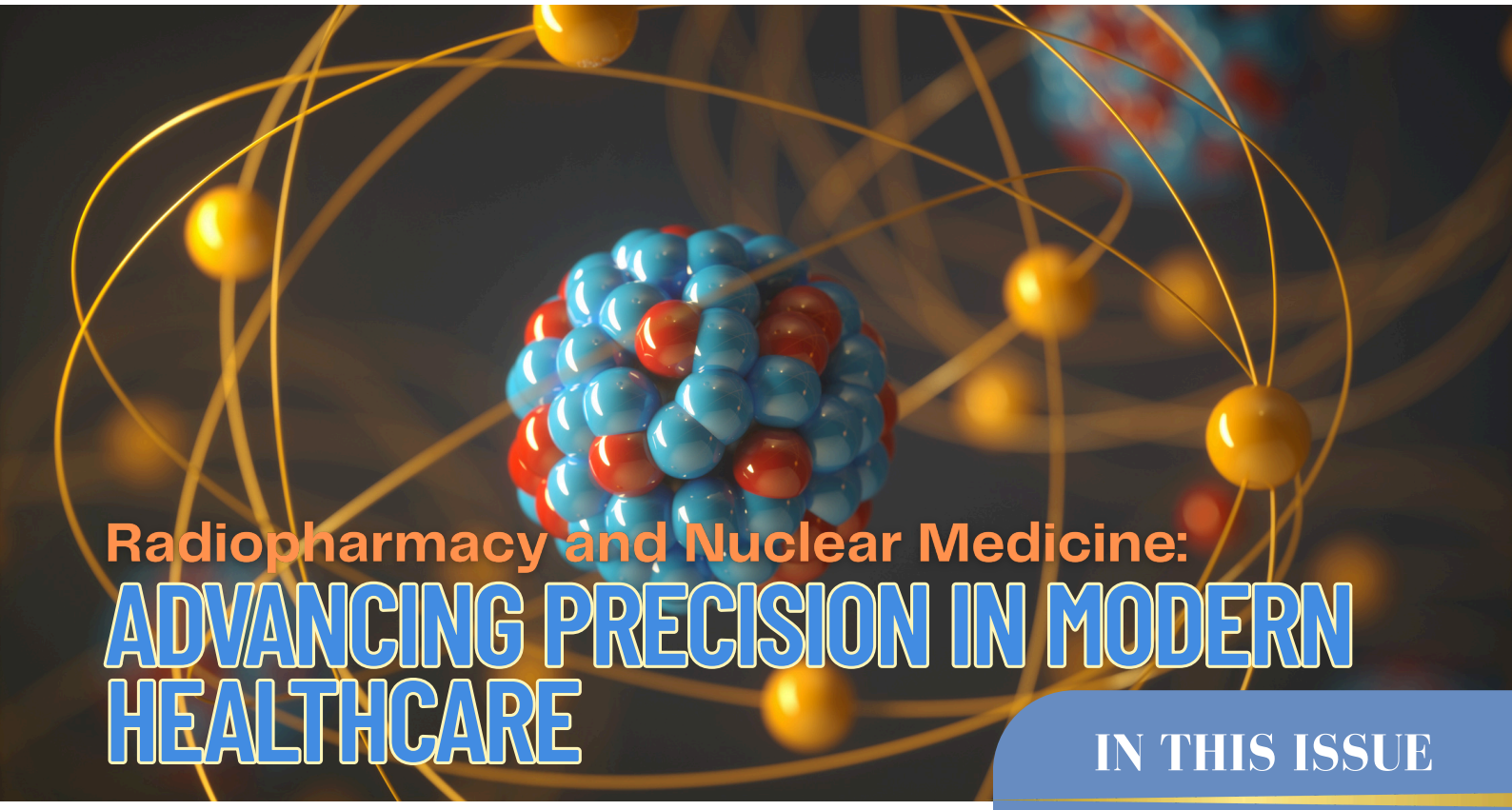
ISSUE 4 / 2025 APRIL 2025

PRESCRIPTION

Latest news and updates from the Faculty of Pharmacy, Universiti Teknologi MARA



Radiopharmacy and Nuclear Medicine: ADVANCING PRECISION IN MODERN HEALTHCARE

By: Dr. Muhamad Faiz Othman

Nuclear medicine stands at the vanguard of precision healthcare, driven by rapid advancements in radiopharmaceutical science. Once centered on a handful of diagnostic isotopes (Technetium-99m and Iodine-131), the field now embraces a wide array of targeted radiopharmaceuticals designed not only to image but also to treat complex diseases with molecular-level specificity.

The rise of theranostics — radiopharmaceuticals that combine diagnostic imaging and targeted therapy — has transformed clinical pathways in oncology, endocrinology, and beyond. Agents such as Lutetium-177 DOTA-TATE for neuroendocrine tumors and Lutetium-177 PSMA-617 for advanced prostate cancer represent a new standard of care. These agents enable personalised treatment, often offering meaningful clinical benefits where conventional therapies fall short.

IN THIS ISSUE

On the diagnostic front, innovations based on Gallium-68 and Fluorine-18 positron emission tomography (PET) tracers, including PSMA- and FAPI-based agents, have allowed earlier disease detection, more accurate staging, and real-time treatment response monitoring. The clinical utility of these agents has led to an expansion of nuclear medicine services in both hospital and outpatient settings.

At the heart of this innovation is the radiopharmacist — a highly specialised professional whose expertise defines what nuclear medicine services can safely and effectively be offered to patients.

Radiopharmacists are responsible for the preparation, quality assurance, and clinical support of radiopharmaceuticals. Their role begins at the radiopharmacy bench, where precision, sterility, and regulatory compliance are non-negotiable. Whether synthesising a short-lived PET tracer or labeling a therapeutic compound, the radiopharmacist ensures that every product delivered to the imaging suite or therapy ward meets strict pharmacopoeial and radiation safety standards.

Yet their role goes well beyond technical preparation. More than a technical role, radiopharmacists serve as critical links between chemistry, pharmacy, and clinical care. They help determine dosing strategies, provide input into imaging and therapy protocols, and ensure radiation protection for patients and staff. In institutions offering theranostic services, radiopharmacists are often the deciding factor in whether advanced radiopharmaceutical therapies can be implemented safely and sustainably.

The scope of nuclear medicine services—be it routine PET/CT imaging, peptide receptor radionuclide therapy (PRRT), or newer alpha-emitter therapies—is directly influenced by the radiopharmacy infrastructure and the competencies of its personnel. Thus, the presence of a skilled radiopharmacist not only enables the introduction of new technologies but also ensures their integration into routine clinical care with confidence and compliance.

Moreover, radiopharmacists contribute to research and innovation. They collaborate on the development of novel radiotracers, optimise labeling techniques, and support clinical trials—playing a pivotal role in translating scientific breakthroughs into practical, patient-centered solutions.

As nuclear medicine continues to evolve, radiopharmacists remain at the core of its safe, effective, and forward-looking practice. Their expertise directly shapes the services offered, the therapies introduced, and the confidence with which nuclear medicine teams operate. Investing in radiopharmacy capacity is not simply a technical requirement—it is a strategic move toward delivering personalised, high-impact care.

Radiopharmacy is not behind the scenes—it is the foundation on which modern nuclear medicine stands.

FAQS

Question: What are the main components of a radiopharmaceutical?

A radiopharmaceutical consists of three key components: a radionuclide, a chelator, and a carrier molecule. The radionuclide emits radiation for diagnostic or therapeutic purposes. The chelator securely binds the radionuclide to the carrier, especially for metallic isotopes like Lutetium-177 or Gallium-68. The carrier—typically a peptide, antibody, or small molecule—targets specific biological structures, directing the radiopharmaceutical to the site of interest. This design enables precise imaging or treatment with minimal impact on surrounding healthy tissues.

Question: Where do Malaysia stand in terms of nuclear medicine service?

Malaysia has made significant progress in the field of nuclear medicine over the past two decades. The country now hosts a growing number of nuclear medicine centers, primarily located in major public hospitals and select private institutions. These centers offer a wide range of diagnostic services using SPECT, SPECT/CT, and increasingly, PET/CT imaging. The production of PET radiopharmaceuticals such as Fluorine-18 FDG is supported by several cyclotron facilities operating under Good Manufacturing Practice (GMP) conditions.

Therapeutically, Malaysia has adopted advanced radiopharmaceuticals like Iodine-131, and Lutetium-177 DOTA-TATE, particularly in tertiary centers for treating thyroid disorders, neuroendocrine tumors, and bone metastases. While access to newer theranostic agents such as Lutetium-177 PSMA-617 is emerging, their routine clinical use remains limited by regulatory and cost-related factors.

Workforce development is ongoing, with efforts to train more nuclear medicine physicians, medical physicists, and radiopharmacists. However, there remains a shortage of trained personnel, uneven distribution of services between urban and rural areas, and the need for stronger integration of nuclear medicine into national cancer care pathways.

Question: Is it safe to receive radioactive treatment/ diagnosis?

Yes, nuclear medicine procedures — both diagnostic and therapeutic — are generally safe when performed under proper medical supervision. The amount of radiation used is carefully calculated to be as low as possible while still achieving accurate results or effective treatment. Diagnostic procedures, such as PET and SPECT scans, involve low radiation doses comparable to or even less than some CT scans. Therapeutic procedures use higher doses, but these are targeted and administered in controlled environments, often with temporary isolation protocols to ensure safety for others.

All radiopharmaceuticals used are approved by regulatory authorities and handled by trained professionals, including nuclear medicine physicians, radiopharmacists, and radiation safety officers. The benefits — such as early diagnosis, accurate staging of disease, or targeted treatment — far outweigh the minimal risks when the procedure is clinically indicated.

ABOUT THE AUTHOR

Dr. Muhamad Faiz Othman is a passionate researcher in the field of nuclear medicine, with a particular focus on radiopharmacy, radiation biology, and radiation science. His research interests also extend to clinical pharmacy, pharmaceutical services, and social pharmacy. In addition to serving as a senior pharmacy lecturer at Universiti Teknologi MARA (UiTM), he is a trained nuclear pharmacist. Dr. Faiz earned both his PhD in Radiobiology (2020) and his Master's degree in Radiopharmacy (2008) from King's College London.