NURA/SCK CEN
Mol, Belgium

Preclinical evaluation of novel theranostic radiopharmaceuticals with emerging radionuclides. Focus on radiobiology, chemistry and dosimetry

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1. PRISMAP biomedical facility: NURA/SCK CEN

The NURA research programme features up and coming state of the art research infrastructure for preclinical radiopharmaceutical research, with direct access to different radionuclides acquired from the SCK CEN BR2 research reactor.

The radionuclides from the PRISMAP portfolio that are already approved in the NURA/SCK CEN biomedical facility are listed in Table 1. Additional radionuclides can be made available upon request. A complete list can be requested at helpdesk@prismap.eu.

Table 1: PRISMAP radionuclides already approved for use in the NURA/SCK CEN facility.

Radionuclide	Remark
Tc-99m	Immediately usable
Tb-161	Immediately usable. Dose calibrator and gamma counter normalized and calibrated for this radionuclide. Quantitative imaging with µSPECT-CT and digital autoradiography.
Lu-177	Immediately usable. Dose calibrator, gamma counter and microSPECT normalized and calibrated for this radionuclide. Quantitative imaging with µSPECT-CT and digital autoradiography.
Re-188	Immediately usable
Bi-213	Gamma counter protocol available for quantification (also without secular equilibrium) Quantitative imaging with µSPECT-CT and digital autoradiography.
Ac-225	Gamma counter protocol available for quantification (also without secular equilibrium). Quantitative imaging with µSPECT-CT and digital autoradiography.

NURA/SCK CEN is equipped to conduct preliminary preclinical research with novel radionuclides and radiotracers. A new and fully equipped research facility is being constructed and will be operational at the beginning of 2024.

1.1 Radiochemistry

- Radioisotope development & production
  - Development of innovative radionuclides for radiopharmaceuticals
  - Development of a process of large-scale isotope production (Lu-177, Tb-161)
- Radiopharmacy (radiolabelling techniques and chelator design)
  - Development of innovative techniques for conjugating radionuclides to carriers
  - Development of innovative radiopharmaceuticals & early evaluation

1.1.1 Radiopharmacy labs

- Radiopharmaceutical development
- Radiolabeling & quality control (iTLC, MiniGITA, Elysia Raytest), Automated gamma counter (2470 Wizard2, Perkin Elmer), HPLC (waters)
- *In vitro* evaluation (dedicated lead shielded BSC), Incubator, plate reader
- 5 Fume hoods (some fitted with schlenck lines)
- Shielded Biosafety cabinet for cell work
- Extended bench space
- Dose calibrator (VIK-202 ionisation chamber; Comecer)
- Centrifuge
- Table top autoradiography scanner (end of 2023)
- Plate reader

1.1.2 (Radio-)chemical analysis

- α- and γ-spectrometry

- Liquid scintillation counting
- O/N/H combustion analysis
- Mass spectrometry (ICP-AES, UV-VIS, IR)
- Total (in-)organic carbon (TIC/TOC)

1.2 Preclinical evaluation

1.2.1 Preclinical Research Facility (Q1 2024)

- Dedicated facility to preclinically evaluate radiopharmaceuticals with longitudinal follow up of treated animals
- Biosafety cabinet
  - *In vitro* evaluation of radiopharmaceuticals on different cell types
- Live cell imaging (Incucyte®)
- µSPECT-CT (U-SPECT6CT, Milabs) with high energy collimator (specs in table 2)
- Automated gamma counter (2480 Wizard2, Perkin Elmer)
- Fidelis secondary standard radionuclide calibrator
- Cryostat
- Digital autoradiography (BeaQuant, ai4r) for quantification of α and β particles.
- Animal housing (with quarantaine area)
- Dedicated labs
  - Preparation room (sterile preparation of injectables)
  - Dissection room
  - Imaging room with µSPECT-CT
  - Cell culture lab
  - Histology lab (HIC, ARX, ...)
  - Molecular lab (DNA extraction, PCR, …)
  - Microscopy

Table 2 summarises the microPET and SPECT detector specifications.

Table 2: microPET and SPECT detector specifications.

Scanner	Modality	Detector technology	Collimators	File type	Reconstruction algorithm	Animal	Gating
U-SPECT6-CT	SPECT-CT	Digital Anger Camera, 3 stationary detectors NaI(TI) 472x595 mm each, 55 PMTs, combination 3" & 2 Energy range: 20 – 480 keV	M5 SPECT collimator (GP-M with 0.6 mm pinholes) M7 high-energy collimator (HE-GP-M with 1.4 mm pinholes)	List mode or raw data. Dynamic capabilities in planar mode	Pixel-based Ordered Subset Expectation Maximization (POSEM) Bi-213, Tc-99m, In-111-dedicated reconstruction matrices available Photopeaks and energy windows can be modified by the user	1 animal. ECG, respiration temperature monitoring. Heating pad. Isoflurane	Cardiac or respiratory

For further technical details, please contact our helpdesk at: helpdesk@prismap.eu.

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