

THE UNIVERSITY OF THE WITWATERSRAND,



JOHANNESBURG, SOUTH AFRICA



**NUCLEAR MEDICINE RESIDENCY TRAINING
PROGRAMME**



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If a man empties his purse into his head, no one can take it away from him. An investment in knowledge always pays the best interest.

- **Benjamin Franklin**

Acquire new knowledge whilst thinking over the old, and you may become a teacher of others

- **Confucius**

One whose knowledge is confined to books and whose wealth is in the possession of others, can use neither his knowledge nor wealth when the need for them arises.

- **Chanakya**

**REGISTRARS' STANDARD OPERATING PROCEDURE
DEPARTMENT OF NUCLEAR MEDICINE (CMJA & CHBA HOSPITALS)
UNIVERSITY OF THE WITWATERSRAND**

STARTER REGISTRAR* 1 - 6 months		
Duties	Learning objectives / Outputs	Measurable
<p>1. Hot lab & in-vitro lab rotation</p> <p style="text-align: center;">2-weeks</p>	<p>1. Observe, learn about the radiopharmacy principles, elution, sterile technique, radiation safety.</p> <p>2. Introduction to the gamma counter and principles of in-vitro labelling of radiopharmaceuticals.</p> <p>3.</p> <p>4. Familiarize concepts such as:</p> <ul style="list-style-type: none"> - Molybdenum and aluminium breakthrough - Quality assurance methods - Instant thin layer chromatography - How to deal with a radiation spill: large and small 	<p>After the rotation: Be able to <u>demonstrate to a consultant</u>:</p> <ol style="list-style-type: none"> 1. How to elute a generator 2. How to prepare a required radiopharmaceutical, with guidance, using sterile techniques. 3. Adherence to radio-safety principles: time, distance, shielding. 4. Technique must be in place: gloves, lab coat etc.
<p>2. Rotation through camera rooms</p> <p style="text-align: center;">2-weeks in each (total of 4-weeks)</p>	<p>Observe Being able to assist with positioning of the patient on the bed (pay attention on pediatric patients, particularly neonates and the neutral position for bone scan)</p> <p>Towards the end of the rotation, be able to assist with imaging parameters / imaging acquisition</p>	<p>After the rotation: Be able to <u>demonstrate to a consultant</u>:</p> <ol style="list-style-type: none"> 1. Courteous patient interaction 2. Be able to extend the bed and position the patient appropriately 3. Basic camera functions – rotate and position head

<p>3. PET/CT rotation</p> <p>2-weeks</p>	<p>Observe; learn about principles of PET/CT imaging, F-18 FDG production, Ge-68/Ga-68 generator.</p>	<p>After the rotation: <u>Be able to demonstrate to a consultant:</u></p> <ol style="list-style-type: none"> 1. Differences in PET and SPECT imaging; transmission and emission scans. 2. Essentials of patient preparation
<p>4. General duties:</p> <p>End of 8th week – 6 months</p>	<ol style="list-style-type: none"> 1. <u>Under a senior registrar:</u> patient bookings, review request forms with seniors, assist with patient preparation, thyroid ca presenting preparation, MPI clerking, assist with stressing after 3 months 2. From 3 months onwards: basic teaching from consultant in the reporting room: introduction to basic nuclear medicine terminology, assessing a scan, report structure, relevant tracer, uptake mechanism, basic reporting skills 3. May administer RAI after permission from a consultant, may administer thyrogen 	<p><u>Feedback from the senior registrar will be obtained at 6 months</u> if the “starter registrar” attended to these duties and if there are any areas lacking.</p> <p>The consultant will write a simple report after the 6 months reflecting:</p> <ol style="list-style-type: none"> 1. Was the registrar present at teaching? 2. Did the registrar show interest / initiative during teaching? 3. Did the registrar apply the knowledge imparted during the teaching sessions?

JUNIOR REGISTRAR 7 – 24 months		
1. Administrative	<ul style="list-style-type: none"> - Review requests day before, - Obtaining additional information when required, - Instructions to radiographers, booking of patients. 	Assessed 6 monthly**
2. Reporting of scans	Evaluate scan quality, Studies being reported timeously, reporting of scans, formulate a provisional conclusion	Assessed 6 monthly
3. Meeting presenting	<ul style="list-style-type: none"> - Needs to be well prepared. - Needs to be of high quality. - Within the specified time. - Showing understanding. <p><i>Note: Review content and structure of presentation with Mentor prior</i></p>	Assessed during every presentation by all consultants present
4. Stressing of cardiac patients and therapy of patients	<ul style="list-style-type: none"> - Safe stressing of patients. - Safely treating patients 	Part of the 6-monthly assessment.
5. MMed	<ul style="list-style-type: none"> - Topic selection by 12 months - Protocol submission to ethics / post graduate committee / central government by 18 months 	Forms part of the 6-monthly assessment
6. Academic “protected” time	Time to be taken periodically for research (MMed) and personal development	Effective utilization of the allocated time, assessed 6-monthly

SENIOR REGISTRAR 25 months – 48 months		
1. Formal “hot lab”, in-vitro and camera room rotations 2-weeks	Consolidate on theoretical knowledge acquired in past 24 months and practically engage in necessary procedures.	Demonstrate practical aspects to a consultant
2. Administrative	<ul style="list-style-type: none"> - Review requests day before, - Obtaining additional information when required, - Instructions to radiographers, booking of patients 	Assessed 6 monthly
3. Reporting of scans	Evaluate scan quality, Studies being reported timeously, reporting of scans, formulate a provisional conclusion	Assessed 6 monthly
4. PET/CT reporting	Full reporting of at least 1/3rd of scans during the PET week rotation including formulation of a provisional conclusion.	Assessed 6 monthly
5. Meeting presenting	<ul style="list-style-type: none"> - Needs to be well prepared. - Needs to be of high quality. - Within the specified time. - Showing understanding. - - Review content and structure of presentation with consultant prior 	Assessed during every presentation by all consultants present
6. Stressing of cardiac patients and therapy of patients	<ul style="list-style-type: none"> - Safe stressing of patients. - Safely treating patients. 	Part of the 6-monthly assessment
7. MMed	Submission before 48 months	Forms part of the 6-monthly assessment

8. Academic “protected” time		Effective utilization of the allocated time, assessed 6-monthly
9. Mentorship / leadership	<ul style="list-style-type: none"> - Time to be taken periodically for research (MMed) and personal development - Mentoring / teaching junior registrars (in addition to consultants). 	Feedback from the junior registrars.

*A detailed outline of objectives as well as recommended study materials for guidance is attached.

** All consultants to provide feedback on registrars rotating in hospitals where they are based 6 monthly and all topics requiring such feedback. Consequently, registrars must print out their logbook and duly inform consultant of their end of rotation within two weeks for assessment.

This SOP is a working document subject to periodic modifications. It is scheduled for review every three years but may be reviewed earlier if deemed necessary.

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Version date: 30 November 2020
Effective date: 01 January 2021
Revision due date: November 2023

I..... have read this document.

I understand the duties expected of me and I am ready to demonstrate the learning objects/output whenever required.

.....
Date

STARTER REGISTRAR: OUTLINE OF INITIAL OBJECTIVES

HOT LAB ROTATION

1. Learn the principles of the radionuclide generator and elution.
2. Make notes of peculiarities of different radiopharmaceuticals in terms of incubation period, activity, maximum dilution volume, patient dose, stability/ shelf life etc. [A brief study of the package leaflets of the common pharmaceuticals /"cold kits" will be useful].
3. Common radionuclides: Half-life, type of emission, energy...
4. Learn the principle of 'tracer' QC and how it applies to common radiopharmaceuticals prepared in the hot lab.
5. Learn the basic principle of the dose calibrator.

The registrar is expected to elute the generator (at least twice) and prepare a radiopharmaceutical before the end of the rotation.

GAMMA CAMERA ROOM ROTATION

Familiarize yourself with the gamma camera; understand its components, their functions and how these all contribute to image formation.

FOR EACH INDIVIDUAL STUDY:

Name of study:

Radiopharmacy:

Radionuclide:

Radiopharmaceutical:

Route of administration:

Principle of localization:

Dose range (adult and paediatrics):

Clinical:

Indication {& contra-indication (s)}:

Patient preparation:

Pharmacological intervention(s) prior to or during study:

Image acquisition:

Collimator:

Patient and camera head(s) positioning:

Acquisition parameters: zoom, matrix size, time vs. counts

Acquisition procedure: e.g. immediate/ delayed (how long post injection?); flow/ static; frame rate; planar/SPECT; gating...

SPECT: Orbit type, degree of rotation, projections/rotation, frame rate, matrix, zoom, total time

Actual acquisition time:

Any artefacts noted on the image?

By the last week in each camera room, the registrar should have an opportunity to operate the gamma camera during image acquisition under the supervision of the radiographer(s).

PET ROTATION

Understand the principle of PET imaging and how it differs from that of the gamma camera.

Know the common positron emitters in use in Nuclear Medicine.

Radiopharmacy:

Focus is on F-18 / F-18FDG & Ga-68

Properties of F-18:

F-18 FDG: production and delivery (including the logistics with regard to patient imaging planning).

Ge-68/Ga-68 generator: properties of the parent and daughter radionuclides.

Observe elution of Ge-68/Ga-68 generator.

Clinical

Patient preparation:

- Study the departmental patient preparation sheet for F-18 FDG PET imaging.
- Learn about the uptake period and its significance in terms of instruction to patients.

Image acquisition

Protocols for different indications.

Contrast: route and time of administration, reason for its use.

Basic principle of CT and its importance in PET imaging.

STUDY MATERIALS RECOMMENDED BY THE DEPARTMENT

Introduction to basic atomic physics, radiopharmaceuticals and instrumentation

- Fred Mettler et al. *Essentials of Nuclear Medicine Imaging*. 6th Ed. 2012: **CHAPTERS 1 & 2**
- Harvey Zeissman et al. *Nuclear Medicine: The requisite*. 4th Ed. 2014: **CHAPTERS 1 – 5**

Radiopharmacy

- Kowalsky RJ *Radiopharmaceuticals in Nuclear Pharmacy and Nuclear Medicine*. 3rd Ed. 2011

Introduction to PET/CT

- Barrington SF et al. *Atlas of Clinical Positron Emission Tomography*. 2nd Ed. 2006 **CHAPTERS 1 – 3**
- Von Schulthess GK. *Molecular Anatomic Imaging [PET/CT, PET/MR & SPECT/CT]*. 3th Ed. 2016 **CHAPTERS 1 & 2**
- Lin E & Alavi A. *PET and PETCT: a clinical guide*. 3rd Ed. 2019. **CHAPTERS 1 – 4, 7 & 8**

General introduction to basic Nuclear Medicine

- Magdy M Khalid. *Basic Sciences of Nuclear Medicine*. 2011
- Andrew Taylor et al *A Clinician's guide to Nuclear Medicine*. 2nd Ed. 2000

Nuclear Medicine Physics

- *Cherry SR, Sorenson JA, Phelps ME. *Physics in Nuclear Medicine*. 4th ed. 2012
- Powsner RA, Powsner ER, *Essential Nuclear Medicine Physics*. 2nd Ed. 2008

Recommended journals:

- Journal of Nuclear Medicine <http://jnm.snmjournals.org>
- Seminars in Nuclear Medicine <https://www.sciencedirect.com/journal/seminars-in-nuclear-medicine>
- Clinical Nuclear Medicine <https://journals.lww.com/nuclearmed/pages/default.aspx>
- European Journal of Nuclear Medicine and Molecular Imaging <https://www.eanm.org/publicpress/journals/ejnmmi/>

Other resources (practice guidelines / consensus statements etcetera)

- Society of Nuclear Medicine & Molecular Imaging <https://www.snmami.org>
- European Association of Nuclear Medicine <https://www.eanm.or>

NOTE: Electronic copies of most of these books are available at the Department of Nuclear Medicine. Electronic access to the journals is available through the WITS University Library.

“It is unacceptable in current times that patients have to travel 200 kilometers or more just to have a thyroid or a bone scan, and continuing to do so will only help to entertain the narrow view that nuclear medicine is kind of an exotic field that is not offered to everybody.”

“...I am of the opinion that it is upon us to increase the awareness of our medical field and make sure that nuclear medicine is recognized by patients, referring physicians and all other decision makers in healthcare environment.”

“...it is about time that we engage all players from health policy makers to decision makers for a fair but practical distribution of nuclear medicine service in the country”

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Quotes from Prof MDT Vangu’s opening speech at the
15th biennial congress of SASNM