

An interview with Prof. Hugo LEVILLAIN,

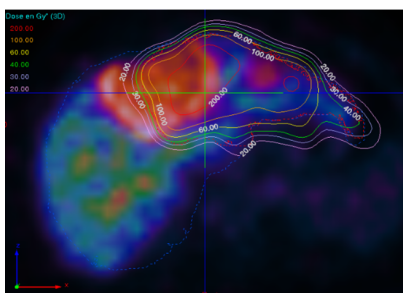
Medical Physicist – Head of R&D, Medical Physics Department – Hopital Universitaire de Bruxelles,

Co-director of the Radiophysics and MRI physics laboratory, Faculty of Medicine ULB,

Director of NuMix, Center of Microscopy and Molecular Imaging (CMMI)

Could you tell us about the ULB Medical Physics Lab?

Created in 2021, the ULB Medical Physics Lab, the academic extension of the medical physics department of the Brussels University Hospital, works in close collaboration with the departments of Nuclear Medicine, Radiology and Radiotherapy of the Brussels University Hospital. It also has strong links with industry (IBA, Elekta, GE Healthcare and Siemens). Its team of around twenty researchers, including five postdoctoral fellows and ten PhD students, is firmly rooted in a hospital-university ecosystem. The lab focuses on oncology, the integration of medical physics innovations into clinical workflows, and the development of personalised and innovative care models.



What about the ULB Medical Physics Lab's research activities?

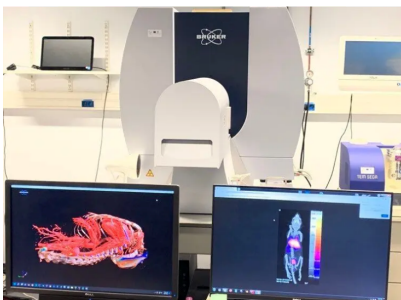
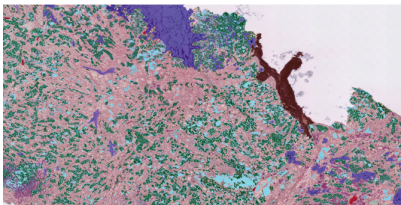
The Medical Physics Lab is developing 4 main areas of research. The first is the development of theranostics (the fusion of diagnosis and therapy) in close collaboration with the Nuclear Medicine Department of the Brussels University Hospital, with the development of vectors marked by radioactive isotopes. The team specialises in

characterising the imaging properties and therapeutic efficacy of these agents, supported by advanced quantitative imaging analysis (PET and SPECT) and precision dosimetry. The overarching goal is to optimise treatment planning and improve patient outcomes by translating research into clinical practice.

Second area: external radiotherapy, with the development of new technologies for instance flash radiotherapy (see [the work of Dr. Sébastien Penninckx](#)), and the implementation of advanced image-guided radiotherapy (IGRT) techniques, such as MR-guided radiotherapy (MRI-Linac) and 4DCT, which allow for real-time treatment adaptation and more precise targeting of tumours, while sparing healthy tissue.

The third area is AI-based data science research, with the development of prognostic and predictive models based on imaging, pathology, immunology, etc. Here, the aim is to create robust, standardised databases in order to develop AI models that will improve patient care, customise treatments and patient selection.

The fourth research axis focuses on medical 3D printing, used to develop personalised devices, anatomical models, and innovative solutions for complex clinical needs. One example is the creation of custom external breast prostheses, designed to enhance patient comfort after surgery.



You are also heading the NuMix Laboratory...

Indeed. Created in 2015 and with a staff of 4 researchers, NuMix is part of the Center for Microscopy and Molecular Imaging (CMMI), an interfaculty platform (ULB-UMONS) located in the Gosselies biopark. This laboratory specialises in preclinical in vivo imaging

using ionising radiation and translational imaging for characterisation, the development of new radiotracers and the validation of industrial processes for radiotracer production. To do this, NuMix uses nuclear medicine and radiology techniques (PET, SPECT and CT scan).

Over the past two years, it has been involved in around twenty academic and industrial projects. For instance, two of these recent projects have been funded by the Walloon BioWin competitiveness cluster: FAR (development of radiopharmaceuticals labelled with alpha emitters and radiolabelling methods evaluated in vivo and in vitro – with Trasis as the coordinating industry) and Aerovid (supported by Aquilon Pharma for the development of a treatment for respiratory diseases, with imaging at NuMix used to characterise and evaluate the drug's effectiveness).

Could you give us some examples of ongoing research projects?

Teams from the Medical Physics Lab and the NuMix laboratory are currently participating in two major European projects, both winners of the 'IHI – Innovative Health Initiative' call launched in 2023 by the European Commission to strengthen Europe's position in this strategic area. These are public-private partnerships involving academic and industrial players. The first project is Accelerate.EU. Scheduled to run from 2024-2029, is under the leadership of the Jules Bordet Institute (coordinator) with Prof. Hugo Levillain (principal coordinator) and IBA (coordinating industry). In all, 17 public and private partners from 9 European countries are involved. The project has a budget of €16 million, with the aim of increasing patient access to alpha therapies. Unlike beta emitters, which emits electrons, alpha emitters emits much larger particles (helium atoms) whose greater effectiveness holds immense promises but has yet to be proven. With this in mind, the project has a dual objective: to increase European production capacity for astatine-211, an isotope obtained using specific cyclotrons developed by IBA, and to develop radiopharmaceuticals associated with astatine-211.

Three cancers with high unmet medical needs have been selected: pancreatic cancer, triple-negative breast cancer and glioblastoma. The three molecular profiles chosen to treat them are at different stages of maturity: the preclinical stage for pancreatic cancer, the full pipeline (including preclinical and phase 1) for triple-negative breast cancer (with the FAPI molecule) and the phase I clinical trial for glioblastoma (substance P + astatine-211). Teams from the Medical Physics Lab and the NuMix laboratory are participating in the Preclinical work package and clinical study in triple-negative breast cancer sponsored by the Jules Bordet Institute as part of Accelerate.eu.

What does the second European project involve?

This project, Thera4Care, brings together 27 partners from 15 European countries under the leadership of the Gemelli hospital in Rome (Italy) and GE Healthcare. Funded by the Joint Undertaking IHI to the tune of €26 million, the project involves the Jules Bordet Institute-ULB, as one of the main beneficiaries, with Prof. Hugo Levillain (as local coordinator). The aim is to build a European ecosystem to develop and personalise theranostic treatments along two lines.

The first is to develop new radiopharmaceuticals to improve patient care. The team from NuMix laboratory is contributing to the Preclinical work package to validate the in vivo and in vitro behaviour of new radiopharmaceuticals and provide data for future clinical studies. As part of Thera4Care's second axis, the Medical Physics Lab is involved in the AI and Dosimetry work packages, focusing on the characterisation and personalisation of Lutetium-177 PSMA, a radioligand therapy routinely used for prostate cancer. This work also aims to refine patient stratification and treatment personalization strategies. Launched in October 2024, the project is scheduled to last 5 years.

What do you see as the major research challenges in your area of expertise?

The first challenge is undoubtedly the personalisation of treatments. At a time when more and more therapeutic techniques can be offered to patients, it is becoming vital to select the right patient for the right treatment. This is what is at stake in precision medicine, which should be stimulated by theranostics and the increased use of AI.

Other challenges include integrating imaging with other diagnostic techniques and combining therapies together to enhance overall effectiveness. Similarly, the translational approach will need to be strengthened to shorten the cycle from basic research to clinical applications. The systematic exploitation of hospital Big Data, the development of new radioisotopes for theranostics (in addition to astatine-211) and the creation of a genuine continuum between fundamental research, clinical research and industry will be just as decisive.

**Medical
Physics*Lab**



HÔPITAL UNIVERSITAIRE
DE BRUXELLES
ACADEMISCH ZIEKENHUIS
BRUSSEL





Radiophysics and MRI physics laboratory
Department of Medical Physics

Institut Jules Bordet
Rue Meylemeersch 90
B-1070 Anderlecht

E-mail : hugo.levillain@hubruxelles.be

<https://mplab-hub.be/>

<https://www.cmmi.be/invivo>