Educational Pathways and Training Programs: A Canadian Example

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Board Exams Pressure

- American Board of Radiology (ABR)
  - Beginning in 2012, Candidates taking the ABR Part 1 Exam in Radiological Physics must have graduated from a CAMPEP-accredited PhD program or Residency.
  - Beginning in 2014, Candidates taking the ABR Part 1 in Radiological Physics must complete a CAMPEP-accredited Residency.

- Canadian College of Physicists in Medicine (CCPM)
  - Radiation Oncology Physics: As of Jan 2016: all applicants writing the Membership Exam must have graduated from a Graduate Program or Residency that is accredited by CAMPEP.
  - Nuclear Medicine, Diagnostic Radiology, Magnetic Resonance: no specific directives at this time.

CAMPEP Programs

GRADUATE PROGRAMS
- Carleton University (PhD)
- McGill University
- University of Alberta – Cross Cancer Institute
- University of British Columbia
- University of Calgary – Tom Baker Cancer Cent
- University of Victoria – BC Cancer Agency
- University of Western Ontario (2010)

RESIDENCIES – RADIATION ONCOLOGY
- Cancer Care Manitoba
- University of Alberta – Cross Cancer Institute
- London Regional Cancer Program (2006)
- McGill University
- The Ottawa Hospital Cancer Centre
- Tom Baker Cancer Centre
- University of Toronto

RESIDENCIES – IMAGING
- University of Alberta – Cross Cancer Institute

Radiation Oncology Demand (2010)

- B.Sc. 96 slots
- M.Sc. 48 slots
- Ph.D. 72 slots

Population: 34 Million
Incidence: 178,000/yr
RT cases: 75,000/yr
Physicists: 300 FTEs

Clinical Physics Residency 48 slots

Actual 153 CAMPEP 75

Actual 45 CAMPEP 30

Residents 24/yr

Clinical Physicist
Pathways

Physics BSc
Medical Biophysics BSc
Engineering BEng

BioMedical Engineering MEng
Medical Biophysics MSc (CAMPEP)
Medical Biophysics PhD (CAMPEP)
Non Medical Physics PhD

Ontario Residency Program

Coordinated Provincial Program 24 FTE positions (max 12 grads/year)
Funded by Ministry of Health Training (20 FTE) and Operating (4 FTE) Budgets
Stipend $54k/yr x 2 years

Has been in formal operation since 2000
Larger Centres are now CAMPEP accredited
Smaller Centres seeking Affiliate status with larger Centres

Accounts for > 70% of current medical physicists on staff!

Medical Biophysics

First Biophysics Department in Canada
- Founded by Dr. A.C. Burton
- M.Sc., Ph.D. Degrees (1947)
- B.Sc., B.MSc. (1966)
- CAMPEP Approval (2010)

Composition
- 10 core members
- > 70 Appointees
- 22 Undergrads (Y4)
- 90+ Grad Students

City-wide partnerships with hospitals and research institutes
New CAMPEP MSc-PhD

Admission Requirements
- More strict than pure Research Option
- "Minor in Physics" (minimum)

Research PhD (Non-CAMPEP)
- Scientific Communications: 0.5 credit (mandatory)
- Students typically take 1-4 additional half-courses (optional)
- Expect 4 Peer-Reviewed Publications, >4 presentations

Research PhD (CAMPEP) – same but more courses
- 6.0 full course credits required by CAMPEP (MSc); mandatory
- Clinically-oriented training and exam material
- CCPM-certified Physicists have a clear role

Sample Curriculum – Radiotherapy
MSc-PhD (CAMPEP)

Year 1
- Radiation and Lab Safety Orientation
- Radiological Physics and Dosimetry (PM655A)
- Radiobiology (9567B)
- Basic Anatomy (e.g. ACB 3319)
- Research Ethics & Biostatistics (Web course)
- Medical Imaging Biophysics (9515A)
- Scientific Communication (9513Y)

Year 2
- Practical Radiotherapy Physics (9510/80)
- Electives (1.0 credit) from other subspecialties
- Thesis Advisory Committee Meeting #1 (thesis proposal)
- Low-Level Comprehensive Examination

Year 3
- Thesis Advisory Committee Meeting #2
- Additional Clinical Exposure: the student will shadow a medical physicist or
  Year 2 resident for special topics such as acceptance testing, QC, site planning, treatment
  planning. Duration: 2 hours/session x 5 sessions.
- Mid-Level Comprehensive Examination

Year 4
- Thesis Advisory Committee Meeting #3
- Thesis Defense
- Clinical Comprehensive Exam (a mock CCPM-like Ontario A-Review oral exam)
  Well prepared for a Residency Program (possibly abbreviated by 6 months)

CAMPEP Non-Thesis MSc?

CAMPEP courses (only) MSc degree
- Access To/From Research PhD degree

- Re-Opens door to Board Exams
- Could generate University revenue!
- Require more CCPM Faculty if it becomes popular with ‘external’ PhD’s (latecomers)
Pathways

- Physics BSc
- Medical Biophysics BSc (CAMPEP)
- Engineering BEng
- Medical Biophysics MSc (CAMPEP)
- Biomedical Engineering MEng
- Non Medical Physics PhD

The “4Rs” Staffing Model

- Residents
- Recruitment
- Requirements
- Retention

Staffing Requirements

![Graph showing staffing requirements over time]

“It's not the roads we take... it's what we make of them”

The Compleat Angler by Izaak Walton (1593 – 1683)
Case/yr-FTE Ratio

Clinical Physicist (RT Cases per FTE)

The University of Western Ontario

Resident/Staff Ratio

GOAL: To provide new growth in Staffing by supplementing External Recruitment and offsetting Attrition through an ideal-sized Residency Program

Residents %/yr = [Demand + Recruitment + Loss] / Residency Capture Efficiency

= (3%/yr + 4%/yr - 7%/yr) / 0.80

= 8%/yr implies 16% Residency FTEs (in 2 yr program)

Canada: 48 Residents/300 FTE Staff = 16%

The University of Western Ontario

Conclusion

The Canadian Training Model continues to be built upon strong graduate programs in Medical Physics/Biophysics feeding Residency Programs

PhD Advantage:

- Courses completed prior to residency
- University academic positions
- Obtain grants for Translational Research in Radiation Oncology
- "Respect" from clinical colleagues and regulatory bodies
- Career Advancement and Flexibility

Is there a specific role for CAMPEP MSc non-thesis degree to "top up" PhDs from non-CAMPEP graduate programs?