



Molecular imaging and Therapeutics (Radiotheranostics) Fellowship Program at University of Toronto

About Molecular imaging and Therapeutics Fellowship at U of T

This is a cross department clinical fellowship, approved jointly by the Department of Medical Imaging and Radiation Oncology at University of Toronto. The fellowship is located at the University Health Network, Princess Margaret Cancer Center and Toronto General Hospital sites. Its administrative home is Department of Radiation Oncology.

Supervision

Accepted fellows will be supervised jointly by Drs. Rebecca Wong (radiation oncology) and Patrick Veit Haibach, Ur Metser (Medical Imaging)

Fellowship Duration

This is a two year fellowship subject to availability of funding and trainee learning objectives. Enrolment into a one year fellowship will be considered on an individual basis.

Fellowship duration

Fellowship typically start Jul 1 of each year.

Eligibility

Physicians who have completed specialty training are eligible. Candidates within 5 years of specialty qualification in nuclear medicine is most suited for this position. Holders of specialty qualification in radiation oncology, medical oncology, surgical oncology are also eligible.

Funding

This is a funded position subject to funding availability. Interested candidate with grant funding support and host institution funding support is welcome to apply.

Program Overview

This cross department clinical fellowship can be undertaken in two streams. For Nuclear Medicine trained physicians and Radiation Oncology Trained physicians.

For Radiation Oncology trained physicians

We offer a “mix and match” 1 year fellowship with 6 months of Molecular Imaging and Therapeutics and 6 months of disease site based radiation oncology. The Molecular Imaging and Therapeutics experience will be primarily focused in therapeutics, and the application of



molecular imaging as applied in guiding radiotherapy treatment design and its current and potential applications in adaptive radiotherapy.

During the 6 months in molecular imaging and therapeutics, we anticipate approx. 40% of the fellow's schedule will be assigned to radiation oncology and molecular therapeutics delivery and dosimetry, 10% dedicated to nuclear medicine focused activities, and 40% s dedicated to research including protocol design, study implementation, data collection and monitoring, analysis and interpretation and knowledge dissemination.

At the completion of the fellowship, we anticipate (s)he will have an enhanced understanding of the principles of molecular oncology imaging and therapeutics (radiopharmaceuticals) and will be able to apply them in clinical practice as part of a multidisciplinary radiotheranostics team. (S)he will also have an enhanced understanding of the principles and methodology commonly used in clinical research in radiotheranostics.

For nuclear medicine trained physicians

We offer a 2 year fellowship structured to provide the Fellow with practical and research experience in molecular guided imaging and therapeutics in oncology. Molecular imaging techniques commonly employed in oncology clinical practice include planar imaging, SPECT/CT imaging and hybrid PET imaging (PET/CT) with widespread applications in diverse cancers for diagnosis, staging and treatment monitoring. Other emerging technologies include PET-MR, advanced MR applications (e.g. IVIM, ASL, BOLD) and molecular ultrasound imaging.

PET/CT has been included into the workflow for external beam radiotherapy treatment planning including the implementation of adaptive radiotherapy. Molecular oncology guided therapeutics using radiopharmaceuticals for the treatment of malignancies, focus on the use of radioligand therapy for the treatment of cancer in clinical situations such as (but not limited to) peptide radionuclide therapy (PRRT) in neuroendocrine tumors, radioligand therapy for the treatment of prostate cancer (e.g. Lu-PSMA), radioactive iodine therapy for thyroid cancer as well as radionuclide therapy for lymphoma and bone metastases in prostate cancer. The methodology to understand the dosimetric impact of theranostics in terms of treatment response and toxicity prediction is rapidly evolving and being included into clinical practice.

Approximately 60% of the fellows' time is dedicated to clinical skills and knowledge in clinical molecular imaging and therapeutics, including participation in relevant multidisciplinary tumor boards, and 40% is dedicated to research including protocol design, study implementation, data collection and monitoring, analysis and interpretation and knowledge dissemination. Rotations will consist of 2-3 month blocks in diagnostic molecular imaging, radiation oncology, research and elective. We anticipate approximately half of the fellows' rotations will be spend in the nuclear medicine department and half will be in the clinical oncology departments.



The fellow will work under the supervision, and within the clinical departments of medical imaging and radiation oncology. The interprofessional team the fellow will work will include diagnostic imaging, radiation oncology, medical and surgical oncology, pharmacy, radiopharmacy, radiation safety, clinical trials program, and other allied health professionals.

At the completion of the fellowship, we anticipate (s)he will have an enhanced understanding of the principles of molecular oncology imaging and therapeutics (radiopharmaceuticals) and will be able to apply them independently in the setting of molecular imaging diagnosis and treatment of patients. (S)he will also have an in-depth understanding of the principles and methodology commonly used in clinical research of the modalities mentioned above with a focus on hybrid PET-imaging modalities.

Through an immersive clinical experience in the use of molecular imaging within the departments of medical imaging and radiation oncology as described above, the fellow will gain:

- understanding of the indications, alternatives, and relative efficacy of commonly employed molecular imaging and therapeutics
- understanding of the decision making, clinical care and toxicity management of cancer patients receiving radiopharmaceuticals
- radiation safety, radiopharmacy (production, quality assurance) for patients and professionals
- radiation oncology applications of molecular imaging techniques
- dosimetric analysis techniques used in clinical application of radiopharmaceutical

Through participation in educational offerings as part of the residency and fellowship training programs and mentorship, the fellow will gain:

- a general understanding of clinical investigation designs suitable for enquiries into diagnostic properties of imaging tools, toxicity, efficacy and effectiveness of treatment interventions, qualitative and quantitative systematic reviews, guidelines development
- gain in depth skills in selected clinical investigation designs (as applicable to the fellow's selected research endeavors) including clinical trial design, trial monitoring, data management, interpretation and reporting,
- gain expertise in issues unique to the conducting and monitoring of clinical trials using radiopharmaceuticals.

Why a cross department fellowship ?



Nuclear Medicine specialty training includes the use of radiopharmaceuticals for imaging and therapeutics. The therapeutic component is typically general and basic in scope. In addition, significant growth is taking place in the discipline of theranostics.

Expertise in the delivery of radiopharmaceuticals for the treatment of cancer patients requires in depth expertise that is not provided in a traditional nuclear medicine curriculum. This expertise exists in the nuclear medicine department and radiation oncology, radiation safety, pharmacy departments within University Health Network and University of Toronto as well as external organizations such as CPDC (Center for Probe Development in Cancer) and CanProbe. This cross institution and departmental collaboration is active in the clinical delivery of theranostics based at University Health Network, making it an ideal and unique environment to offer this cross department fellowship.

The specific expertise include:

- a detailed understanding in the differential diagnosis and management of the complications and comorbidities post treatment. Theranostics are indicated in multiple disease site groups including endocrine, neuroendocrine tumors (gastrointestinal & lung), lymphoma and prostate cancer
- the developmental pipeline for theranostics, from the design of radiopharmaceuticals, compounding for clinical use
- radiobiology, medical physics principles as it relates to its mechanism of action are useful for excellence in clinical care
- principles and tools available for tumor segmentation, dose quantification and emerging machine learning applications
- general research skills required for clinical trials design to support research and development of theranostics
- responsibilities as a principal investigator in both diagnostics and therapeutics

About Princess Margaret Cancer Center & The Joint Department of Medical Imaging

Princess Margaret Cancer Center is one of the top 5 cancer centers globally, with comprehensive medical imaging and radiation oncology departments. The radiation oncology department provides over 9100 consults and over 11,000 courses of treatment courses annually. It is home to the largest radiation oncology fellowship program globally. Of its 36 radiation oncologists, 3-4 are actively involved in the delivery of radiopharmaceuticals (Drs Rebecca Wong, Aruz Mesci, Jelena Lukovic, Michael Yan), and one (of its 30) physicist are and one (of its 196) therapist are actively involved in the treatment delivery.

The Joint Department Medical Imaging is the largest academic imaging department in Canada. The Toronto JDMI offers imaging and interventional services at all sites at the University Health Network, including Toronto General Hospital, Princess Margaret Hospital, Toronto Western Hospital, Toronto Rehab as well as Woman's College Hospital and Mount Sinai Hospital. Overall,



3 PET/CT, 11 SPECT/CT and 1 PET/MR scanners are operating within this framework. The clinical PET program is a growing program in Ontario and there are currently over 3500 PET-examinations performed at UHN last year, with an increase of 10-15 % annually. There are more than 15 prospective trials ongoing in PET/MR and numerous multicenter, individual researcher led and industry led PET/CT trials involving various radiopharmaceuticals including FDG, FLT, 68Ga-DOTATATE, PSMA, FAZA and others. Furthermore, the JDMI molecular imaging division is partnering with the pharmaceutical industry in multiple trials, including first in human trials. The Center for Probe Development and Commercialization at the University of Toronto delivers standard clinical as well as experimental tracers for JDMI. Overall, currently there are eight radiopharmaceuticals in regular use.

Application Process

Since this fellowship is intended to be personalized based on the primary specialty of the potential candidate, Interested candidates is strongly encouraged to contact the primary supervisors to discuss training objectives

Rebecca.wong@rmp.uhn.ca
Patrick.Veit-Haibach@uhn.ca
Ur.Metser@uhn.ca

or

contact the fellowship program office at radonc.fellowship@utoronto.ca



Fellowship objectives – CanMEDS Roles

Medical Expert

As Medical Experts, physicians integrate all of the CanMEDS Roles, applying medical knowledge, clinical skills, and professional attitudes in their provision of patient-centered care. Medical Expert is the central physician Role in the CanMEDS framework

At the completion of the fellowship, the fellow will

- have an understanding in diagnosis and management of standard indications for molecular oncology imaging and therapeutics (theranostics) including neuroendocrine tumors, prostate cancers, thyroid cancers with special focus on treatment decision making, treatment alternatives, management and follow up outcomes assessment in patients who are candidates for treatment using radiopharmaceuticals
- have an in-depth understanding of the indications, implementation, interpretation of molecular imaging techniques including planar nuclear medicine imaging, SPECT/CT and especially hybrid PET-imaging (PET/CT and PET/MR)
- have an understanding of the potential applications of PET-MR and the use of PET in radiotherapy planning and delivery (Radiotherapy planning and adaptive radiotherapy)
- have an in depth understanding of the principles of designing and conducting clinical research using molecular imaging techniques and therapeutics (radiopharmaceuticals)
- have an in depth understanding of the radiopharmacy, radiation safety, quality assurance, dosimetry principles, medical biophysics considerations as it relates to the application of molecular imaging and theranostics (radiopharmaceuticals).

2. Communicator

As Communicators, physicians effectively facilitate the doctor-patient relationship and the dynamic exchanges that occur before, during, and after the medical encounter.

At the completion of the fellowship, the fellow will

- have an enhanced understanding of the doctor/patient relationship, and the importance of effective communication with special focus on the use of radiopharmaceuticals, risks and benefits and radiation safety concerns
- recognize the potential barriers to effective communication, with special focus on cultural diversity and needs
- be aware of the need for effective written communication, and understand the environment of accountability and transparency which allows family and patients to have access to their medical records

3. Collaborator



As Collaborators, physicians effectively work within a healthcare team to achieve optimal patient care.

At the completion of the fellowship, the fellow will

- have a profound understanding of the need for effective interdisciplinary and interprofessional collaboration necessary to care for patients requiring molecular imaging techniques and therapeutics (radiopharmaceuticals)
- -will have an in-depth understanding of the role and expertise of all members of the multidisciplinary team in both the ambulatory and inpatient settings
- -will have a patient centered approach to care
- will have an understanding of the multidisciplinary expertise required to build an effective molecular imaging program for the delivery and investigation of molecular imaging and therapeutics (radiopharmaceuticals)

4. Manager

*As Managers, physicians are integral participants in healthcare organizations, organizing sustainable practices, making decisions about allocating **resources**, and contributing to the effectiveness of the healthcare system.*

At the completion of the fellowship, fellow will

- have an enhanced understanding of the effective utilization of resources necessary to provide multimodality therapy for oncology patients requiring molecular imaging and molecular therapeutics (radiopharmaceuticals).
- have an enhanced understanding of the treatment options for oncology pts suitable for molecular therapeutics (Radiopharmaceuticals)
- balance the prioritize of the various responsibilities of teaching, learning, consultation, research
- -demonstrate the ability to manage time effectively when conducting a clinic assessment or an assessment in both the ambulatory and in-patient settings

5. Health Advocate

As Health Advocates, physicians responsibly use their expertise and influence to advance the health and well- being of individual patients, communities, and populations.

The fellow will have the ability to

- balance the role of a navigator and patient advocate in order to provide optimal patient centered care.
- be aware and demonstrate advocacy for resources (including community) available appropriate care to patients' functional status.



- -be aware of the methodology available to evaluate the relative cost effectiveness of health care with specific focus on molecular imaging and therapeutics

6. Scholar

As Scholars, physicians demonstrate a lifelong commitment to reflective learning, as well as the creation, dissemination, application and translation of medical knowledge.

The fellow will

- have an enhanced understanding of the role of life-long learning as a care provider for oncology patients
- participate in knowledge generation and translation through developing skills in (but not limited to) protocol design, trial implementation, data management, analysis, presentation, publication, guidelines development

7. Professional

As Professionals, physicians are committed to the health and well-being of individuals and society through ethical practice, profession-led regulation, and high personal standards of behavior.

Will have an enhanced understanding and demonstrated behaviors in ethical practice, personal standards of behavior and compliance to profession led regulations to provide the highest quality of expert care