to a level of competency sufficient to practice the desired Medical Physics field (diagnostic imaging, therapy, nuclear medicine) independently.
  - Prepare the resident for his/her board certification exam.

Diagnostic Physics Residency Structure

- Residency program broken into 11 modules over two years:
  - Radiography
  - Fluoroscopy
  - Digital Radiography
  - Magnetic Resonance Imaging
  - Computerized Tomography
  - Ultrasound
  - Mammography
  - Image Display, Processing, and Informatics
  - Image Quality
  - Shielding
  - Dose Estimates, Radiobiology, Dose Reduction, and Personnel Dosimetry

Module Completion Requirements

- Observe the testing of at least five units (or as needed)
- Independently test one unit under supervision
- Written test
- Oral test
- Remedial work (if needed)

- For one module, this would typically amount to about two to three months of work.

My Job Responsibilities

- Observation, supervised testing, and independent testing of imaging equipment.
- Assisting with teaching of Radiology residents, MRT's, and in-services to physicians.
- Occupational worker pregnancy consultations.
- Shielding considerations/calculations.
- Adult and Fetal Dose Calculations and Determination of Risk.

Diversity in Teaching

- I had observed multiple physicists performing the same tests for a specific modality.
- Both a very good thing and a challenge at the same time.
- I was able to take the "best of all worlds" and create my own way to test units.

Interaction With Technologists

- In-service presentations
  - Digital Mammography
  - CT Dose Reduction Initiative

- Annual Physics Testing
  - Operating the unit (e.g. CT, MR)
  - Discussion regarding if any test failed and how to correct it

A Typical Day's Work

- Ask other physicists what units I can help out with/observe testing.
- Finish testing units which have been assigned to me.
- Compiling the report after an inspection and then sending it to the site contact.
- STUDY STUDY STUDY!

A Take Home Point

- Coming from a background of a four year B.Sc. (Hon.) and a two and a half year M.Sc., I was very academically inclined.
- Needed to make the transition to gaining practical knowledge, while still having the didactic knowledge gained through courses.
- This transition is essential in order to portray yourself at a higher level of professionalism to other physicists, technologists, radiologists, etc.
- This takes time.

Another Take Home Point

- NEVER, be afraid to ask a question.
- There is no such thing as a stupid question. The only "stupid" thing about stupid questions is not asking them.
- One of, if not, the most effective ways to learn a new concept (or be reminded of one).

Commission on Accreditation of Medical Physics Educational Programs (CAMPEP)

- nonprofit organization whose objectives are the review and accreditation of educational programs in medical physics

- accreditation is to ensure program or institution has met a defined standard (provides a quality service or education)

CAMPEP Accredited Graduate Programs in Medical Physics

Entries Last Updated May 1, 2014

† Indicates institutions offering tracks within their degree program which are not CAMPEP compliant. Students graduating from these institutions who have completed the CAMPEP accredited program will be identified through an appropriate certificate awarded on completion of the program.

** Indicates Institutions offering a Professional Doctorate in Medical Physics (DMP), Therapy and Diagnostic Physics Tracks

Institution	Initial Accreditation
Carleton University	2010
Cleveland State University	2011
Columbia University	2009
Duke University Medical Center	2008
East Carolina University	2006
Georgia Institute of Technology	2010
Louisiana State University	2006
McGill University	1993
Oklahoma State University	2013
Oregon State University †	2011
Purdue University/Indiana University †	2012
Ryerson University	2013
San Diego State University	2010
Seoul National University†	2012
SUNY Stony Brook University†	2010
University at Buffalo (SUNY) School of Med	2009
University of Alberta - Cross Cancer Institute	2002
University of Arizona	2012
University of British Columbia	2004
University of Calgary - Tom Baker Cancer Centre	2005
University of California - Los Angeles †	1994
University of Chicago	2008
University of Cincinnati	2009
University of Florida	2001
University of Kentucky Medical Center	1998
Universite Laval	2011
University of Manitoba - CancerCare Manitoba†	2008
University of Massachuesetts Lowell	2012
University of Miami	2013
University of Minnesota	2013
University of Missouri	2011
University of Nevada Las Vegas†	2011
University of New Mexico	2009
University of Oklahoma HSC	2005
University of Pennsylvania	2011
University of Texas HSC - Houston	1989
University of Texas HSC - San Antonio†	1997
University of Toledo Medical Center	2009
University of Victoria - BC Cancer Agency	2009
University of Wisconsin	1988
Vanderbilt University School of Medicine **	2010
Virginia Commonwealth University	2010
Wayne State University†	1988
Western University†	2010

RT

DI

CAMPEP Accredited Graduate Program Typical Content

- As per AAPM report 197:
- Core topics (e.g. Radiobiology)
- Imaging Science (e.g. X-ray Imaging)
- Radiation Therapy (e.g. Treatment Planning)
- Imaging for Treatment Guidance and Monitoring (e.g. Portal Imaging)

Essentials and Guidelines for Clinical Medical Physics Residency Training Programs – AAPM Report 249

- **Patient Care and Procedural Skills**
  - Providing physicians with appropriate technical and dosimetric information
  - Improving and maintaining image quality

- **Medical Physics Knowledge**
  - specification, acceptance testing, and quality assurance of imaging and therapeutic equipment
  - applications of physics problem-solving skills to clinical medical physics problems

- **Practice-based Learning and Environment**
  - contributing to research and development projects in cooperation with radiologists, nuclear medicine physicians, radiation oncologists, etc.
  - investigating and evaluating patient care practices

- **Interpersonal and Communication Skills**
  - demonstrating effective teaching of medical physics and radiation effects to trainees, technologists, etc.
- **Professionalism**
  - demonstrating a commitment to excellence and ongoing professional development
  - respecting patient privacy and confidentiality
- **Systems-based Practice**
  - showing competence in information technology (IT) issues such as electronic media, software licensing, levels of access, and information security
  - understanding policy development procedures and quality management systems

American Board of Radiology (ABR)

- Governing board in the U.S. to certify Medical Physicists and Radiologists

- For Medical Physicists, there are three sub-specialties for ABR certification:
  - Therapeutic Medical Physics
  - Diagnostic Medical Physics
  - Nuclear Medical Physics

ABR Process

- The ABR process is broken down into three parts.
- In Part I, a written general medical physics exam of basic topics (with some core physics) is given along with a written clinical exam (anatomy, physiology, and radiobiology).
- Part II is a specialty-specific exam. This is also written.
- Part III involves an oral examination in the specialty desired.
- For Parts II and III, if an individual is applying for more than one specialty, separate exams must be taken for each one.

Part I Requirements

- The candidate must have completed a CAMPEP-accredited residency program.
- This implies that one must enroll in a CAMPEP-accredited graduate program first.

Canadian College of Physicists in Medicine (CCPM) Exam

- Board Certification Exam for individuals whom are Canadian Citizens, whom have received schooling in Canada, or whom have a job in Canada.
- Four specialties:
  - Radiation Oncology Physics
  - Diagnostic Radiology Physics
  - Nuclear Medicine Physics
  - Magnetic Resonance Imaging Physics

Exam Requirements

- Master's or Doctoral degree in Medical Physics, Physics, or a related discipline.
- At least two years of patient-related experience in the sub-speciality being applied for.
- As of January 1, 2016, all applicants for certification in the Radiation Oncology Physics subspecialty must have graduated from either a CAMPEP accredited graduate or residency program.

CCPM Exam

- Written Exam:
  - Part I (general medical physics)
  - Part II (radiation or MR safety)
  - Part III (specific questions related to sub-speciality)
  - Part IV (general questions related to sub-speciality)

- Oral Exam:
  - Test practical knowledge learned through a residency or OTJ training.

American Association of Physicists in Medicine (AAPM)

- Largest organization of Medical Physicists.
- Purposes are to:
  - promote the application of physics to medicine and biology,
  - encourage interest and training in medical physics and related fields
- Annual and spring meetings
- www.aapm.org

AAPM Reports

- #249: Essentials and Guidelines for Clinical Medical Physics Residency Training Programs
- #197: Academic Program Recommendations for Graduate Degrees in Medical Physics
- Additional Reports on www.aapm.org

Canadian Organization of Medical Physicists (COMP)

- Analogous to the AAPM

- Objectives are:
  - Promote scientific knowledge
  - Further the exchange and publication of scientific or technical information
  - Promote and protect professional standards
  - Promote and encourage certification by the CCPM
  - Link to activities of other organizations with similar objectives

- www.medphys.ca

Applying to a Medical Physics Residency

- CAMPEP website
- AAPM website
- COMP website

- Where one applies to depends upon the certification board one wants to attain (ABR vs. CCPM) and also on the sub-speciality.

Application Process

- Written Application
  - Education
  - Courses
  - Practical experience

- Phone Interview
  - A re-cap of your written application
  - If applying across borders, be prepared to have some basic knowledge on the work visa process
  - Possibility of being asked questions regarding a medical physics concept. Know your stuff!
  - Don't be nervous!

Radiological Society of North America (RSNA)

- Largest Radiology conference in the world.
- Purposes are to:
  - promote and develop the highest standards of radiology and related sciences through education and research
  - provide professionals with educational programs and materials of the highest quality, and to constantly improve the content and value of these educational activities
- Annual Meeting in Chicago
- www.rsna.org

Society of Nuclear Medicine and Molecular Imaging (SNMMI)

- Purpose is to:
  - promote the science, technology and practical application of nuclear medicine and molecular imaging
  - Annual and mid-winter meetings.
- www.snmmi.org

Mailing Lists

- **Diagnostic Imaging Medical Physicists List (DXIMGMEDPHYS)**
- **The *American* Medical Physics Mailing List (MedPhysUSA)**
- **The *Global* Medical Physics Mailing List (MedPhys)**

Journals

- Medical Physics
  - http://www.medphys.org/
- Radiology
  - http://radiology.rsna.org/
- Radiographics
  - http://radiographics.rsna.org/
- Physics in Medicine and Biology
  - http://iopscience.iop.org/0031-9155

Questions?

- Thank you for your time today.

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