Centre universitaire de santé McGill

McGill University Health Centre

McGill

Medical Physics Unit
Unité de physique médicale

May 2015

Information Package

Residency in Radiation Oncology Physics

Address (from June 15th, 2015):

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General Information

The primary focus of the resident's experience shall be clinical training and educational activities. The program follows, as closely as possible the CAMPEP *Standards for Accreditation of Residency Educational Programs in Medical Physics (CAMPEP, rev 2104)*. The main objective of the McGill *residency training program (RTP) in radiation oncology physics* is to educate and train medical physicists in the practice of radiation oncology physics. Graduates of the program will gain the level of competency required to independently practice Radiation Oncology Physics. Specifically, the resident will gain the technical knowledge and skills to practice in a modern state of the art clinical facility, and will acquire an understanding of the necessary protocols and practices to operate safely in the radiation oncology milieu, while understanding the clinical usefulness and purpose of the advanced technologies used in the field. The resident will learn their role, and that of clinical physicists, and how to behave and to communicate professionally, and ethically, in a team multi-disciplinary, collaborative, clinical environment. The resident will learn problem solving skills for the clinical environment and be made aware of the importance of continuing education, and the evaluation of research and scholarship in the field. The residents will be made acutely aware of the importance of understanding that the field concerns it self with the treatment of patients and will understand the ethics and confidentiality issues.

An important objective of the residency-training program is to prepare the resident for the professional examination in radiation oncology physics that is given by the *Canadian College of Physicists in Medicine* (CCPM) and the *American Board of Radiology* (ABR).

The residency program is of 2-years duration and provides the resident with clinical experience and theoretical knowledge in all aspects of modern radiation oncology physics. The minimum requirement for admission is M.Sc. degree in Medical Physics; however, the preferred candidate will have a M.Sc. or Ph.D. degree in Medical Physics from a CAMPEP-accredited educational program in Medical Physics. The residency program consists of four rotations and a possibility of remediation in the form of didactic courses for candidates accepted from non CAMPEP graduate programs. **Only 2 courses will be able to be remediated as part of this program.**

The four rotations are as follows:

(1) *Basic Treatment Planning and Standard Treatment Techniques*
(2) *Advanced Treatment Planning and Special Treatment Techniques*
(3) *Quality Assurance and Radiation Protection*
(4) *Clinical Physics Practice and Clinical Physics Project*

Each rotation is followed by a comprehensive examination.

Two of the following 6 courses may be remediated. The courses are offered at the MUHC as part of the McGill University Medical Physics Unit CAMPEP accredited M.Sc. program in Medical Physics.

(1) *Radiation Physics (MDPH-601)*
(2) *Applied Dosimetry (MDPH-602)*
(3) *Health Physics and Radiation Protection (MDPH-613)*
(4) *Radiation Biology (MDPH-609)*
(5) *Introduction to Medical Imaging (MDPH-607)*
(6) *Physics of Diagnostic Radiology (MDPH-614)*

Requirements for Successful Program Completion

The residents complete the program after the following requirements are fulfilled:

- All four rotations completed in a minimum time of 24 months.
- All four rotation examinations passed.
- Final examination passed.
- Successful completion of remedial coursework (if required).
- Completion of self directed anatomy course.
- Satisfactory attendance record at all prescribed seminars organized by the Medical Physics and Radiation Oncology departments.
- The resident has completed the above requirements while behaving in a professional and ethical manner, respecting colleagues, staff members, and patients, demonstrating appropriate industry, competence, responsibility, and learning abilities.

General program regulations

Working conditions

- For the 2-year duration of the training the resident is considered a staff member of the respective hospital department and has the same rights, privileges and obligations as the permanent staff members, with the exception that the resident's position is classified as a temporary 2-year appointment.
- **Vacation allowance**: **20 working days/year**.
- **Statutory holidays**: **13 days/year**.
- **Sick days**: up to 0.8 days/month, i.e., **9.6 days/year**.
- **Remuneration**: as per signed contract.
- Office desk and computer: assigned upon start of residency.
- Open access to libraries, xerox machine, and fax machine for official use.
- **Grievances** are to be addressed to the program director who is also the Chairman of the Residency Training Committee.
- **Radiation safety** concerns should be addressed to the institutional Radiation Safety Officer (Class II).
- **Normal working hours** are **08:30-16:30**; occasional evening and weekend work will be required to gain experience with QA procedures and equipment commissioning carried out by staff medical physicists.
- Scheduling of rotations, end-of-rotation examinations, research colloquium, and vacation time is arranged with the clinical coordinator.

Formal evaluation of resident performance

The residency program consists of four rotations, each of 6 months duration. To complete a rotation the resident must spend the prescribed amount of time on each rotation and meet the clinical competencies associated with each sub-rotation. The

resident is guided through the various aspects of each rotation by the resource staff assigned to each rotation and the site clinical coordinators.

The evaluation of the resident comes in two forms, through a continual informal assessment by the supervising physicists for each rotation, and by oral exams given shortly after each rotation is complete as well as a final oral exam. The assessment by staff during the resident's rotation is particularly important in the evaluation of the resident's attitude, professionalism, and work ethics.

The examinations are organized by the clinical coordinator and conducted by an examination committee consisting of the clinical coordinator and two faculty members appointed by the clinical coordinator. Each element of the rotation (listed in the rotation syllabus) has an oral examination question associated with it. The oral examination questions are selected from a question bank by the clinical coordinator. The pass mark for each rotation is 70%, the grading system is as follows:

- "P" Pass
- "I" Incomplete (partial pass)
- "F" Fail

At the end of the examination, the examination committee grades the candidate in a private session and the final grade is the average grade for the three examiners. A grade I by two or three examiners results in grade I for the examination and the resident is expected to take the examination in whole or in part (whichever applies) again within one month. Three incomplete results for the same rotation examination would result in failure F. A failed rotation has a potential for dismissal from the program, after the particular situation is discussed in a residency training committee meeting and extenuating circumstances (if any) are considered. The grading sheets that form part of the resident's file are given in *Appendix J*. After every examination, the clinical coordinator debriefs the resident,

and areas of improvement in terms of subject knowledge as well as examination techniques are pointed out.

Resident feedback

Residents are asked for feedback continuously through the program. There are several mechanisms for this:

- one-on-one meetings with the clinical coordinator and/or the director
- report of the senior resident to the residency program steering committee
- mid-rotation evaluations
- end of rotation evaluations
- end of program survey

Self directed readings and reference materials

The resident is expected to use appropriate literature to supplement their learning experience. A list of reference books is available to them, and most of the books are in the medical physics library at the MUHC. Other directed readings are related to the teaching sessions and can include the relevant ICRU, AAPM, and IAEA documents. The list of reference books is given in the clinical rotation summaries. **It is the resident's responsibility to seek out any documentation necessary to successfully acquire any knowledge required within a rotation.**

Residents' issues and concerns

The senior resident, program director, and clinical coordinator present resident's issues and concerns at the program steering committee meeting. The issues are discussed and recorded in the minutes of each committee meeting. A plan is formulated and presented to the residents soon after in one of the weekly teaching sessions.

Dismissal from the program

The resident may be dismissed at any time from the program, after due process and at the discretion of the Residency Program Training Committee, if the resident fails to demonstrate the appropriate learning ability, competence or ethical behavior. Specifically 3 repeated failures of a rotation or final examination, or failures of a remedial course can result in dismissal. Notwithstanding the above, if the any staff involved with the program feels the resident is at risk, the program director and clinical coordinator are informed and every effort is made to “coach” the resident through any difficulties. Additionally, the resident can be dismissed if he/she breaches any of the employer’s conditions for employment or codes of conduct or is released from employment by the institution.

Residency Training Program Committee

Voting members:

Co-Chairs:

William Parker, *M.Sc., FCCPM, Program Director*

Jan Seuntjens, *Ph.D., FCCPM, FAAPM, Graduate Program Director*

Secretary:

Emilie Soisson, *Ph.D., CMD, MCCPM, DABR*

Clinical Coordinator:

Horacio Patrocinio, *M.Sc., FCCPM, DABR*

Physics Members:

Russell Ruo, *M.Sc., MCCPM, DABR*

Michael D.C. Evans, *M.Sc., FCCPM*

Francois DeBlois, *Ph.D., FCCPM (JGH site coordinator)*

Normand Frenière, *Ph.D., MCCPM (CHRTR site coordinator)*

Jean Francois Carrier, *Ph.D., MCCPM (CHUM site coordinator)*

Fréderic Lacroix, *Ph.D., MCCPM (CHUQ site coordinator)*

Lawrence Reinstein, *Ph.D., DABMP (SPH site coordinator)*

Physician Members:

Tarek Hijal, *M.D., FRCPC*

Treatment Planning Dosimetry:

Christopher Kaufmann, *R.T. (A.C.), CMD (Dosimetry Coordinator)*

Non-Voting members:

Resident representative:

Senior resident

MPU graduate program secretary:

Margery Knewstubb

The residency-training program is governed by the Residency Training Program Committee (RTPC). The committee is co-chaired by the residency training program director and the graduate program director. The committee consists the co-chairs, a clinical coordinator, a program secretary, several senior medical physicists, a physician member, the chief dosimetrist, as well as a physicist from each of the affiliated hospitals. The senior resident (MUHC) is invited as a resident representative to relevant portions of the committee meetings, and asked to bring any feedback or concerns the residents might have. The role of the committee is to oversee the program operation in its entirety, specifically:

- Set and review the residency program curriculum
- Review resident performance
- Review resident feedback
- Set the timeline and schedules for the residents
- Participate in the examination and evaluation of residents
- Evaluate potential candidates for the residency positions

The committee has a minimum of 2 meetings per year. The minutes of each meeting are maintained. Other ad-hoc meetings can be called at any time to discuss different aspects of the program.

Staff List - MUHC

Academic Staff (McGill University - Medical Physics Unit)

Administrative Assistant
Margery Knewstubb

Medical Physicists
Jan Seuntjens, PhD, FCCPM, FAAPM (Associate Professor, Director MPU)
Shirin Enger, PhD (Associate Professor)

Clinical Staff (MUHC - Montreal General Hospital)

Administrative Officer
Tatjana Nisic, MA

Medical Physicists
William Parker, MSc, FCCPM (Chief, Department of Medical Physics, MUHC, Assistant Professor)
Michael Evans, MSc, FCCPM (Radiation Safety Officer, Class II, MUHC, Assistant Professor)
Horacio Patrocinio, MSc, FCCPM, DABR (Assistant Professor)
Emilie Soisson, PhD, CMD, MCCPM, DABR (Assistant Professor)
Russell Ruo, MSc, FCCPM, DABR (Lecturer)
Maritza Hobson, PhD, MCCPM, DABR
Marija Popovic, PhD, MCCPM
Emily Poon, PhD, MCCPM
John Kildea, PhD, MCCPM
Steve Davis, PhD, MCCPM, DABR
Marija Popovic, PhD, MCCPM
Gyorgy Heygi, PhD (Medical Imaging Physicist – Diagnostic Radiology)
Ives Levesque, PhD (Medical Imaging Physicist – MRI)

Dosimetrists
Chris Kaufmann, RTT, CMD (Chief Dosimetrist)
Cenzetta Procaccini, RTT
Irene Belanger, RTT
Line Comeau, RTT, CMD
Loudmila Dychant, RTT
Francesco Paolino, RTT, BSc
Maria Papageorgiou, RTT

Support Staff
Joe Larkin (Engineer)
Bhavan Siva, BEng (Engineer)
Suzana Darvasi, BSc (Information systems technician)

MAJOR RADIOTHERAPY EQUIPMENT LIST: McGILL UNIVERSITY HEALTH CENTRE (Glen Site, opens June 2015)

	Equipment	Features
	Accelerators	
6	Varian Truebeam	120 DMLC, EPID (aSi), OBI, CBCT, resp gating, IMRT, VMAT
2	Varian Truebeam STX (Novalis)	120 HDMLC, EPID (aSi), OBI, CBCT, resp gating, Exactrack, IMRT, VMAT, SRS cones
1	Accuray Cyberknife M6 FIM	Cones, Iris, MLC
	Simulators	
3	Philips Brilliance Big Bore CT-Sim	4DCT, 16 slice, Ultrasound guided prostate localization
1	Philips Ingenia 3T MRI Sim	3T MRI simulator, 70cm bore, LAP laser bridge
	Brachytherapy	
1	Elekta Nucletron HDR microselectron V3	30 channels
	Information system	
1	Varian ARIA 11	Clinic operates in a paperless environment, enterprise licensing, CITRIX deployment
	Treatment Planning	
46	Varian Eclipse 11	24 Calculation, 20 Contouring, 2 teaching stations, Smart Segmentation
3	Brain Lab iPlan V4	
2	Oncentra MasterPlan Brachytherapy	
2	Accuray Multiplan	
2	MimVista advanced contouring	

DESCRIPTION OF CLINICAL ROTATIONS
for RADIATION ONCOLOGY PHYSICS RESIDENTS

Clinical Rotation 1

Basic Treatment Planning and Standard Treatment Delivery Techniques

Resource faculty:

Rotation Coordinator: Emilie Soisson and Site Clinical Coordinator

Purpose:

To familiarize the resident with all basic aspects of radiotherapy treatment planning and treatment delivery. The rotation duration is 6 months and is divided into three sub-rotations: (1.1) Simulation (1 month); (1.2) Basic training in treatment planning (2 months), and; (1.3) Clinical treatment planning (3 months).

Objectives:

- The resident will be familiarized with the radiation oncology information system including the electronic charting aspects, treatment planning system, and transfer of information.
- The resident is introduced to basic and intermediate treatment planning concepts (ICRU 50, 62, 83).
- The resident will aid dosimetrists and MDs in contouring of target volumes, normal tissues, organs at risk, and critical structures.
- The resident will learn virtual simulation and simple planning concepts for palliative cases.
- The resident will learn 3D conformal radiation therapy (3D CRT) treatment planning techniques and basic IMRT and plan assessment and evaluation
- The resident will work full time in the “planning room” for a minimum period of 3 months as a dosimetrist producing 3D CRT and IMRT treatment plans.

Schedule:

1.1 Simulation

The resident will become familiar with:

1.1.1 Patient positioning and immobilization:
Standard radiotherapy treatment positioning, immobilization techniques, use of fiducial markers, tattooing, and marking of patients.

1.1.2 Treatment simulation:
Principles of treatment simulation and patient data acquisition. Differences between conventional and virtual (CT-based) simulation.

1.1.3 Target and structure delineation:
The contouring of target structures and organs at risk following the ICRU 50, 62 and 83 document guidelines for organ and target definition.

1.1.4 Field definition:
Basic treatment techniques and concepts including: SSD direct field setups, SAD isocentric setups, AP/PA beams, lateral opposed fields, mounted blocks, multileaf collimator, field matching techniques.

1.1.5 Simulation techniques for curative intent cases:
Tangential breast irradiation, tangential breast and supra-clavicular lymph node irradiation, head and neck, lung, whole CNS, Hodgkin lymphoma, seminoma.

1.1.6 Simulation techniques for palliative intent and emergency cases:
Whole brain irradiation, irradiation for various bone metastatic sites, irradiation for superior vena cava (SVC) syndrome, and irradiation for spinal cord compression.

1.1.7 Treatment time and monitor unit calculations
Manual calculations based on simulation data.

1.2 Basic training in treatment planning

The resident will become familiar with:

1.2.1 Data transfer and planning tools including:
The basic operation of the treatment planning computer including data transfer, beam placement, block and MLC design, dose calculation, and printing.

1.2.2 Prescription, evaluation, and dose reporting guidelines:
The ICRU 50, 62 and 83 documents and guidelines for treatment plan evaluation and dose reporting.

1.2.3 Basic 2D/3D treatment planning concepts including:
Basic treatment planning techniques including the use of multiple fields, static wedges, dynamic wedges, field weighting, field-in-field compensation, bolus, basic plan evaluation, and dose volume histograms (DVH).

1.2.4 Basic IMRT treatment planning concepts including
Optimization techniques, DVH based planning constraints, plan evaluation. Clinical issues for beam geometry selection.

1.2.5 3D and/or IMRT Treatment planning techniques for the following sites:

Central nervous system (CNS)
- *Whole brain*
- *Brain tumors*
- *Whole CNS irradiation*

Head and neck
- *Nasopharynx*
- *Oropharynx*
- *Hypopharynx*
- *Larynx*
- *Parotid tumors*
- *Thyroid*

Gastro-intestinal (GI)
- *Upper GI – esophagus*
- *Gastric*
- *Lower GI – rectum, anal canal*

Lung

Genito-urinary (GU)
- *Prostate*
- *Bladder*
- *Seminoma*

Gynecological (GYN)

Breast
- *Tangential irradiation*
- *Tangential and supra-clavicular*

Lymphoma

Mantle irradiation for Hodgkin's lymphoma
Para-aortic irradiation

Sarcoma

Sarcoma of the extremities

1.2.6 Clinical trials treatment planning and electronic submission

1.3 Clinical treatment planning

1.3.1 Clinical aspects of treatment planning:
The resident will perform treatment planning duties as part of the facility's treatment planning service under the supervision of the treatment planning coordinator or site coordinator.

1.3.2 Clinical treatment delivery (treatment room):
The resident will spend 5 days on a treatment unit (dual energy linear accelerator with electron beam capability) or a variety of treatment units and observe the treating technologists perform their routine work including chart checks, patient setup, treatment delivery, production of treatment records, and the entering of treatment parameters into the record and verify system.

1.3.3 Clinical treatment planning and delivery of electron beams:
The resident will become familiar with all aspects of treatment planning, setup, delivery, and dosimetric considerations for electron beam treatments.

1.3.4 Clinical treatment planning and delivery of superficial, orthovoltage, and supervoltage beams:
The resident will become familiar with all aspects of treatment planning, setup, delivery, and dosimetric considerations for kilovoltage x-ray beam treatments.

Relevant reports:

ICRU reports: 50, 62, 83
AAPM TG reports: 34, 63, 70, 114

Radiation Therapy Committee Task Group #34 Management of Radiation Oncology Patients with Implanted Cardiac Pacemakers (Reprinted from Medical Physics, Vol. 21, Issue 1) (1994)

Radiation Therapy Committee Task Group #63 Dosimetric considerations for patients with HIP prostheses undergoing pelvic irradiation. Medical Physics, Vol. 30, Issue 6

Work Group on Radiation Dosimetry Task Group #70 Recommendations for clinical electron beam dosimetry: Supplement to the recommendations of Task Group 25
Medical Physics, Vol 36, Issue 7

Work Group on Information Technology Task Group #114 Verification of monitor unit calculations for non-IMRT clinical radiotherapy: Report of AAPM Task Group 114
Medical Physics, Vol 38, Issue 1

Clinical Rotation 2

Advanced Treatment Planning and Treatment Delivery Techniques

Resource faculty:

Rotation Coordinator: Russell Ruo and Site Clinical Coordinator

Purpose:

To familiarize the resident with advanced treatment planning techniques. The rotation consists of 2 sub-rotations: (2.1) Brachytherapy treatment planning and dose delivery, and (2.2) Advanced external beam treatment planning and dose delivery techniques. The residents are expected to pass through both sub-rotations concurrently as the brachytherapy schedule is variable.

Objectives:

- The resident will learn treatment planning and QA procedures for various advanced radiotherapy treatment techniques including: Intensity modulated radiation therapy (IMRT), Stereotactic body radiation therapy (SBRT), and Stereotactic radiosurgery (SRS).
- The resident will learn treatment planning, delivery, and QA techniques for total body irradiation (TBI) and total skin electron irradiation (TSEI).
- The resident will learn radiation safety concepts in brachytherapy treatments.
- The resident will learn how to treatment plan and perform QA for various types of brachytherapy cases.

Schedule:

2.1 Brachytherapy treatment planning and dose delivery

The resident will become familiar with:

2.1.1 High dose rate brachytherapy (HDR) basics:
All aspects of high dose-rate brachytherapy treatment delivery, radiation safety, and emergency procedures.

2.1.2 Treatment time calculations for HDR brachytherapy:
Dose rate tables for pre-determined source configurations, for simple arrangements and using nomograms.

2.1.3 2D Treatment planning for HDR brachytherapy:
Treatment planning using single or orthogonal radiographic films. E.g. Esophagus, lung, vaginal vault treatments.

2.1.4. 3D Treatment planning for HDR brachytherapy:
Treatment planning using CT, MR, or CBCT images for complex sites such as Breast, ENT, GYN, lower GI, extremities, and liver.

2.1.5 Eye treatments:
Treatment planning and delivery for choroidal melanoma eye-plaque treatments with I-125 or Ru-106 and Pterygium treatments using Sr-90.

2.1.6 LDR brachytherapy (not practiced at the Program site or satellites)*
Treatment planning and delivery for LDR brachytherapy.

2.1.7 Permanent implants
Treatment planning and delivery for permanent implants of prostate cancer with I-125 and Pd-103.

*2.1.6 implies only theoretical knowledge, since the technique is not practiced within the Program's sites.

2.2 Advanced external beam treatment planning and delivery techniques

The resident will become familiar with the theoretical and practical aspects of (including quality assurance):

2.2.1 Single fraction stereotactic radiosurgery (SRS)
SRS treatment planning, dose calculations, QA, and treatment delivery. Localization techniques using invasive frames, mask systems, infrared, and x-ray imaging based equipment. Use of cone based systems, high-

resolution multi-leaf collimators, IMRT, and VMAT for SRS applications. CyberKnife planning.

2.2.2 Multi-fraction stereotactic radiotherapy (SRT)
Multi-fraction SRT treatment planning, dose calculations, QA, and treatment delivery. Localization techniques using mask systems, infrared, and x-ray imaging based equipment. Use of cone based systems, high-resolution multi-leaf collimators, IMRT, and VMAT for SRT applications.

2.2.3 Stereotactic Body Radiation Therapy (SBRT)
SBRT principles for lung, liver, and spine treatments. 4DCT Simulation, immobilization systems for SBRT, abdominal compression. Planning concepts including ITV definition and radiation biology and normal tissue tolerance for hypo fractionated or single fraction SBRT. Localization techniques using CBCT and x-ray imaging based equipment. Use of multi-leaf collimators, IMRT, and VMAT for SBRT applications. Gating and other motion management techniques.

2.2.4 Advanced Inverse planned Intensity Modulated Radiation Therapy (IMRT)
Helical Tomotherapy planning and delivery vs. fixed gantry vs. VMAT. Preparation of QA procedures.

2.2.5 Image Guided Radiation Therapy (IGRT)
Basic concepts and principles behind IGRT. Use of CBCT, MVCT, EPID, kV x-ray imaging, and ultrasound systems for IGRT.

2.2.6 Total body photon irradiation (TBI)
Treatment planning and concepts of TBI. Review of techniques for large field photon irradiation, requirement for a robust back-up technique, calibration of TBI beams, dose and monitor setting calculations.

2.2.7 Total skin electron irradiation (TSEI)
Treatment planning and concepts of TSEI. Review of techniques for large field electron irradiation, requirement for a robust back-up technique, calibration of TSEI beams, dose and monitor setting calculations.

2.2.8 Intra-operative radiation therapy (IORT)*
IORT principles for conventional linac based IORT, electron applicators, docking procedures, output measurements, dosimetry, and treatment room preparation. X-ray source based IORT. Mobile units, radiation safety in hospital ORs.

2.2.9 Respiratory gating and motion management systems
4DCT simulation with various systems, immobilization, gated treatment delivery, free breathing and breath-hold techniques. Gating and tracking with x-ray systems.

*2.2.8 Electron based IORT is covered only through theoretical knowledge, since the technique is not practiced at the main center or the satellite centers.

Relevant reports:

ICRU reports: 50, 62, 83
AAPM TG reports: 29, 42, 43, 56, 59, 64, 72, 75, 76, 84,101, 104, 137

Radiation Therapy CommitteeTask Group #29 The Physical Aspects of Total and Half Body Photon Irradiation

Radiation Therapy Committee Task Group #30 Total Skin Electron Therapy: Technique and Dosimetry

Radiation Therapy Committee Task Group #42 Stereotactic Radiosurgery

Radiation Therapy Committee Task Group #43 Dosimetry of Interstitial Brachytherapy Sources (Reprinted from Medica Physica, Vol. 22, Issue 2)

Brachytherapy Subcommittee Workgroup on Low Energy Brachytherapy Source Dosimetry Update of AAPM Task Group No. 43 Report: A revised AAPM protocol for brachytherapy dose calculations. Medical Physics, Vol. 31, Issue 3

Radiation Therapy Committee Task Group #56 Code of Practice for Brachytherapy Physics (Reprinted from Medical Physics, Vol. 24, Issue 10)

Radiation Therapy Committee Task Group #59 High Dose-Rate Brachytherapy Treatment Delivery (Reprinted from Medical Physics, Vol. 25, Issue 4)

Radiation Therapy Committee Task Group #64 Permanent Prostate Seed Implant Brachytherapy (Reprinted from Medical Physics, Vol. 26, Issue 10)

Radiation Therapy Committee Task Group #72 Intraoperative radiation therapy using mobile electron linear accelerators

Therapy Imaging Subcommittee Task Group #75 The management of imaging dose during image-guided radiotherapy: Report of the AAPM Task Group 75 Medical Physics, Vol 34, Iss 10

Radiation Therapy Committee Task Group #76 The Management of Respiratory Motion in Radiation Oncology

Brachytherapy Subcommittee Workgroup on Low Energy Brachytherapy Source Dosimetry Supplement to the 2004 update of the AAPM Task Group No. 43 Report

Treatment Delivery Subcommittee Task Group #101 Stereotactic body radiation therapy: The report of AAPM Task Group 101
Medical Physics, Volume 37, Issue 8

Task Group 104 of the Therapy Imaging Committee The Role of In-Room kV X-Ray Imaging for Patient Setup and Target Localization: Report of AAPM Task Group 104

Low Energy Brachytherapy Source Dosimetry Work Group Task Group #137 AAPM recommendations on dose prescription and reporting methods for permanent interstitial brachytherapy for prostate cancer: Report of Task Group 137

Clinical Rotation 3

Quality Assurance and Radiation Protection

Resource faculty:

Rotation Coordinator: Stephen Davis and Site Clinical Coordinator

Purpose:

To familiarize the resident with quality assurance (QA) techniques and radiation protection issues applicable to a radiation therapy facility. The rotation consists of two sub-rotations: (3.1) Quality assurance (5 months) and (3.2) Radiation Safety (1 month).

Objectives:

- The resident will be familiarized with all aspects of quality assurance including: Comprehensive QA programs, QA equipment, QA measurement techniques, acceptance and commissioning, QA audits, and absolute dosimetry.
- The residents will be familiarized with the following aspects of radiation protection as applied to radiation oncology: radiation safety programs, regulations, licensing, radiation safety issues, and basic radiotherapy facility design.
- The residents will be familiarized with all aspects of ethics and professional issues as applied to the practice of radiation oncology physics.

Schedule:

3.1 Quality Assurance

The resident will become familiar with:

3.1.1 QA program:
All aspects of the quality assurance program in the medical physics and radiation oncology department.

3.1.2 Guidelines for radiation oncology QA programs:
The AAPM TG reports 40, 45, 142, describing quality assurance procedures for radiation oncology facilities in general and linear accelerators in particular.

3.1.3 QA equipment:
The resident will become proficient with the use of all required equipment for QA procedures including: ionization chambers, electrometers, XV film and film scanner, radiochromic film and densitometer, thermo-luminescent dosimetry (TLD), and 3D water phantom and isodose plotter.

3.1.4 QA measurement:
The resident will assist in all aspects of scheduled quality assurance including daily, weekly, monthly, bi-annual, and annual QA procedures.

3.1.5 Technical specification, acceptance testing, and commissioning of treatment units.

3.1.6 Technical specification, acceptance testing, and commissioning of treatment planning systems.
The resident will participate either in the real commissioning of a radiotherapy beam or alternatively, will commission a “mock” beam in a treatment planning system and conduct a validation of this beam (expect work time ~2 weeks)

3.1.7 Clinical reference dosimetry:
Implementation of the AAPM TG-51 or IAEA TRS-398 protocol.

3.1.8 External QA audits:
Radiological physics center (RPC), protocols, quality assurance review center (QARC).

3.1.9 Reference and absolute dosimetry:
Dealing with issues related to securing the calibration of secondary standard dosimeters in a standards laboratory, TG-51 calibration.

3.1.10 QA of imaging systems:
Basic quality assurance and functional testing of imaging systems used in radiation therapy (CT, MRI, MVCT, CBCT, Simulator).

3.1.11 IMRT QA dosimetry:
Preparation, delivery, and analysis of patient specific IMRT QA procedures.

3.1.12 SRS small field dosimetry:
Dealing with issues related to the measurement of sub-centimeter fields, choice of detectors, proper technique, and relevant correction factors.

3.1.13 In-vivo dosimetry:
Dealing with issues related to the measurement of dose on/in patients. Use of TLD, films, MOSFETS and other relevant dosimeters.

3.2 Radiation protection

The resident will become familiar with:

3.2.1 Radiation safety program:
All aspects of the radiation safety program in the medical physics and radiation oncology departments.

3.2.2 Regulations:
The relevant regulations and legislation (local, provincial, federal) applicable to the medical physics and radiation oncology department.

3.2.3 Licensing:
Licensing requirements for a CNSC Class II radiation facility and specific radiation devices and sources.

3.2.4 Radiation safety issues:
Radiation safety issues with workers in the radiation oncology department including personnel monitoring, exposure reports, pregnancies, emergencies, lost dosimeters.

3.2.5 Facility design:
Facility design and radiation surveying techniques.

3.3 Ethics and professional issues

3.3.1 Ethics:
Basic ethics, medical physics code of conduct, privacy, etc.

3.3.2 Professional issues:
Professional organizations, certification bodies, protection of the public, professional insurance, legal issues, institutional accreditation.

Relevant reports:

AAPM TG reports: 40, 45, 51, 58, 61, 62, 65, 66, 74, 105, 106, 109, 119, 128, 142, 148, 159, 160
AAPM report 82, 86

Radiation Therapy Committee Task Group #40 Comprehensive QA for Radiation Oncology (Reprinted from Medical Physics, Vol. 21, Issue 4)

Radiation Therapy Task Group #45 AAPM Code of Practice for Radiotherapy Accelerators (Reprinted from Medical Physics, Vol. 21, Issue 7)

Radiation Therapy Committee Task Group #51 Protocol for Clinical Dosimetry of High-Energy Photon and Electron Beams (Reprinted from Medical Physics, Vol. 26, Issue 9)

Radiation Therapy Committee Task Group #58 Clinical use of electronic portal imaging (Reprinted from Medical Physics, Vol. 28, Issue 5)

Radiation Therapy Committee Task Group #61 AAPM protocol for 40–300 kV x-ray beam dosimetry in radiotherapy and radiobiology.
Medical Physics, Vol. 28, Issue 6

Radiation Therapy Committee Task Group #62 Diode in Vivo Dosimetry for Patients Receiving External Beam Radiation Therapy

Radiation Therapy Committee Task Group #65 Tissue Inhomogeneity Corrections for Megavoltage Photon Beams

Radiation Therapy Committee Task Group #66 Quality assurance for computed-tomography simulators and the computed-tomography-simulation process. Medical Physics, Vol. 30, Issue 10

Therapy Physics Committee Task Group #74 Report of AAPM Therapy Physics Committee Task Group 74: In-air output ratio, Sc, for megavoltage photon beams Medical Physics, Vol 36, Issue 11

Work Group on Treatment Planning Task Group #105 Report of the AAPM Task Group No.105: Issues associated with clinical implementation of Monte Carlo-based photon and electron external beam treatment planning Medical Physics, Vol 34, Issue 12

Therapy Physics Committee Task Group #106 Accelerator beam data commissioning equipment and procedures: Report of the TG-106 of the Therapy Physics Committee of the AAPM. Medical Physics, Vol 35, Issue 9

Ethics Committee Task Group #109 Code of Ethics for the American Association of Physicists in Medicine: Report of AAPM Task Group 109

Work Group on IMRT Task Group #119 IMRT commissioning: Multiple institution planning and dosimetry comparisons, a report from AAPM Task Group 119
Medical Physics, Vol 32, Issue 11

Ultrasound Subcommittee Task Group #128 Quality assurance tests for prostate brachytherapy ultrasound systems: Report of Task Group 128. Medical Physics, Vol 35, Issue 12

Quality Assurance and Outcome Improvement Subcommitte Task Group #142 Task Group 142 report: Quality assurance of medical accelerators Medical Physics, Vol 36, Issue 9

Working Group on Recommendations for Radiotherapy External Beam Quality Assurance Task Group #148 QA for helical tomotherapy: Report of the AAPM Task Group 148 Medical Physics, Vol 37, Issue 9

Ethics Curriculum Task Group #159 Recommended ethics curriculum for medical physics graduate and residency programs: Report of Task Group 159

Government and Regulatory Affairs Task Group #160 Radiation Safety Officer Qualifications for Medical Facilities: Report of Task Group 160

Radiation Therapy Committee IMRT Subcommittee Guidance document on delivery, treatment planning, and clinical implementation of IMRT: Report of the IMRT subcommittee of the AAPM radiation therapy committee.
Medical Physics, Vol. 30, Issue 8

Radiation Therapy Subcommittee on Quality Assurance Physics for Cooperative Trials Quality Assurance for Clinical Trials: A Primer for Physicists

Clinical Rotation 4
Clinical Physics Practice and Clinical Project

Resource faculty:

Rotation Coordinator: Horacio Patrocinio and Site Clinical Coordinator

Purpose:

The resident will assist in the daily clinical physics tasks required in the radiation oncology and medical physics departments. The resident will also work on a clinical physics project and prepare a report detailing the specifics of the project. The rotation duration is 6 months and it is expected that the resident will work on the project simultaneously with clinical work.

Objectives:

- The resident will work full time as a clinical medical physicist (supervised).
- The resident may embark on a clinical project or research idea.

4.1 Clinical Rotation

4.1 Clinical practice:
The resident will provide clinical physics support with minimal supervision in the radiation oncology and medical physics departments including: Treatment planning, treatment plan verification, treatment delivery support, treatment setup verification, routine quality assurance, and brachytherapy.

4.2 Clinical Project

4.2 Project:
The resident will undertake a collaborative clinical/physics project with a radiation oncology resident (or a radiation oncologist if the institution does not have a medical residency program). A written report will be presented to the department upon completion of the project.

4.3 Clinical Project Colloquium

4.3 Colloquium:
The resident will present the clinical project (section 4.2) at a medical physics residency-training session.

Recommended general literature for Radiation Oncology Physics Residents

1. Bentel, Gunilla: "**Radiation Therapy Planning**", Second edition, McGraw-Hill, New York, New York (1995).

2. Chao, Clifford KS; Perez, Carlos; Brady, Luther: "**Radiation Oncology Management Decisions**", Second edition, Lippincott, Williams and Wilkins, Baltimore, Maryland (2002).

3. Johns, Harold E; Cunningham, John R: "**The Physics of Radiology**", Fourth edition, Thomas, Springfield, Illinois (1984).

4. Khan, F: "**The Physics of Radiation Therapy**", Third edition, Williams and Wilkins, Baltimore, Maryland (2003).

5. Khan, Faiz M; Potish, Roger A (Editors): "**Treatment Planning in Radiation Oncology**", Williams and Wilkins, Baltimore, Maryland (1998).

6. Podgorsak, Ervin B (Editor): "**Review of Radiation Oncology Physics: A Handbook for Teachers and Students**"; International Atomic Energy Agency (IAEA), Vienna, Austria (2005). The book is also available at www.medphys.mcgill.ca/iaeabook/

7. Van Dyk, Jake (Editor): "**The Modern Technology of Radiation Oncology: A Compendium for Medical Physicists and Radiation Oncologists**", Medical Physics Publishing, Madison, Wisconsin (1999).

8. *BRITISH JOURNAL OF RADIOLOGY*, Supplement **25**, "**Central Axis Depth Dose Data for Use in Radiotherapy**", The British Institute of Radiology, London, U.K. (1996).

9. *INTERNATIONAL COMMISSION ON RADIATION UNITS AND MEASUREMENTS*, ICRU Report **50**, "**Prescribing, Recording, and Reporting Photon Beam Therapy**", ICRU, Bethesda, Maryland (1993).

10. *INTERNATIONAL COMMISSION ON RADIATION UNITS AND MEASUREMENTS*, ICRU Report **62**, "**Prescribing, Recording, and Reporting Photon Beam Therapy (Supplement to ICRU Report 50)**", ICRU, Bethesda, Maryland (1999).

11. *INTERNATIONAL COMMISSION ON RADIATION UNITS AND MEASUREMENTS*, ICRU Report **58**,"**Dose and volume specification for reporting interstitial therapy**", ICRU, Bethesda, Maryland (1997).

12. *INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION* (ICRP), Publication 60, " **Recommendations of the ICRP on Radiological Protection**", Annals of the ICRP **21** (1-3), Pergamon Press, Oxford, U.K. (1991).

Sample meetings and conferences for residents

The following is an example of the required attendance at departmental meetings at the MUHC. A similar plan is to be prepared for satellite facilities. The medical physics residency training session is compulsory for all residents regardless of site.

	MON	TUE	WED	THUR	FRIDAY
08:00	Rad. Onc. Rounds (1)	Patient Management Rounds (2 or 10)	Patient Management Rounds (3)		
09:00					Med. Phys. Research Seminar (7)
10:00					
11:00					
12:00					Medical Physics Colloquia (8)
13:00					
14:00		Med. Phys. Meeting (4,5)			Medical Residents Clinical (9)
15:00		Physics Residents Clinical (6)			
16:00					

1. Radiation Oncology Rounds (Scientific or clinical presentations, 1 hrs/wk)
2. Curative Patient Management Rounds (chart rounds, 1 hrs/wk)
3. Palliative Patient Management Rounds (chart rounds, 1 hrs/wk)
4. Medical Physics Departmental meeting (Administrative meeting, 0.5 hrs/wk)
5. Medical Physics Clinical meeting (Clinical cases/issues, 0.5 hrs/wk)
6. Medical Physics Residency teaching session (Teaching, 1.5 hrs/wk)
7. Medical Physics Research Seminar (Seminar, 1 hr/wk)
8. Medical Physics Colloquia, Osler Amphitheatre MUHC (Seminar, 1hr/month)
9. Radiation Oncology Residents teaching session (teaching, 2hrs, when relevant)
10. Patient Management Rounds JGH Rad Onc meeting room (chart rounds, 1 hrs/wk)