Innovative research and applications for radioactive tracers

Nuclear Medicine and Molecular Imaging is a medical division at Gasthuisberg UZ/KU Leuven. It aims at high-quality second and third-line specialized molecular diagnostic imaging, focusing on quantitative emission tomography (PET and SPECT) and the development of novel radionuclide-based therapy.

Diagnostic Procedures

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The division performs approximately 20,000 diagnostic procedures per year, including skeletal scintigraphy (43%), PET oncology (31%), cardiology (6%), infection (5%), brain (4%), lung (2%), and kidney (2%) imaging. Additionally, it conducts around 400 radionuclide therapies annually for thyroid disease, liver cancer, neuroendocrine tumours, prostate cancer, and neuroblastoma.

The camera park consists of two PET-CT and one simultaneous PET-MR scanner, four SPECT(-CT) systems, and preclinical equivalents (microPET/SPECT/CT/MR). “Besides patient care, the division actively educates and innovates: during the last decade, it published over 500 papers and secured over 30 million euros in funding,” says team leader Prof. Dr. Koen Van Laere.

MIRaCLe

Alongside the Laboratory for Radiopharmaceutical Research (Prof. Guy Bormans) at KU Leuven, the division started the Molecular Imaging Research and Clinic Leuven (MIRaCLe) as a structural cooperation between nuclear medicine, radiopharmacy, and medical imaging. “MIRaCLe integrates probe development with highly sensitive techniques of PET combined with other anatomo-functional imaging modalities for state-of-the-art human and animal research to foster novel radioligands for therapeutic use,” says Van Laere.

MIRaCLe aims at continuous improvement and innovation in health care as it enables fundamental and academic research as well as contract research for radiopharmaceutical and drug development. Together with major pharmaceutical companies, MIRaCLe is building a library of PET probes that can accelerate drug development. “We have already used more than 60 probes in this way,” adds Van Laere.

Ambitions

Largest European Supplier

MIRaCLe also aims to increase the European supply of radiopharmaceuticals. Van Laere explains, “With the cyclotron at UZ, we can manufacture many pharmaceuticals using 18F (fluorine) and 11C (carbon) ourselves under full GMP (Good Manufacturing Practice) conditions. Sixteen ‘world-first’ tracers have been developed and validated for human use in Leuven, including 18F-MK6240 (tau protein) and 18F-flutemetamol (amyloid protein), used in combination for Alzheimer’s disease.

UZ Leuven is the largest producer in Belgium and distributes radioligands to twelve other hospitals and research centres. In 2025, a new, larger production facility named ‘Imagination’ will become operational, featuring an additional cyclotron. We are already one of the leading suppliers in Europe, but this will triple our production capacity and increase our research capabilities while expanding our portfolio, including 89Zr (zirconium) for immunotherapy selection and monitoring.”

Cancer Therapy

The Department is increasingly focusing on cancer treatment as well as diagnosis. “We want to combine therapeutic isotopes (α- and β-emitters) with probes that target cancer cells, delivering them directly to tumours for precise irradiation. We are also expanding our treatment capacity with ten treatment rooms at UZ Leuven.

Belgium is at the forefront of medical isotope and tracer research in Europe. With partner institutions such as the SCK in Mol, we aim to develop and produce novel ligands for therapy, including 225Ac (actinium) and terbium-based probes,” says Van Laere.

Total Body Imaging

Another ambition is the installation of a large-field PET scanner capable of scanning the whole body within a minute. “This technique will allow simultaneous examination of all tissues with very high contrast, enabling the detection of very small lesions, such as tumour metastases, that might be missed with current equipment.”

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