

Flanders Bioimaging

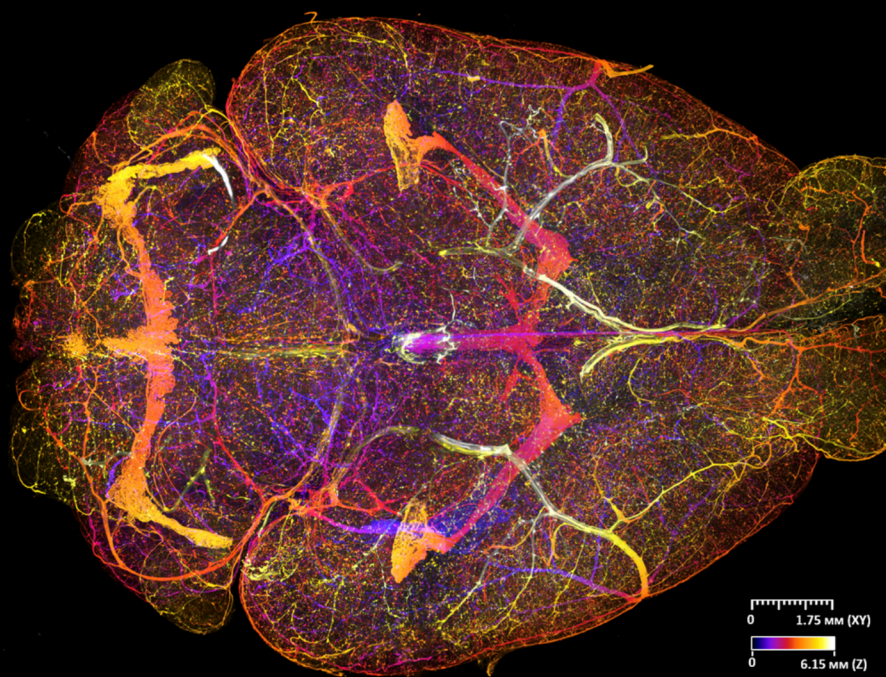


Annual Report 2024

Flanders Bioimaging Annual Report 2024

Table of Contents

- Foreword
- Introduction
- Flanders Bioimaging and EuroBioimaging
- Our Spearpoints: Flanders Bioimaging (FLABI) LIAISE
- Service Integration: Data and Quality Management
- Training Courses
- Outreach



Foreword

Imaging is indispensable in both biology and biomedical science, with an ever-expanding suite of technologies increasing our understanding of basic science as well as health and disease.

However, these technologies are extremely resource-intensive, and over the past 20 years, the imaging core facility has arisen as the most efficient way to provide access to state-of-the-art infrastructure and, importantly, application knowledge, not only reducing costs but also acting as a hub for innovation. Flanders has invested heavily in imaging infrastructure and has been at the forefront of this movement, with leading core facilities present in both its universities as well as bespoke knowledge institutions.

Since 2022, our 'spearpoints' have reflected the most highly developed and unique applications from each of our sites and are intended to act as innovation hubs for users and collaborators both within Flanders and beyond. Our focus on quality management supports both open science and the attraction of industry users to create an 'innovation pipeline'. We believe that integrated services (i.e. techniques, technologies, and applications that can exploit fundamental research to deliver high-quality results to both academic and industry users) have been identified as a priority for the EU when compared to the US and China. Furthermore, we see that core facilities can provide an innovation focus for Research Infrastructures (as identified in the Draghi report of 2024). This way, Flanders Bioimaging ensures the highest value proposition and impact for our stakeholders, funders, and, most importantly, users.



Sebastian Munck,

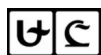
Promotor and Spokesperson for Flanders Bioimaging





Ghent Light Microscopy Core (GLiM)

Ghent CORE ARTH Infinity



Antwerp Centre for Advanced Microscopy

Molecular Imaging Centre Antwerp/Bio-Imaging Lab



VIB Bioimaging Core Leuven & VIB Bioimaging Core Ghent

Leuven Cell & Tissue Imaging Cluster



Molecular Imaging Research and Clinic Leuven

Hasselt Advanced Optical Microscopy Centre



VUB In Vivo Cellular&Molecular Imaging Core Facility

Introduction

Flanders BioImaging (FLABI) is funded by the International Research Infrastructure (IRI) program of the FWO and consists of 9 core facilities/research centres across 10 sites, housing medium and heavy infrastructure for biological and biomedical imaging and representing >€50mi in investment. Each core facility serves its users by providing access to a range of imaging technologies and applications.

The IRI programme is intended to support Flemish participation in European Research Infrastructure Consortia (ERICs) of strategic importance to Flanders, promoting the performance of Flemish consortia and integration in international strategic basic research across all scientific disciplines via open access.

FLABI and EuroBioimaging

EuroBioimaging is the ERIC dedicated to biological and biomedical imaging, providing a framework for high-quality and open access to imaging infrastructure across Europe (ERICs can be thought of as representing 'international' core facilities in this sense). The establishment of EuroBioimaging as a Landscape ERIC intends to create both an international roadmap and community for all aspects of biological and biomedical imaging. This created leverage for its constituent national members to develop the national imaging nodes that form the core component of the consortium.

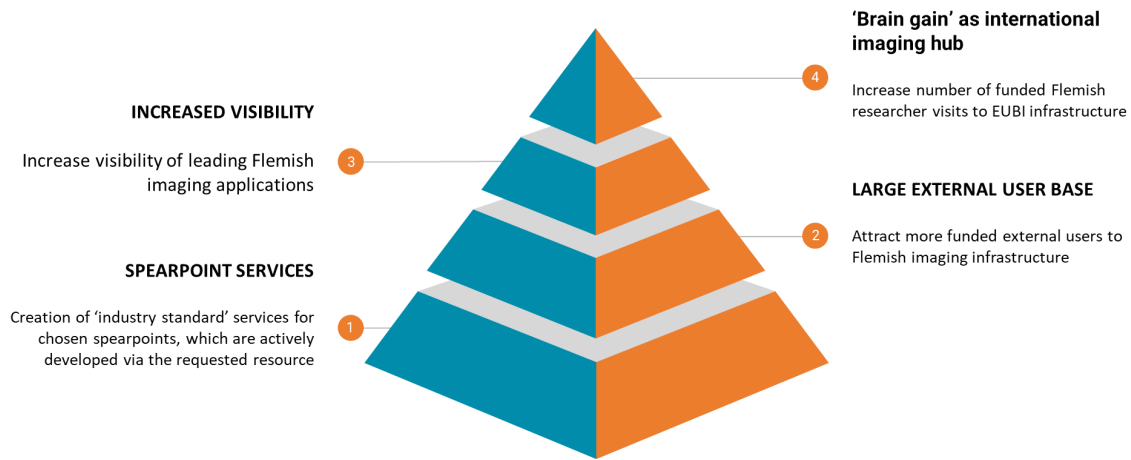
Belgium was only an observer when EuroBioimaging was established. However, with a determined ambition to become full member, IRI funding was still obtained with the goal of integrating the Flemish Light Microscopy Bioimaging Operations (LIMBO) and Flanders Molecular Imaging Organization (FLAMINGO) nodes that had been accredited during the preparatory phase of EuroBioimaging. These were merged into the FLABI consortium, implementing a single point of contact for handling user access to all the imaging sites and applications within the consortium. As part of this process, FLABI obtained candidate Node status in the EuroBioimaging ERIC in 2022.

Crucially, continued (candidate) Node funding and full EuroBioimaging membership were dependent on an external evaluation of our consortium by an international panel to assess value and fit-for-purpose. Feedback from this process required an answer to the question: 'Why would a user travel to Flanders to carry out an imaging experiment?'. We realized that an increased focus on the development of leading image applications at each site would allowed us to address this question r, providing cutting-edge applications for (inter)national visitors and collaborators from academia and industry.

In 2023, FLABI successfully obtained further IRI funding to support operation as a full node (Flanders Biolmaging Leading Imaging Application Integrated Service Enablement, LIAISE). Membership of EuroBioimaging is central to the attraction of funded users and collaborators to Flanders, providing an overall 'brain gain' both to the region and to Europe.



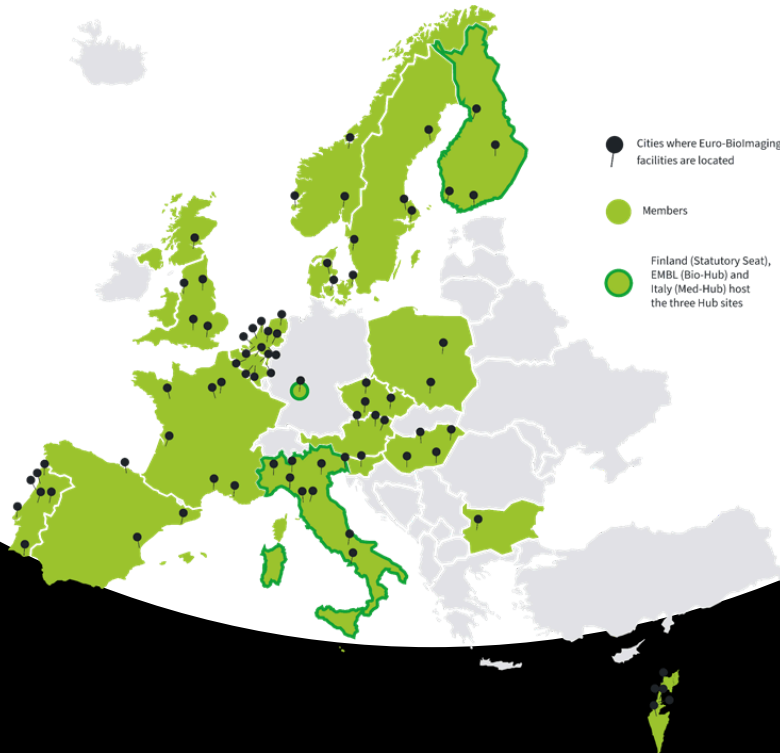
Projected outcomes of Flanders BioImaging/Open Access Imaging



The bulk of our funding supports expert staff to develop these leading applications and provide them as services for users, in line with the recent LERU blueprint for FP10, which states:

“For research infrastructures, investment in staff retention and training is vital and largely overlooked in favour of investments in (new) hardware.”

In 2024, FLABI was formally ratified as a full member of the EuroBioimaging ERIC by the EuroBioimaging board, joining 40 Nodes hosted by 18 other countries and the EMBL in Germany. Together, this brings the number of sites within EuroBioimaging to 237.



In 2024, FLABI served >900 users/user groups, of which >170 were external to the hosting institution. These projects contributed to >75 scientific publications, and our sites hosted 12 training courses, including the interuniversity course iCALM 2024 described below.

As a EuroBioimaging member, FLABI is equipped to host international visitors and projects at each of its member sites, and becomes an integrated member of the EuroBioimaging community, able to form consortia with other imaging nodes to attract European funding (e.g. INFRA-SERV projects). EUBI nodes are also eligible to apply for job shadowing, mentoring, training, and the EUBI Scientific Ambassador program that is part of the EVOLVE project. In 2024 we were able to receive funding for 2 x Job Shadowing placements via this project.



EuroBioimaging is also an active member of multiple international imaging organizations, allowing FLABI to participate in a wide range of initiatives, e.g.:



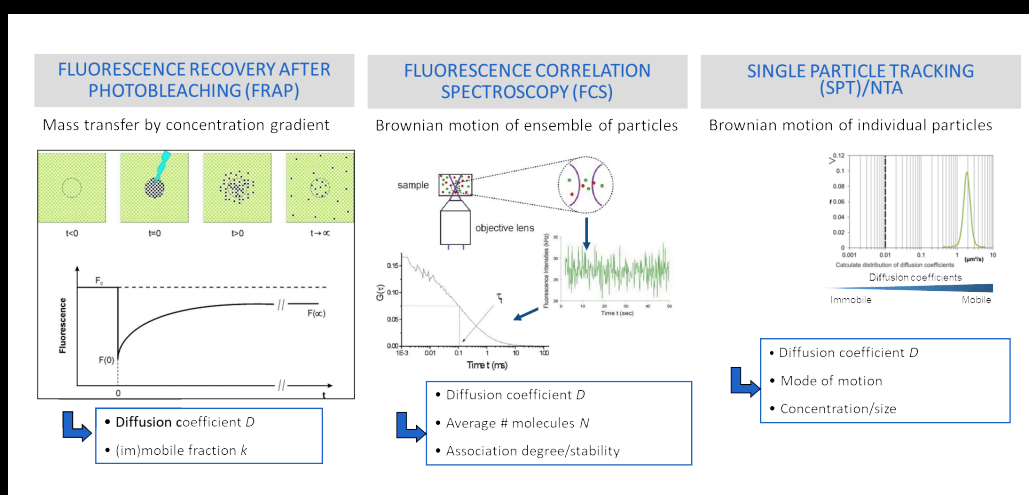
Our Spearpoints: FLABI LIAISE

Each core facility has particular expertise, reflecting the research interests of its academic leadership and the needs of its users. An essential part of the FLABI LIAISE mandate is the focus on the further development of the leading imaging technologies at each site in the consortium. These applications fall into two scientific themes that are central to the academic focus of the consortium: oncology and CNS diseases, especially neurodegeneration. Each spearpoint is summarised below:



Pharmacokinetic Imaging

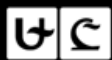
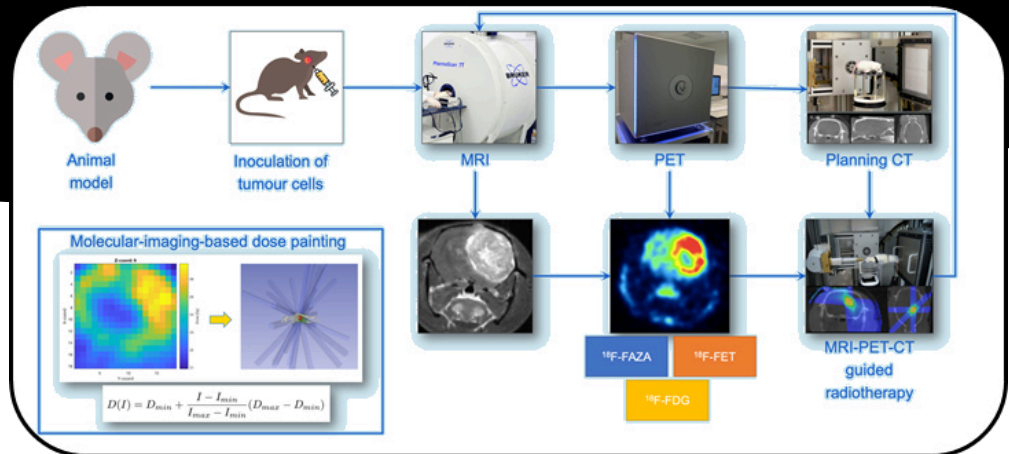
The Ghent Light Microscopy Core Facility (GLiM) uses a range of biological imaging techniques to provide multimodality evaluation of candidate (therapeutic) molecules and nanoparticles in biologically relevant substrates. These techniques allow physical transport parameters to be derived for the interaction of molecule/nanoparticle with media and also allow for the evaluation of vector stability in drug delivery and release studies.



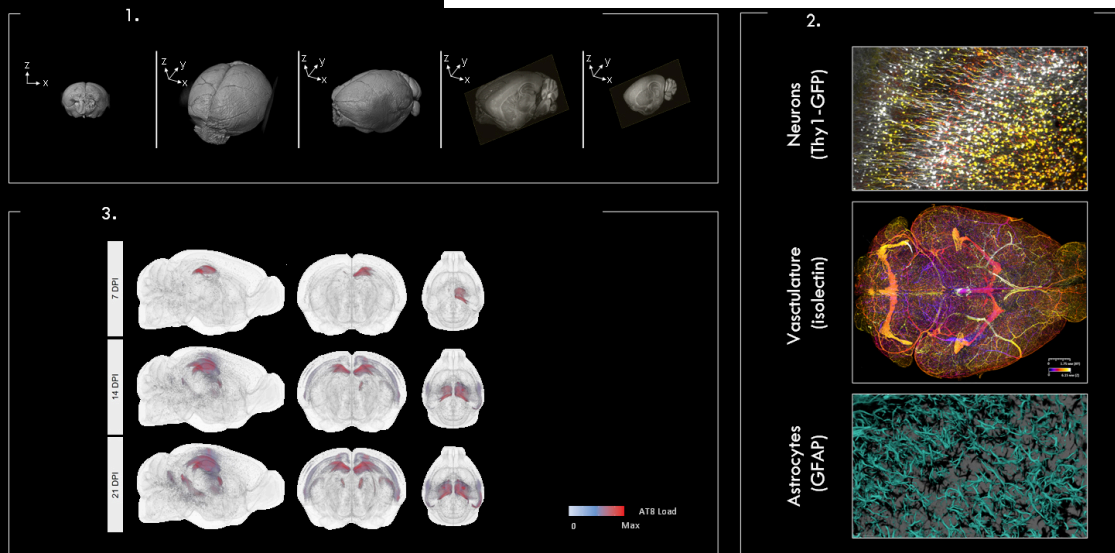


Multimodal Imaging for Radiotherapy Studies

The CORE ARTH Infinity Core Facility at the University of Gent hosts a unique preclinical platform that enables image-guided preclinical radiotherapy studies using a range of modalities. This allows the targeting of radiotherapy to heterogeneous tumour regions based on molecular markers (hypoxia, glycolysis etc.), as well as the delivery of clinically relevant radiotherapy regimes and combination therapy evaluation via imaging biomarkers.

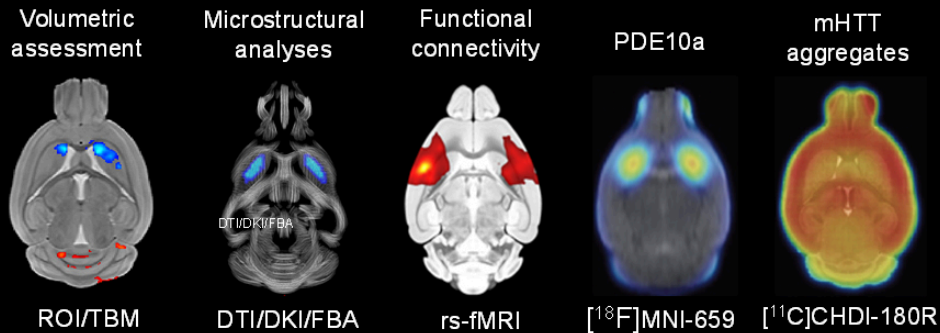


Systems Microscopy



The Antwerp Centre for Advanced Microscopy hosts an array of advanced microscopes dedicated to ultrastructural imaging, spatial molecular interrogation, high throughput imaging, and in toto imaging. A particular focus is the comprehensive mapping of cell types and states in organoids (tumouroids and cerebral organoids) and intact organs (in particular whole mouse brain) using automated light-sheet microscopy and AI-driven image recognition. In direct extension, ACAM works closely with MICA-BIL to augment and enhance bioimaging readouts with in toto histopathology (an example is absolute mapping of Tau pathology in K18-seeded P310L mouse brain and its correlation with fMRI).

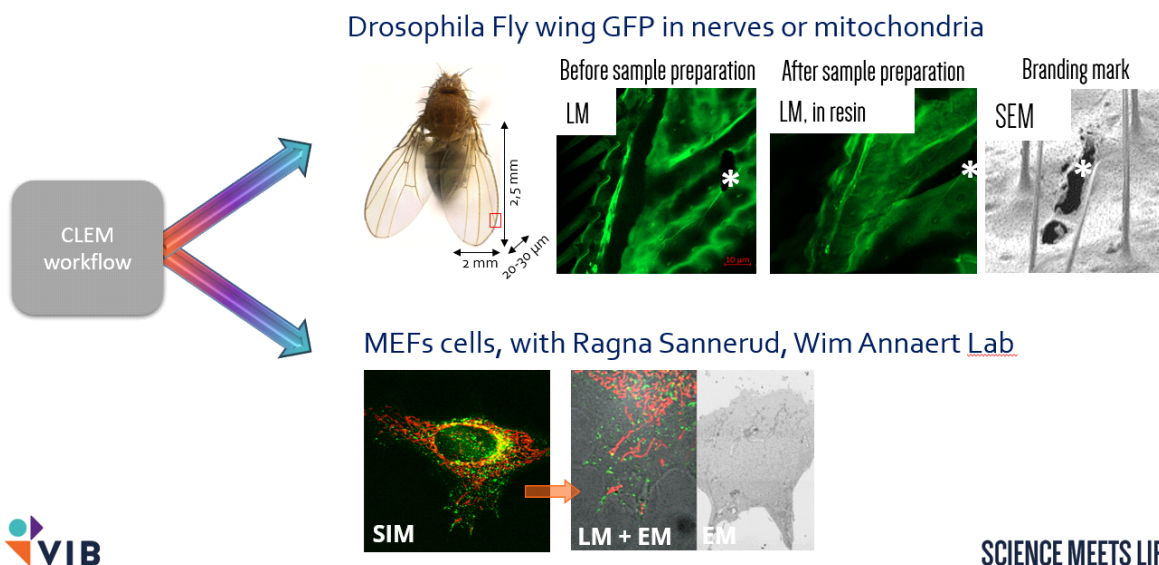
The Molecular Imaging Centre Antwerp/Bio-Imaging Lab focuses on the multi-modal integration of preclinical PET/MRI biomarkers in disease models to determine the temporal profile of changes and their causal relationships, strengthening sensitivity to generate integrated predictive biomarkers for disease progression and the response to candidate therapies.



Correlative Light and Electron Microscopy VIB

The BioImaging Core Facility of the VIB at KU Leuven focuses on the application of Correlative Light and Electron Microscopy (CLEM) to a range of biological samples. This enables the incorporation of ultrastructural information into the relevant physiological context provided by fluorescent reporters and light microscopy. Moreover, it allows connecting dynamic measurements with (ultra-)structure, allowing the elucidation of structure-function relationships on the nm scale. The facility has developed CLEM workflows for a wide range of biological samples and organisms.

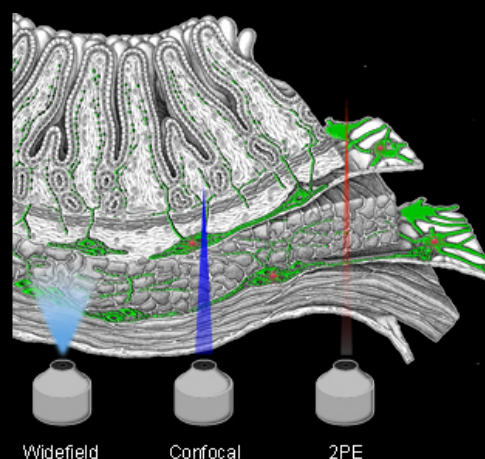
The CLEM workflow applied to different types of sample





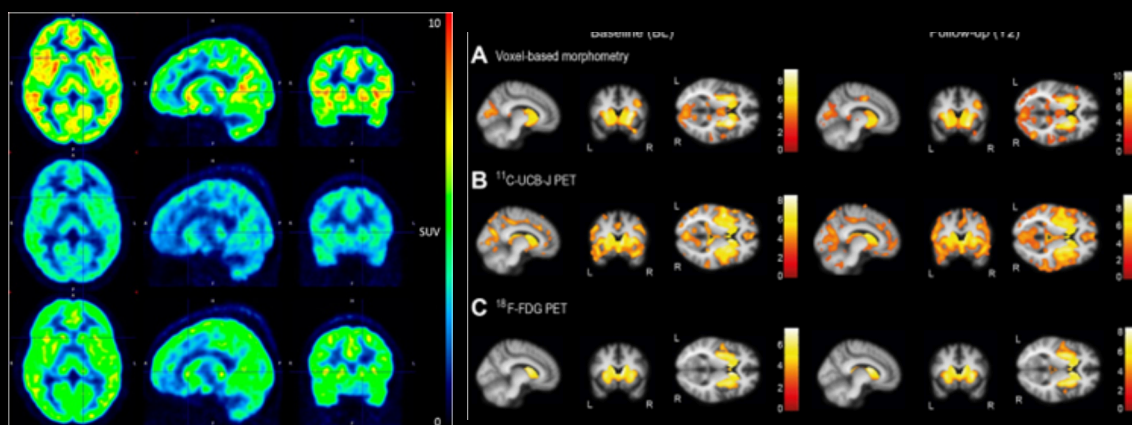
Enteric Nervous System Imaging

The CIC utilises multiphoton and second harmonic imaging techniques to study the enteric nervous system. This includes the measurement of cellular activity in the intact three-dimensional (3D) environment, with very high spatial and temporal resolutions. This enables the study of the integrated enteric nervous system function in a range of disease models and in response to therapy.



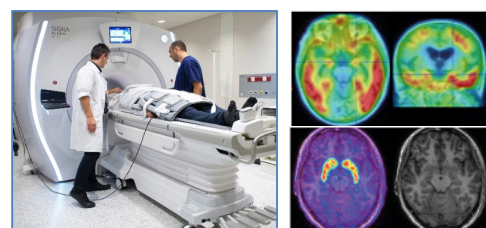
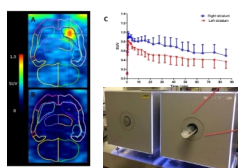
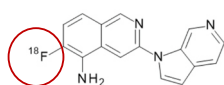
Translational Biomarkers for CNS Disease

MIRaCLE provides a full translational service for the development of PET radiopharmaceuticals in CNS disease, including preclinical evaluation, GMP production and first-in-man studies, including application to drug discovery studies to evaluate receptor occupancy in the brain.



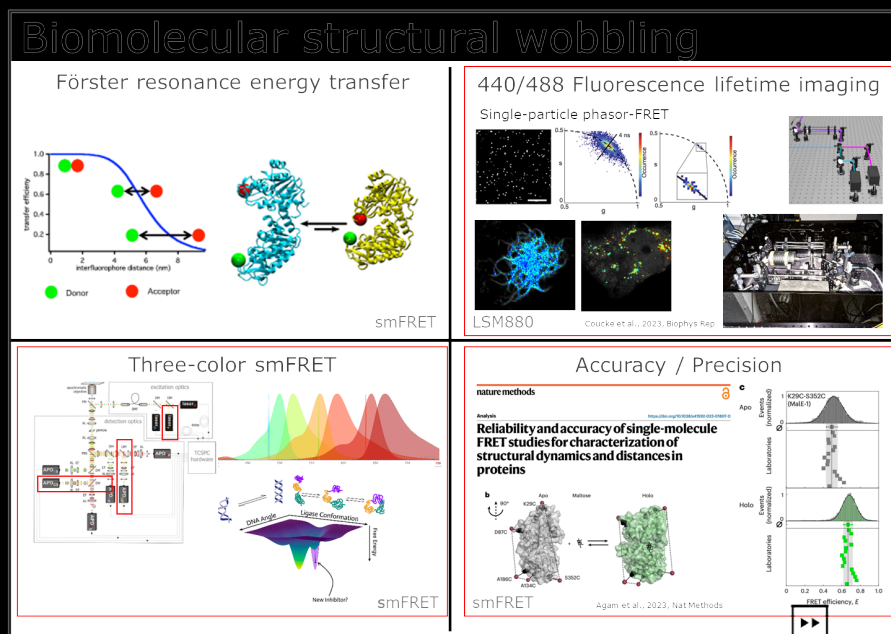
Above: study examples, left: SV2A receptor occupancy determined for a novel therapeutic; right: study of changes in CNS biomarkers in early-stage Huntington's Disease.

Below: PET probe validation schema: radiochemistry, (pre)clinical studies



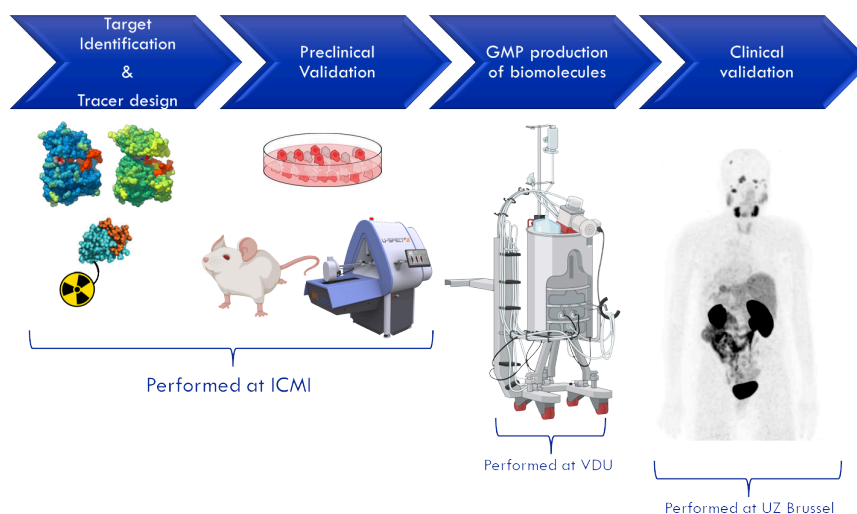
AOMC Dynamic Optical Microscopy

The AOMC specialises in the evaluation of biomolecular movement and interactions using Fluorescence Correlation and Raster Image Correlation Spectroscopy. These techniques can be applied for advanced flow characterization and asymmetric diffusion studies. Single-molecule (3-color) Förster Resonance Energy Transfer techniques are also available to evaluate biomolecular structural wobbling' for fluorescence lifetime imaging and to evaluate the conformational status and interactions of proteins.



Translation of Nanobody Theranostics

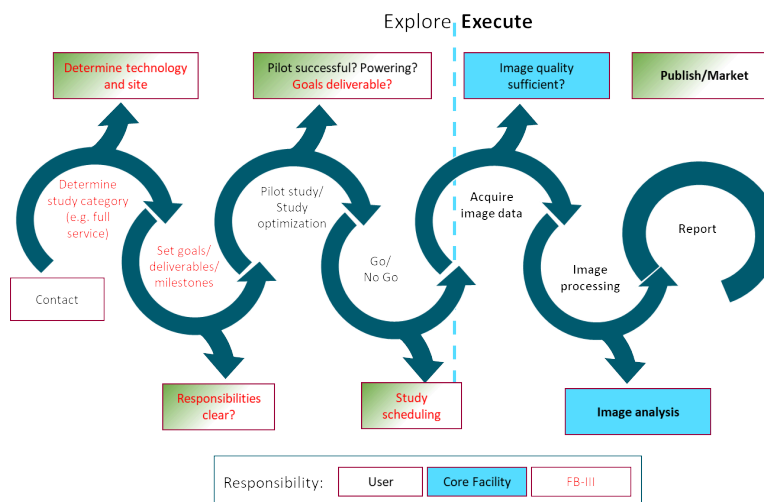
ICMI hosts a full platform for the discovery of nanobody-based theranostics (radiopharmaceuticals suitable for diagnosis and cancer therapy). This includes facilities for the manufacture of biomolecules in accordance with GMP to support clinical translation and evaluation in human studies.



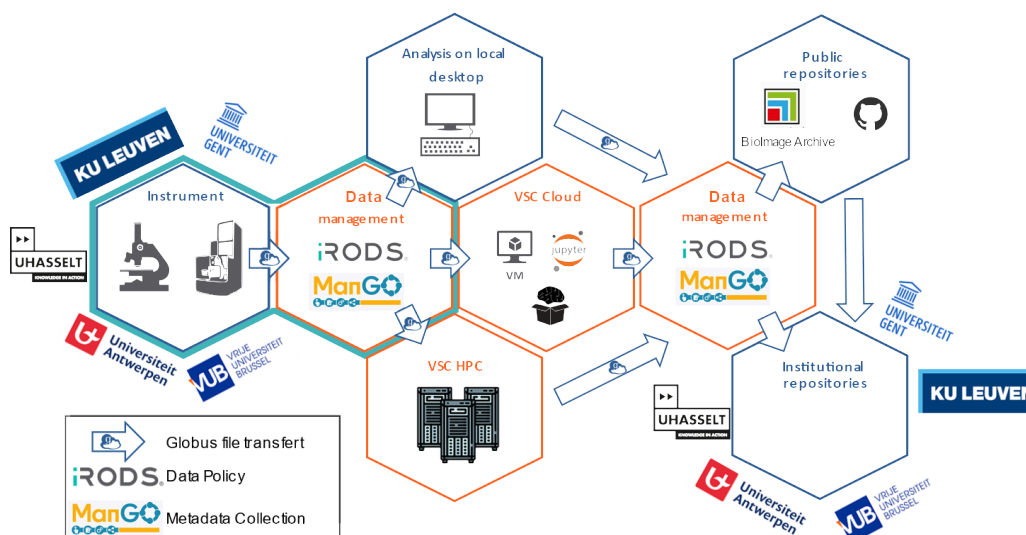
These 'Spearpoints' are designed to serve as flagship applications and services, acting as hubs to attract national and international users from academia and industry. In 2024, FLABI hosted 180 external users across sites, including 11 remote and 30 industry users, contributing to 79 papers.00

Service Integration: Data and Quality Management

Complementary to the focus on leading imaging applications is the provision of service: management of user projects to ensure delivery of reliable, reproducible data that is as Open and FAIR as possible. To establish service and promote engagement with industry, FLABI LIAISE has developed unified frameworks for both project development and imaging practice across its sites:



Major efforts have also been made to create a FAIR data management framework for imaging data produced at FLABI, making use of the extensive ManGO framework developed at KU Leuven/VIB, and connecting to the Flemish Supercomputing Centre for active data storage. This project has been supported by both the KU Leuven RDM office as well as a user grant from the VSC, in coordination with ELIXIR Belgium. The overall schema is illustrated here:



In addition, two of the consortium sites have joined the iRISE project and will be evaluated for accreditation by the EQIPD quality management



Training Courses

Our final KPI is the provision of integrated training services, with our flagship programs based on multi-site, hands-on training courses in advanced biological and biomedical imaging based on the application expertise available across sites. These courses are aimed at PhD students, postdoctoral fellows, and industry scientists.

In 2024, the second Interuniversity Course in Advanced Light Microscopy (iCALM 2024) was hosted by the UAntwerp ACAM, UHasselt AOMC and KU Leuven CIC/ VIB Leuven BIC, focusing on light sheet imaging, expansion microscopy, and non-linear optical (NLO) imaging; the measurement of molecular dynamics and super-resolution microscopy and was attended by 22 PhD students.



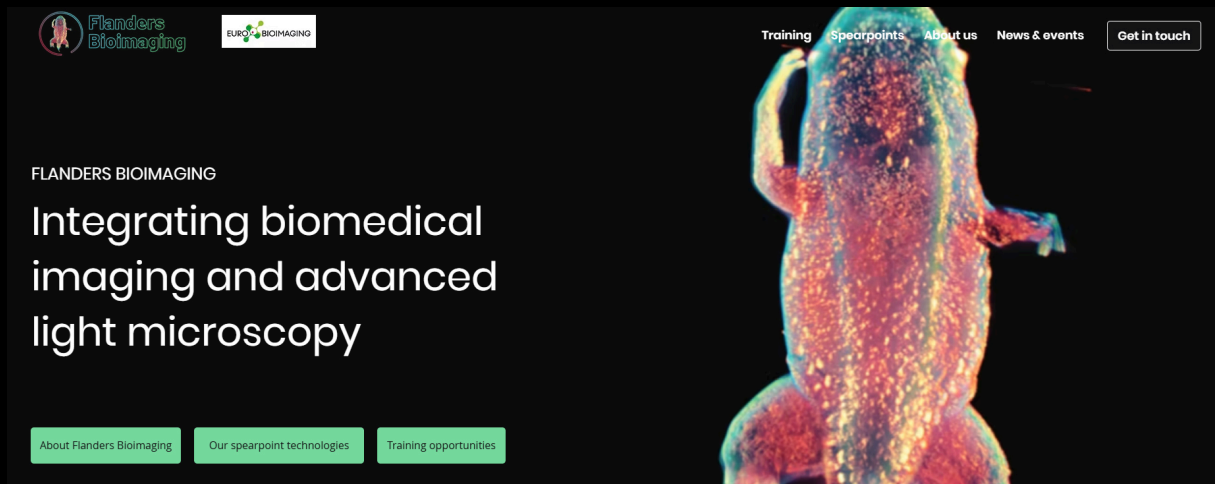
The poster for iCALM 2024 features a header with logos for Flanders Bioimaging, Ghent University, Universiteit Antwerpen, VIB, UHASSELT, and KU LEUVEN. The main title 'iCALM 2024' is displayed in large, colorful letters. Below the title, the text reads 'INTERUNIVERSITY COURSE ON ADVANCED LIGHT MICROSCOPY'. To the right, it states '3 days, 3 locations, MANY modalities'. The schedule is as follows: 24/10/24 at University Antwerp (Light sheet, expansion microscopy and NLO); 14/11/2024 at University Hasselt, Campus Diepenbeek (Imaging molecular dynamics); and 04/12/2024 at KU Leuven, Campus Gasthuisberg (super-resolution microscopy). A QR code is provided for registration, with the note 'With hands-on practical sessions' and 'REGISTRATION REQUIRED'. The bottom of the poster includes logos for Leica Microsystems, Miltenyi Biotec, Zeiss, Bruker, and other sponsors.



Attendees at Day 1 and 2 of iCALM 2024

Outreach

In 2024, FLABI was highly active in engaging with EuroBioimaging and a wide range of other stakeholders in the European Research Infrastructure community. We also redesigned our website to focus on our Spearpoint service offering.



FLABI attended the "All-Hands" Node meeting hosted by EuroBioimaging in Torino, Italy. Held over 3 days, this event included Workshops on Health Data platforms for AI-driven discovery, Imaging services for Discovery and Translational Research as well as updates and scientific presentations from the EuroBioimaging nodes. It also marked the 10th Anniversary of the EuroBioimaging Industry Board.

On June 6th, FLABI was delighted to host Antje Keppler and Ilari Pulli, who visited the VIB BioImaging Core, the Cell and Tissue Imaging Core (CIC) and the Molecular Research and Clinic Leuven (MIRaCLe) at the Gathiusberg campus in Leuven. Antje and Ilari are pictured with Pieter Vanden Berghe, Head of the CIC, and Jelle Hendrix, Head of the Advanced Optical Microscopy Node at UHasselt, at the CIC facility. The visit gave us an excellent opportunity to showcase our facilities and applications, whilst Antje and Ilari updated on the opportunities available for Node staff as part of the EVOLVE project led by EuroBioimaging.





On the occasion of the Belgian EU Presidency, the VIB hosted an event at the Agro-incubator (Nevele) for delegates from the European Strategy Forum on Research Infrastructures. This highlighted the EMPHASIS plant phenotyping facility which opened last year and aimed to showcase how the VIB contributes to strategic research infrastructure in Europe. Other research infrastructures active in Belgium were also invited to present (ELIXIR, INSTRUMENT and FLABI as the Node for EuroBioimaging)

For this event, FLABI created a flyer outlining the various spearpoint imaging applications available at the node - available on request!



EuroBioimaging hosted its 10th Board Meeting at EMBL, Heidelberg, between the 4-6th June. In addition to the packed agenda of the board meeting itself, there was the opportunity to tour the EMBL Imaging Centre with an overview of the most recent developments.

On June 7th, FLABI was invited to attend a workshop on enhancing SME access to Research Infrastructures, co-organised by the Alba Synchrotron, ELIXIR, ESRF, Euro-Bioimaging and INESC Brussels Hub. The event brought over 40 participants together from SME associations, industry, major European RTS as well as policymakers, with the objective of addressing the current barriers faced by SMEs in utilising RTIs (and to develop strategies to enhance collaboration). FLABI shared our experience of delivering spearpoint imaging services to SMEs, with the workshop underscoring the importance of cohesive strategies and supportive policies to enhance SME uptake of RTI services.





On Tuesday, November 4th, Euro-Bioimaging and the European Innovation Council (EIC) organised a joint matchmaking event at UZ Leuven. This first-of-its-kind workshop connected EIC-supported startups and SMEs with Euro-Bioimaging's leading experts, providing a unique platform for direct interaction, hands-on support, and valuable insights into how our research infrastructure can accelerate growth and innovation in healthcare and beyond. Over 60 participants—including some of Europe's most innovative AI-driven medical imaging companies—engaged in sessions designed to bridge the gap between R&D needs and cutting-edge technological resources. Hosted within the Flanders EuroBioimaging node, this event demonstrated the importance and unique capacity to leverage our strong network's expertise.



On the 9th of December 2024, our networking event was held at the PXL-NeXT venue in the centre of Hasselt. This event was intended both to showcase the capabilities and research spearpoints from the members of FLABI and to connect with the other Life-Sciences ERICs and intergovernmental organisations active in Belgium; with presentations from ELIXIR, INSTRUCT, BBMRI, EMPHASIS and AnaEE.

The event included panel discussions on core facilities and research infrastructures, including contributions from John Eriksson (EuroBioimaging Director-general, who also gave the keynote speech), Caroline Volckaert from the Research Foundation Flanders (FWO, who also gave a 'sneak preview' of the new FWO-IRI funding channel), Phillip Van den Heede from the University of Gent and Ken Haenen, Vice-Rector for Research, Innovation and Internationalization at UHasselt. Attendees were also treated to a walking dinner from the 'Stad van de Smaak'.



FLABI also attended the Global Bioimaging Exchange of Experience meeting in Okasaki, Japan, presenting a talk on 'managing the data journey and completing metadata annotation'.



Sebastian Muck, Flanders Bioimaging

Also, in 2024, FLABI led contributions to a special issue in the Journal of Microscopy dedicated to core facility management. This was intended as a series of practical guides to the complex business of running a microscopy core facility and became the journal's second-most-downloaded paper of all time.



Journal of Microscopy A Special Issue on LM Core Facility Management

<https://doi.org/10.1111/jmi.13199>



Kurt I. Anderson

This special issue grew out of an awareness that planning and managing a light microscopy facility requires more than a deep understanding of imaging technology (although you need that too!). Facility staff and managers have to deal with many other domain specialists, from administrators and accountants to architects and sysadmins, who generally support our mission but occasionally want to subjugate our needs to theirs ("Do you *really* need 20 kW of cooling in that room?"). A major motivator for this article was to provide support for our colleagues when having critical conversations with the many adjacent specialists who impact our ability to deliver imaging and support science. It is our hope that at some point, someone will turn to this issue to help justify why, yes, in fact, *we do need* 20 kW of cooling in that room (and the fan coil unit *does need* to be over the door where it can't leak on anything).



Sebastian Muck

