Post-Doctoral Certificates in Radiation Oncology Physics

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Graduate Training and Career Pathways in Medical Physics

Non-CAMPEP PhD (MS) in Med Phys or other Physics

Post Doc in Physics or Med Phys

Research/teaching/industry

PhD (MS) in CAMPEP Med Phys

CAMPEP Post-doctoral certificate in Med Phys

CAMPEP Med Phys Residency

CAMPEP PMDM or DMP

Board Exams

QMP and clinical Med Phys career
Certificate Program Motivation

- Many applicants to our residency programs
- Few have the background preparation and soft skills needed to be exceptional medical physicists.
- Several applicants each year to our M.Sc. Program from people who already hold a Ph.D. in physics
Certificate Program Goals

- To prepare Ph.D. level physicists for entry into a radiation oncology physics residency program
  - Complying with AAPM Report 197s

However...
residency positions are extremely competitive!
Certificate Program Design Considerations

- How do you prepare a Ph.D. physicist for a medical physics residency?

As detailed in AAPM Report 197S

Credit Courses
American Association of Physicists in Medicine, Report No. 197S graduate-level core topics in 18 credit hours:

1. Radiological Physics and Dosimetry
2. Radiation Protection and Radiation Safety
3. Fundamentals of Imaging in Medicine
4. Radiobiology
5. Anatomy and Physiology
6. Radiation Therapy Physics
Credit Courses

These courses set the minimum time requirement to about 8 months.

They also form the minimum requirement for entry into a residency position.

Is doing the minimum enough? For you? For someone who’s treating your mother for cancer?
Why can’t I just do these courses online?

So these courses are necessary, but are they sufficient?

What else should I be doing to get a residency position?
What are residency programs looking for?

- Clinical Experience
- Non-Credit Learning
- Credit Courses
Non-credit learning

Professional Development

- Adjusting to a clinical environment
  - Demonstrate professionalism
  - Ability to prioritize
  - Handle competing projects
  - Focus on getting the job done, rather than your own needs

- Communication skills
  - Ability to interact with various professionals

Would I want to work with you?
Non-credit learning

• Exposure to clinical and research issues
  ○ E.g. Ethics and Errors: a discussion-based introduction to
    ▪ ethical analyses in clinical, professional, academic and research activities
    ▪ analysis and management of errors in clinical radiation therapy
Non-credit learning

- Exposure to clinical and research issues
  - Reading journals
  - Attending conferences
  - Talking to medical physicists and medical physics students

Can you have a basic conversation about radiotherapy?
Non-credit learning

- Exposure to clinical and research issues
  - Journal Club
  - Radiation Oncology Rounds
  - Cancer Centre Grand Rounds
Non-credit learning

- Competency based learning

www.rtp-learning-centre.ca
Non-credit learning

Professional Development

• Get your application noticed
  ○ Resume and cover letter writing
  ○ Interview skills
What are residency programs looking for?

- Clinical Experience
- Non-Credit Learning
- Credit Courses
Any clinical experience will set you apart from the other applicants:

- Volunteer
- Job shadow
- Demonstrate you know what you’re getting into!
Clinical experience

- Clinical Rotations (Minimum of 6 half-days)
  - Hands-on in cast and mould,
  - Simulator
  - 3DCRT
  - IMRT
  - SBRT
  - SRS
  - TBI
  - Brachytherapy
Clinical experience

- **Basic Linac Operations and Quality Assurance**
  - Weekly lecture/laboratory sessions aimed at competency in
    - performing monthly QA on linear accelerators,
    - Cobalt-60,
    - CT simulator.
  - Shadowing of Physics Assistants
    - HDR/LDR source calibration and QA
    - TBI measurements and calibration
    - Patient specific IMRT QA
• Physics assistantship work (plus it pays the bills!)
Clinical Equipment:
- 9 Varian linear accelerators
- 1 cobalt treatment unit
- 1 conventional and 2 CT simulators
- Eclipse treatment planning system (20 workstations)
- Prostate brachytherapy using the Nucletron seedSelectron
- HDR brachytherapy
- Stereotactic program with Novalis
- IMRT, IGRT, SBRT and
- participation in RTOG trials
- Total Body Irradiation
- Pediatric radiation therapy
Risk/benefits from the student perspective

- No guarantee of a residency position
- Risk investing 8 months and lots of money
- Opportunity to pursue a career in Medical Physics
Conclusions

- Several programs now offer Certificates
- Residency programs will continue to favor certificate and graduate students who have done more than just the minimum.
Certificate programs?

- Several programs now offer Certificates Program in Radiation Oncology Physics
- Residency programs will continue to favor students who have done more than just the minimum.
Credit Courses

Fall Semester
- MDPH 623 Radiological Physics and Radiation Dosimetry
  - Photon and electron interactions, charged particle and radiation equilibrium, cavity theory, absolute and relative dosimetry, calibration protocols.
- MDPH 639 Radiobiology and Radiation Safety for Medical Physicists
  - Cell kinetics, cell survival curves, radiation pathology, fractionation, radiation safety and shielding.
- MDSC 689.01 Medical Imaging Techniques
  - Introduction to the theory and practical applications of medical imaging

Winter Semester
- MDPH 625 Radiation Oncology Physics
  - Clinical photon and electron beams, brachytherapy, treatment planning, radiation therapy devices, special techniques.
- MDPH 637 Anatomy and Statistics for Medical Physicists
  - Anatomy, physiology, probability, statistical inference, hypothesis testing, regression models, clinical trials, survival analysis.
- MDPH 633 Radiation Oncology Physics Laboratory
  - Absorption dose determination, dose descriptors, photon beam modelling, quality control.

Students are eligible to receive credit for up to 1 course already completed at a graduate level. Encompasses all didactic components identified by the American Association of Physicists in Medicine, Report No. 197S
What are residency programs looking for?

- Clinical Experience
- Non-Credit Learning
- Credit Courses
What are residency programs looking for?

- **Clinical Experience**
- **Non-Credit Learning**
- **Credit Courses**
Is it worth it? Program Costs

- Increase teaching load
- Increased number of learners per course
  - Up from 2 per course
  - May require TA for marking
  - Laboratory course workload is significantly increased
- Competition for our graduate students
Is it worth it? Program Benefits

- Enthusiasm, maturity, experience help elevate courses
- Expanded pool of residency applicants
- Provides opportunity for career changes
- Competition for our graduate students
Certificate Program Design Considerations

- Credit Courses
- Non-Credit Learning
- Clinical Experience
U of Calgary: Radiation Oncology Physics

- **CAMPEP Graduate Program**
  - Radiation Oncology Physics, a specialization within Physics and Astronomy
  - Average enrollment 8-10 total (half Ph.D.)

- **CAMPEP Residency Program**
  - Incorporates the University of Calgary Post-Doctoral Diploma in Radiation Oncology Physics
  - 3 current residents in a two-year program

- **CAMPEP Certificate Program**

- [http://www.ucalgary.ca/rop/](http://www.ucalgary.ca/rop/)
Time to run a 10-student graduate program

- Courses, 793
- Supervision, 1040
- Lab Course, 141.6
- Program Administration, 156
- Clinical Experience, 88
- Non-credit learning, 106.6

Hours per year

Non-credit learning includes:
- Ethics and Errors,
- Journal Club,
- Clinical Experience includes
- Clinical Rotations
- QA training
Incremental cost of certificate program

Grad program costs

Courses

Lab Course

Non-credit learning

Clinical Experience

Program Administration

8th Certificate Student
7th Certificate Student
6th Certificate Student
5th Certificate Student
4th Certificate Student
3rd Certificate Student
2nd Certificate Student
1st Certificate Student
Course fees are set by FGS at $695.16 per course for 2010-2011; we suggested a program fee of $2000 per student. We chose to run a surplus to ease University approval of the program.

All international students get a grant in the amount of the differential between Canadian and International fees, by departmental policy.

<table>
<thead>
<tr>
<th>Enrollment</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>8</th>
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<tbody>
<tr>
<td><strong>Revenue</strong></td>
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</tr>
<tr>
<td>Program Fees</td>
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<td>$8,000</td>
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<tr>
<td>Course Fees</td>
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<td><strong>Subtotal</strong></td>
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<td><strong>Expenditures</strong></td>
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<tr>
<td>Salaries</td>
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<td>$11,936</td>
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<td>(1 TA)</td>
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<td>(1.5 TA)</td>
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<td>(2 TAs)</td>
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<td>Administration Expense (27%)</td>
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<td><strong>Excess of Revenue over Expenses</strong></td>
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Stop talking now, Peter.
U of Calgary: Radiation Oncology Physics

- **Summer student research experience**
  - Average 4-5 per summer
  - 3 Canadian, medical physics / physics undergraduates
  - 1 French summer internship in Biomedical Engineering
  - 1 machinist

- **Undergraduate research project supervision**
  - 1-3 per year

- **Provide RO residency physics education**
  - Average 7 total residents in 5 year program.
Time required to run a graduate program

- **Courses are 13 weeks long, 3 h per week**
  - 1st time teaching prep = 5 x lecture
  - 2nd time teaching = 1.5 x lecture time

- **Laboratory**
  - Primary instructor = 5 hr contact, 5 h prep x 8 labs
  - Secondary instructor = 5 hr contact, 2.5 hr prep x 8 labs

- **Clinical rotation 6 hours**

- **Journal Club**
  - 2 hr/wk * 26 weeks = 52 hours
Supervision hours

- Summer Students = 2 hr per week * 13 wks = 26 hr
- 599 Students = 2 hr per week * 13 wks = 26 hr
- 598 Students = 2 hr per week * 26 weeks = 52 hr
- MSc Students = 2 hrs per week * 52 weeks per year = 104 hr per year
- PhD Students = 2 hrs per week * 52 weeks per year = 104 hr per year
- Graduate committee members 5 hrs/ year
- Resident project supervision = 26 hr
Distance learning

- Loss of clinical opportunities
- Increased convenience for students
- Little direct benefit to our centre with our budget model
The Tom Baker Cancer Centre is a fully equipped, tertiary cancer treatment facility, delivering ~3000 RT courses/yr

**Clinical Staff**
- 11 Qualified Medical Physicists
- 18 Radiation Oncologists
- 4 Radiation Therapy Equipment Service Specialists.
- 2 Instrument makers
- 20 FTE Radiation Therapists in immobilization, treatment planning and simulation
- 45 FTE Radiation Therapists in treatment delivery