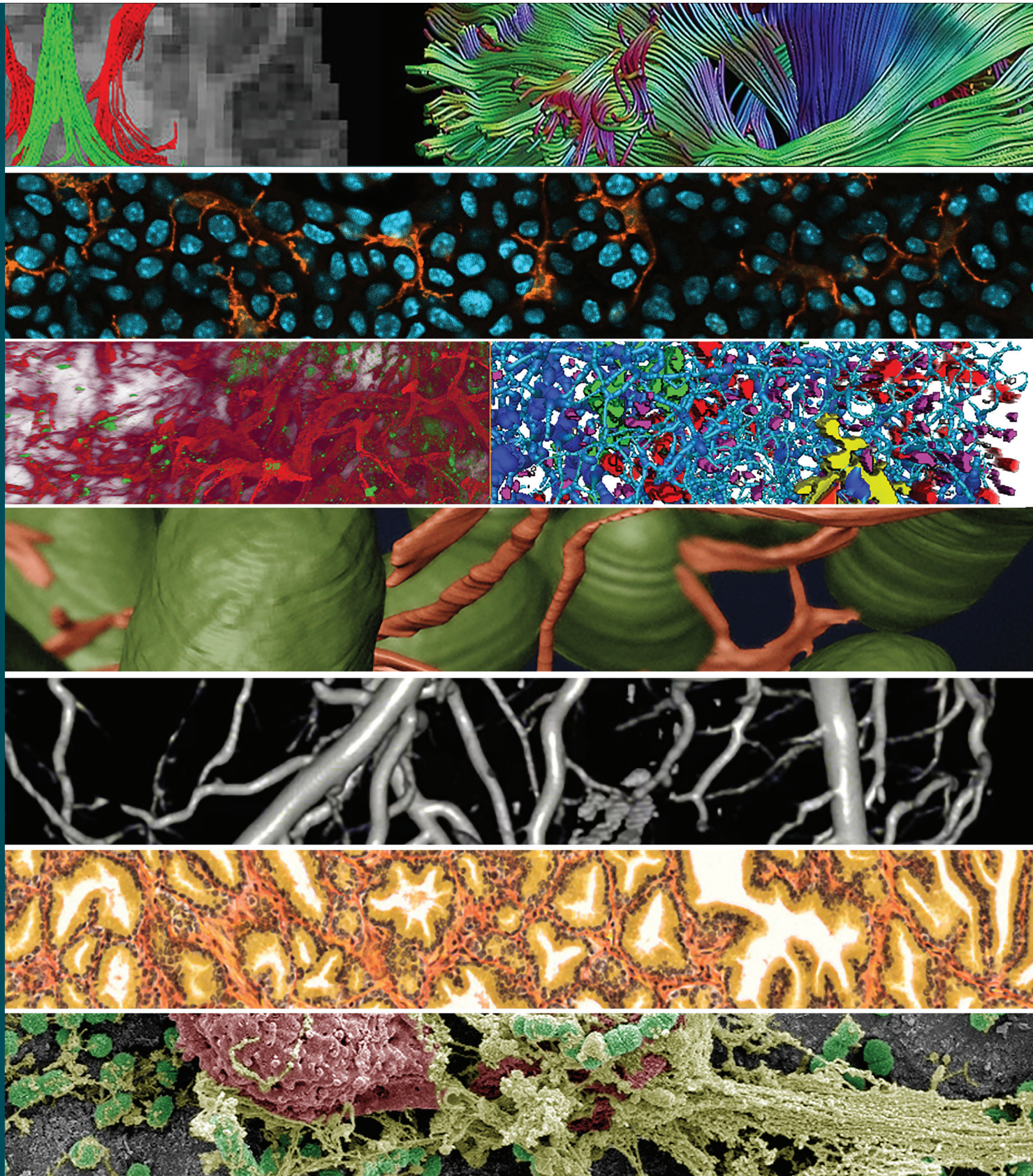
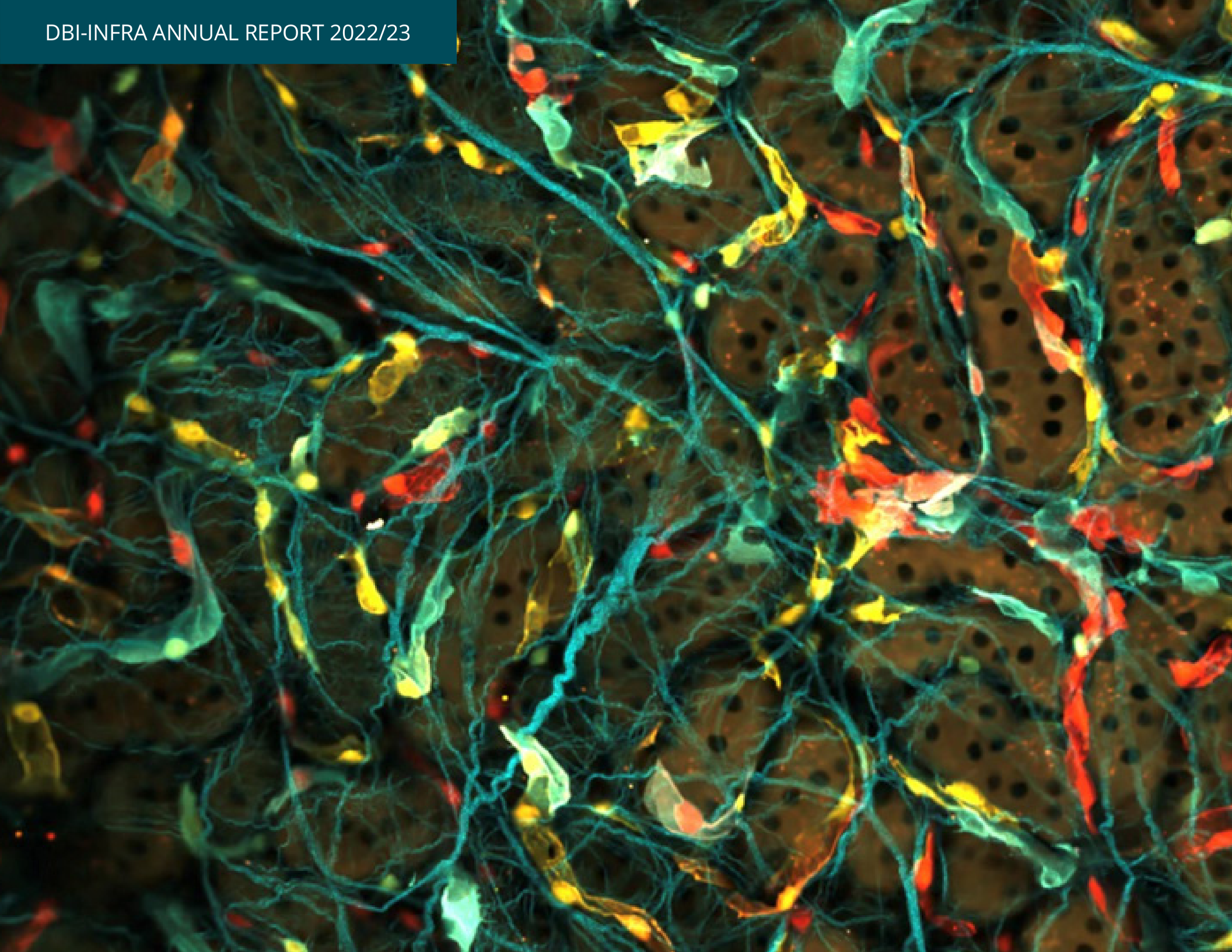
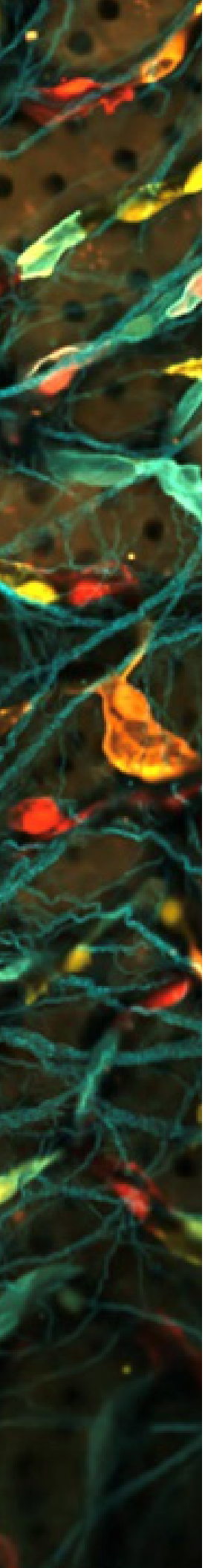
DANISH BIOIMAGING INFRASTRUCTURE

ANNUAL REPORT 2022/23







DBI-INFRA
ANNUAL REPORT 2022

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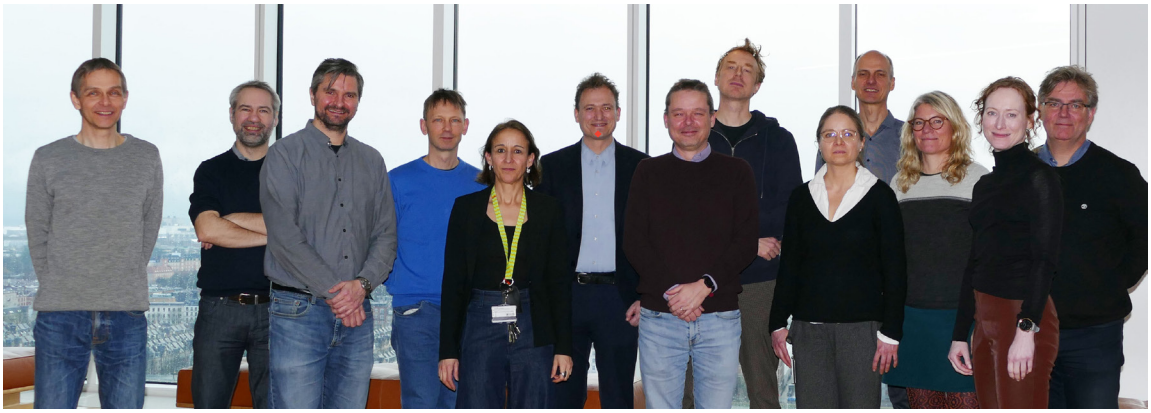


In 2015, a group of bioimaging scientist gathered with the common goal of working together towards a nation wide bioimaging community and infrastructure. Some of the first goals we prioritised were to improve knowledge and information exchange among the Danish bioimaging community (DBI). In 2016, the DBI website (www.danishbioimaging.dk) was launched, allowing any member of the community to create their own personal bioimaging profile, sharing any relevant expertise and equipment across Denmark. The community has since then only grown, and connected to national and international communities and initiatives.

" Life sciences have experienced a transformation in the last decades. Research excellence requires expertise and access to technologies that are unavailable and/or unsustainable in individual research groups, departments, and even institutions. We need to understand that excellent and sustainable research infrastructures can only be achieved through cross-institutional and inter-disciplinary cooperation"

Clara Prats, DBI-INFRA Director

In 2017, the DBI consortium signed the DBI Collaboration agreement to work together towards a long-term financial sustainability plan for our bioimaging infrastructures. Bioimaging technologies have become essential to life scientists, but at the same time, their complexity and costs make them unsustainable for individual research groups, departments/centers, and even institutions in the case of some technologies. In 2019, the DBI consortium coordinated the Danish membership to the Euro-BioImaging ERIC, and in 2020 five of the DBI core facilities were certified as part of the European infrastructure.

In 2021, and after six years on the Danish Roadmap for Research Infrastructures, the Danish BioImaging INFRAstructure (DBI-INFRA) received financial support from the Danish Ministry for Higher Education and Research and the DBI-INFRA hosting institutions. Today, the DBI-INFRA consortium includes seven institutions, and hosts eight open access technology platforms across Denmark. The DBI-INFRA services include bioimaging technologies for clinical and pre-clinical imaging, high content screening, monitoring of cellular and molecular dynamics, and structural and ultrastructural analyses. Under the DBI-INFRA, these platforms work together to coordinate capital investments and technology development and implementations, aligning them with the needs of the local life science communities, while minimising unnecessary investment redundancy at the national level.

Bioimaging technologies generate a wealth of information, with individual experiments generating terabytes of data in some cases. Image analysis expertise, computing power, and data storage/ management have become important bottlenecks for bioimaging technologies today. This is why DBI-INFRA is implementing a world-wide unique facility, the national DBI-INFRA Image Analysis Core Facility. A team of bioimage analysis experts to secure open access to computing power and image analysis expertise to support data extraction from all bioimaging technologies across the DBI-INFRA.

This report is designed to present the Vision, Mission and Goals of the DBI-INFRA, and to update all relevant stakeholders on the implementation progress, and the impact DBI-INFRA has at the national and international level.

On behalf of the DBI-INFRA Executive Board,

Clara Prats, Director of the DBI-INFRA

DANISH BIOIMAGING INFRASTRUCTURE

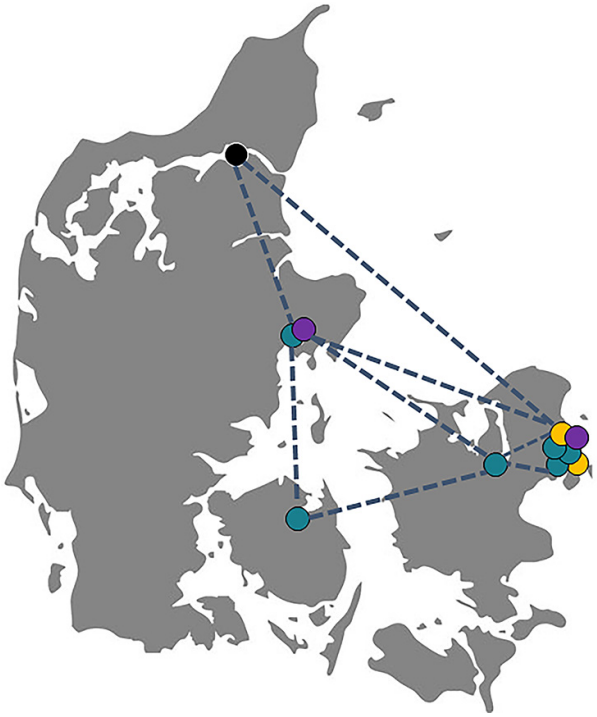
A national, distributed, interinstitutional, interdisciplinary infrastructure

Future microscopy core facility
Aalborg University

Clinical and Preclinical core facilities
Aarhus University
Technical University of Denmark

Image Analysis core facilities
Technical University of Denmark & University of Copenhagen
Danish Bioimaging Infrastructure

Microscopy core facilities
Aarhus University
Southern Denmark University
Roskilde University
University of Copenhagen
Danish Cancer Institute



Denmark is home to world-leading life scientists and pharmaceutical companies, which are key players in the country's economy and development. Bioimaging technologies have become central research drivers in most disciplines of life sciences.

The DBI-INFRA is designed to strengthen bioimaging infrastructures in Denmark as a coordinated effort across life science institutions, towards a common long-term strategic and sustainability plan. Bioimaging technologies are costly and require big financial and resource investments. At the same time, bioimaging technologies have become essential research tools for life scientists. Our vision is that all life scientists in Denmark should have access to the bioimaging technologies they need to innovate and discover in their fields. To achieve this, DBI-INFRA works to secure a healthy bioimaging technology ecosystem, as an essential part of a healthy life science ecosystem in Denmark. Our main strategic goals are to secure the long-term sustainability and strategic development of bioimaging infrastructures, tailored to support the life science ecosystem in Denmark.

DANISH BIOIMAGING INFRASTRUCTURE

VISION

“ all Danish life scientists should have access to state of the art bioimaging technologies to innovate and discover

MISSION

“ To secure a Healthy Bioimaging Technology Ecosystem in Denmark – as an essential pillar of Danish Life sciences

DBI-INFRA STRATEGIC PLAN

Strengthen the Danish Bioimaging Infrastructures

- coordinating the implementation and development of open-access cutting-edge imaging technologies across institutions
- minimizing infrastructure redundancy to maximize investment impact
- driving collaboration and knowledge exchange between DBI-INFRA facilities
- defining guidelines for service provision quality and performance monitoring
- creating career paths for bioimaging technology researchers/experts working at DBI-INFRA

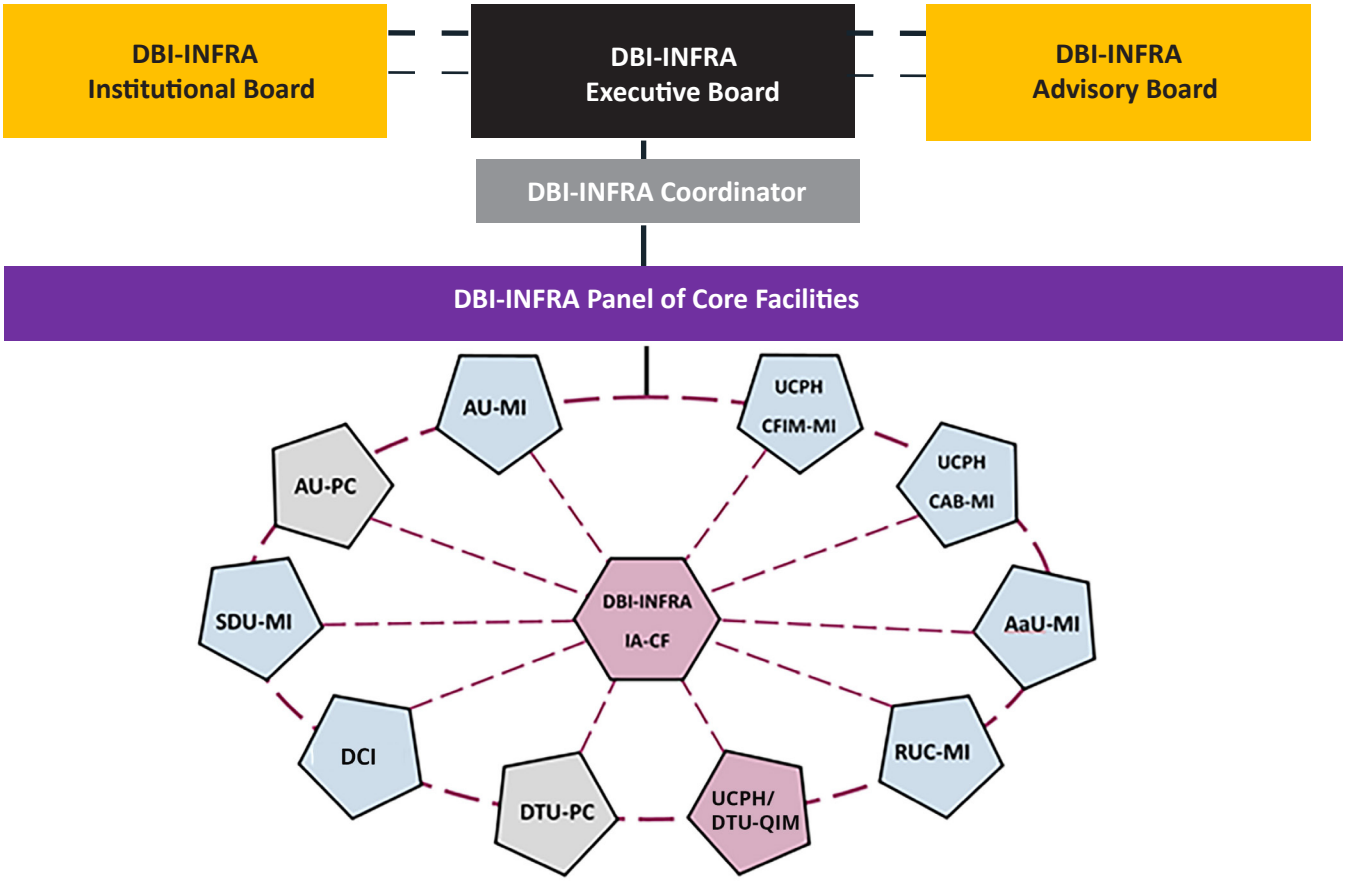
Support the life science ecosystem

- coordinating interdisciplinary collaboration for technology development, beta testing, and implementation
- continuously updating the technology portfolio offered as open access services
- educating the next generation of bioimaging life scientists
- promoting the application of the FAIR principles for image-based data sharing at the national and international level
- driving the integration of bioimaging technology core facilities and their professionals into life science institutions

Secure the long-term sustainability of BioImaging Infrastructures

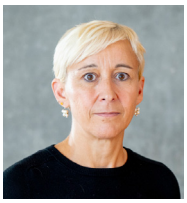
- communicating society & economic impact and value to all relevant stakeholders
- lobbying toward a long-term financial plan to maximize the impact of invested resources
- driving infrastructure and expertise sharing across institutions
- defining protocols and strategies to minimize the environmental footprint
- coordinating fundraising activities to sustain and develop bioimaging infrastructures and services
- continuously adapting to the changing needs of the community, and emerging new opportunities

DBI-INFRA GOVERNANCE



The DBI-INFRA organigram was designed to secure the engagement of all relevant stakeholders, and facilitate an efficient information flow between the different partner institutions/DBI core facilities.
The DBI-INFRA Coordinator meets regularly with the DBI-INFRA Panel of Facilities (TCF), to coordinate activities and collect information and needs. The DBI-INFRA Coordinator reports to the DBI-INFRA Executive board (EB) on behalf of the Panel of TFC, as essential input for decision-making. The EB reports back to the Institutional Board (IB) and Advisory Board (AB), and gathers feedback and advise from both organization bodies. Reporting communication is indicated as long dashed discontinuous black bold arrows, while advice is indicated as short dashed discontinuous black arrows. Based on all the gathered information the EB defines, revises and adapts the DBI-INFRA strategic plan, and identifies executive actions to achieve the strategic goals. Management communication is represented in the organization chart as continuous bolded black lines between the EB and the Panel of TCF, via the Coordinator, who monitors the execution and implementation of actions, and reports back to the EB when feedback or decisions are needed. DBI-INFRA is responsible for the implementation of the services, the service provision is done by the DBI-INFRA TCF across Denmark, giving access to different bioimaging technologies; from Medical to high resolution molecular imaging, including technology focused image analysis.

DBI-INFRA EXECUTIVE BOARD



Clara Prats
DBI-INFRA Director
EuBI board
University of Copenhagen

Morten S Nielsen
DBI-INFRA Deputy Director
Aarhus University

Torben Moos
Aalborg University

Jonathan Brewer
University of Southern Denmark

Jon Sporring
University of Copenhagen

Pia Nyeng
Roskilde University

Anders B Dahl
Technical University of Denmark

Michael Lisby
University of Copenhagen

Michael Pedersen
EuBI board
Aarhus University

Mathilde H Lerche
Technical University of Denmark

Christoffel Dinant
Danish Cancer Institute

DBI-INFRA COORDINATOR

Sonia Diaz Houbak
University of Copenhagen

DBI-INFRA INSTITUTIONAL BOARD

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Vice dean for Research and Innovation
University of Aalborg

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University of Aarhus

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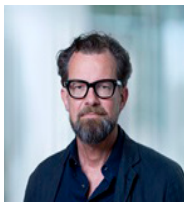
DTU



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Head of DTU Compute
Technical University of Denmark

DTU

Susanne Sørensen
Dean of Natural and Mathematical Sciences
Roskilde University

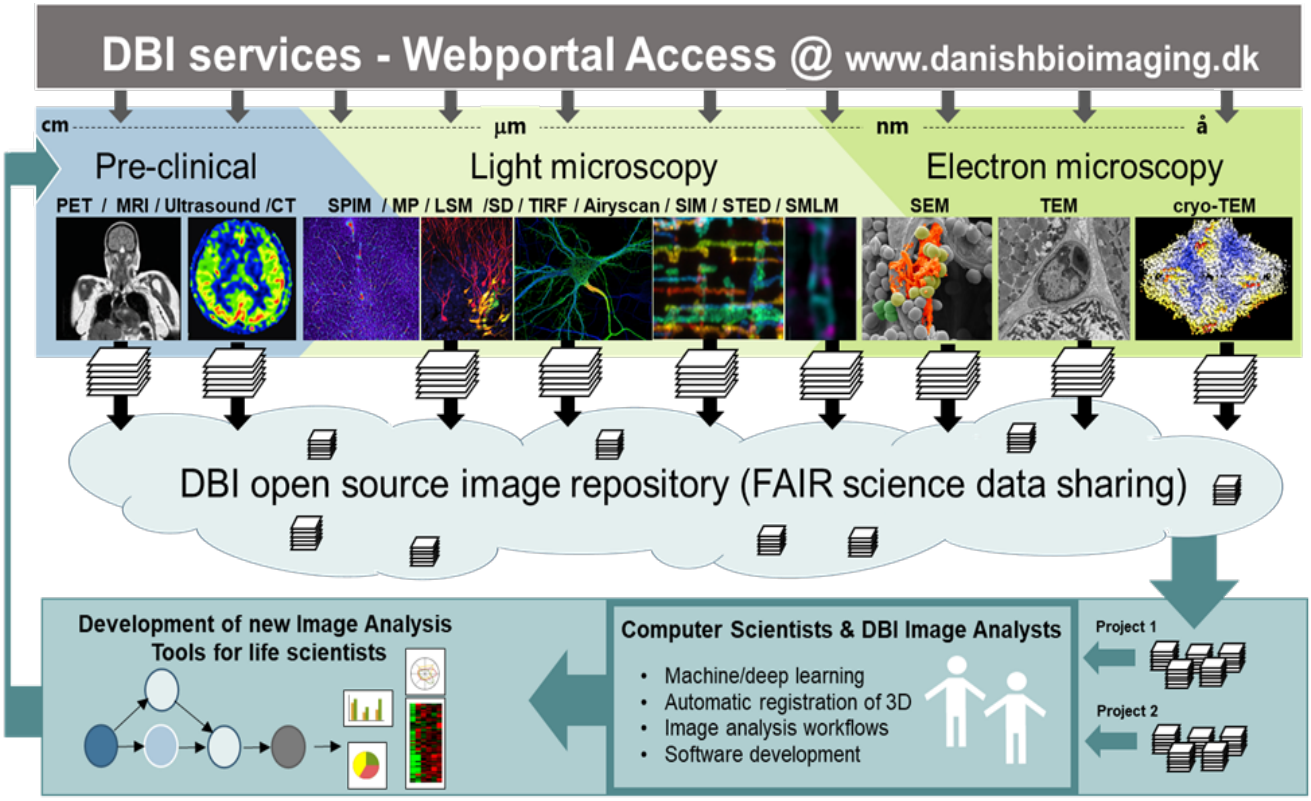
RUC

Uffe Holmskov
Vice dean for Research and Innovation
University of Southern Denmark

SDU

DBI-INFRA IMPLEMENTATION STATUS

The Ministry of Higher Education and Research has supported the implementation of the DBI-INFRA as a National bioimaging infrastructure. The implementation phase will take five years (2022/2027), during which the DBI-INFRA Executive board (EB) is to coordinate the implementation of new open access bioimaging technologies at the different DBI-INFRA technology Core Facilities (TCF), and create a unique national-wide Image analysis Core Facility to, in close collaboration with computer scientists at DTU and DIKU, support life scientists using the DBI-INFRA, from open access to remote computing solutions to common guidelines to share image-based data in compliance with the FAIR principles.



In this report, we will outline the implementation status of the current three main DBI-INFRA strategic goals:

1. COORDINATION AND COMMUNICATION - All DBI-INFRA services are to be visible to all relevant stakeholders, and openly accessible through a common access portal.

2. IMPLEMENTATION OF NEW TECHNOLOGIES - Coordination of capital investments for the implementation of new bioimaging technologies across DBI-INFRA.

3. DBI-INFRA IMAGE ANALYSIS CORE FACILITY- Implementatio of nation-wide open access image analysis services and a FAIR science image-based data sharing repository.

1. COORDINATION AND COMMUNICATION

To coordinate the implementation of new DBI-INFRA technologies, drive collaboration between DBI-INFRA partner institutions, and ensure the visibility and accessibility of DBI-INFRA services, the EB hired a DBI-INFRA Coordinator.

Sonia Diaz Garcia is a journalist and holds an European Master degree in Digital Communication. She has a vast experience in internal and external communications at previous positions at DTU and IBM Denmark. Most recently, Sonia was the Project Manager & Outreach Officer of CIRCULAR VISION, a EU Horizon 2020 (FET-Open) coordinated by the University of Copenhagen.

"April 2022 was the start of a great and exciting adventure. Since then we have been busy outlining the implementation of our main strategic goals. We have hosted and participated in many events, workshops, and national and international activities. In this report we showcase a few highlights. I hope you have a nice reading experience with the DBI-INFRA annual report".

SONIA GARCIA, DBI-INFRA Coordinator

The DBI-INFRA Retreat - December 5-6th, 2022

Many members of the Danish Bioimaging scientific community joined the DBI-INFRA consortium for a two-days retreat in SDU, Odense. The program was designed to drive knowledge exchange, for the DBI-INFRA TCF teams to meet each other, and to gather information from different stakeholders on strategic subjects. The retreat started with technology development talks by three guest speakers: Pratik Shah from Roskilde University, Emil Boye Kromann from DTU Health Tech, and Thomas Levin Andersen from University of Southern Denmark. Johanna Bischof, Scientific project Manager at Euro-BioImaging, followed with an overview on how the DBI-INFRA team and the scientific community can benefit from Euro-BioImaging services, activities and funding opportunities.

During the meeting, the DBI-INFRA team gathered information from the TCF and the scientific community to define the strategy for DBI visibility and coordination, create and implement the DBI-INFRA image analysis services, and talk about the future developments needed for the future sustainability of core facilities, and core facility professionals. The program also included a session on Technology Core Facilities flash talks to drive collaborations and mobility across institutions. The retreat ended with a poster session, a tour around the DaMBIC facility and a finger-food dinner for networking.

1. COORDINATION AND COMMUNICATION

***DBI-INFRA Retreat** - From top-left to bottom-right: Daniel Wüstner and Jonathan Brewer; Pratik Shah giving and online talk from Roskilde University; Thomas Braunstein from CFIM (UCPH) asking a question; people at the poster session; Johanna Bischof from Euro-BioImaging and Clara Prats during the session discussion; Mathilde H Lerche, Sebastian J Kjeldgaard-Nintemann and Nynne Christensen during a talk; Emil Boye Kromann from DTU Health Tech during his technology development talk; Thomas Levin Andersen from University of Southern Denmark during his technology development talk.*

The DBI-INFRA Tour - Fall 2022

The DBI-INFRA Coordinator, the Head of DBI-INFRA IACF, and the DBI-INFRA Director went for a tour around the DBI-INFRA TCF in order to get to know the teams, services, infrastructures and needs of each facility.

This was a unique opportunity to spend time with the TCF teams and gather information about how the Coordinator and the Image analysis core facility can support their services. The tour included site visits to:

- The Bioimaging Core Facility (BCF) in the University of Arhus
- The Danish Molecular Bioimaging Center (DaMBIC) at the University of South Denmark
- The Translational Imaging Center (TIC) and the Center for Quantification of Imaging Data from MAX IV (QIM) at the Technical University of Denmark
- The Microscope-core at Roskilde University, the Center for Advanced Bioimaging (CAB)
- The Core Facility for Integrated Microscopy (CFIM) at the University of Copenhagen
- The Microscopy Core Facility at the Danish Cancer Institute.

1. COORDINATION AND COMMUNICATION

MICROSCOPY-CORE
ROSKILDE UNIVERSITY

DANISH MOLECULAR BIOIMAGING CENTER
UNIVERSITY OF SOUTHERN DENMARK

BIOIMAGING CORE FACILITY
AARHUS UNIVERSITY

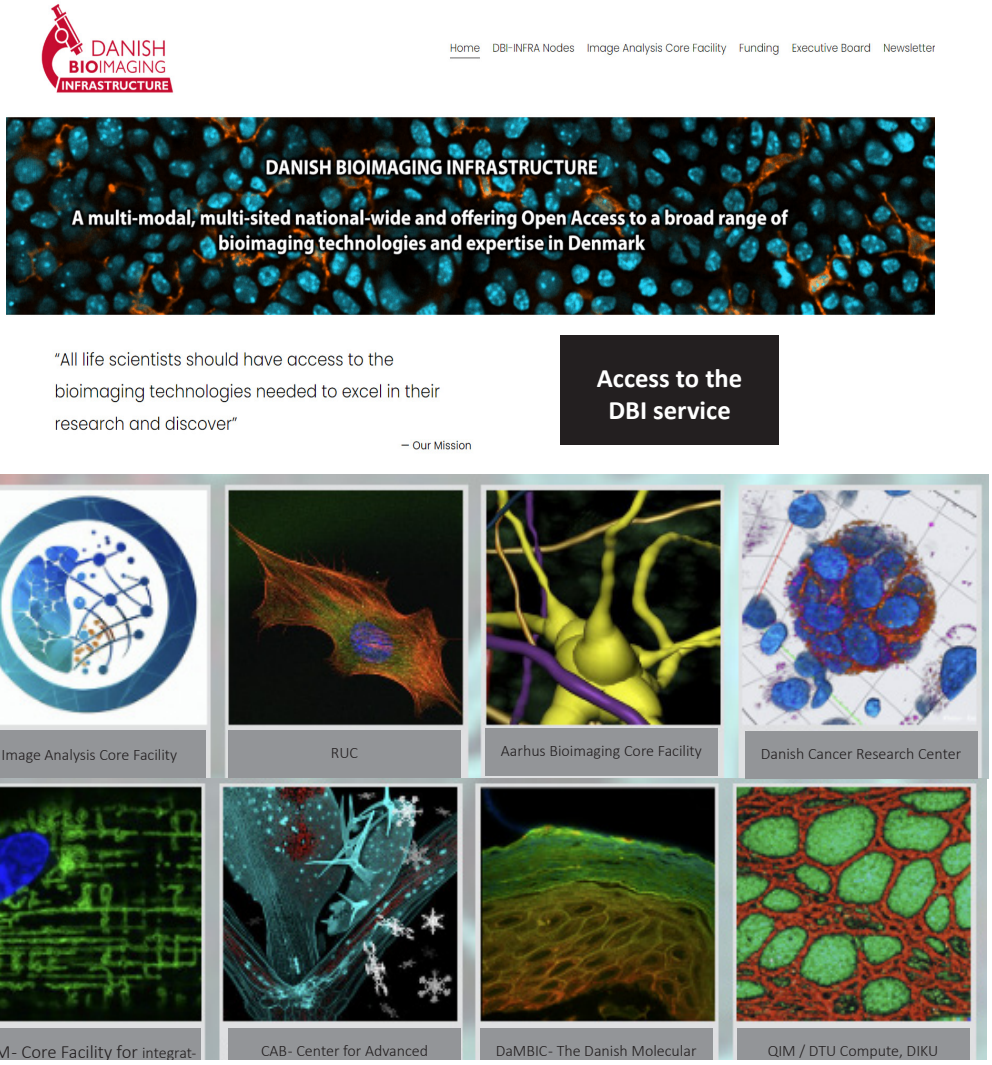
QIM AND 3D IMAGING CENTER
TECHNICAL UNIVERSITY OF DENMARK
UNIVERSITY OF COPENHAGEN

DBI-INFRA Tour 2022 *- Photo galleries published on DBI-INFRA Social Media - from the top-left to bottom-right: Visiting the microscopy core facility at RUC with Pia Nyeng; Visting DaMBIC at SDU with Jonathan Brewer and Morten Frendø Ebbesen; Visiting the Bioimaging Core Facility at Aarhus University with Michael Pedersen, Anna Lorentzen, and Morten Nielsen; Visiting the 3D imaging Center (3DIM) and QIM at both DTU and DIKU, with Jon Sporring, Anders Dahl, Rajmund Mokso, Francois Bernard Lauze, Hans Martin Kjær, and Carsten Gundlach.*

1. COORDINATION AND COMMUNICATION

The DBI-INFRA website and access portal

In August the DBI-INFRA website (www.dbi-infra.eu) was launched, showing an overview of the bioimaging technologies and activities offered at the different DBI-INFRA facilities. Under the DBI-INFRA nodes, a list of the DBI-INFRA TCF with links to their open access services and booking systems is to serve as the DBI-INFRA service portal. To support life scientist on their search for advanced bioimaging technologies, a project form can be filled to request expert advice. An expert group revises the projects and will advise on the most optimal technologies to answer the described research questions. In case the technologies are not available in Denmark, the project will be submitted through the Euro-BioImaging web-portal, and the users referred to state-of-the-art European core facilities.

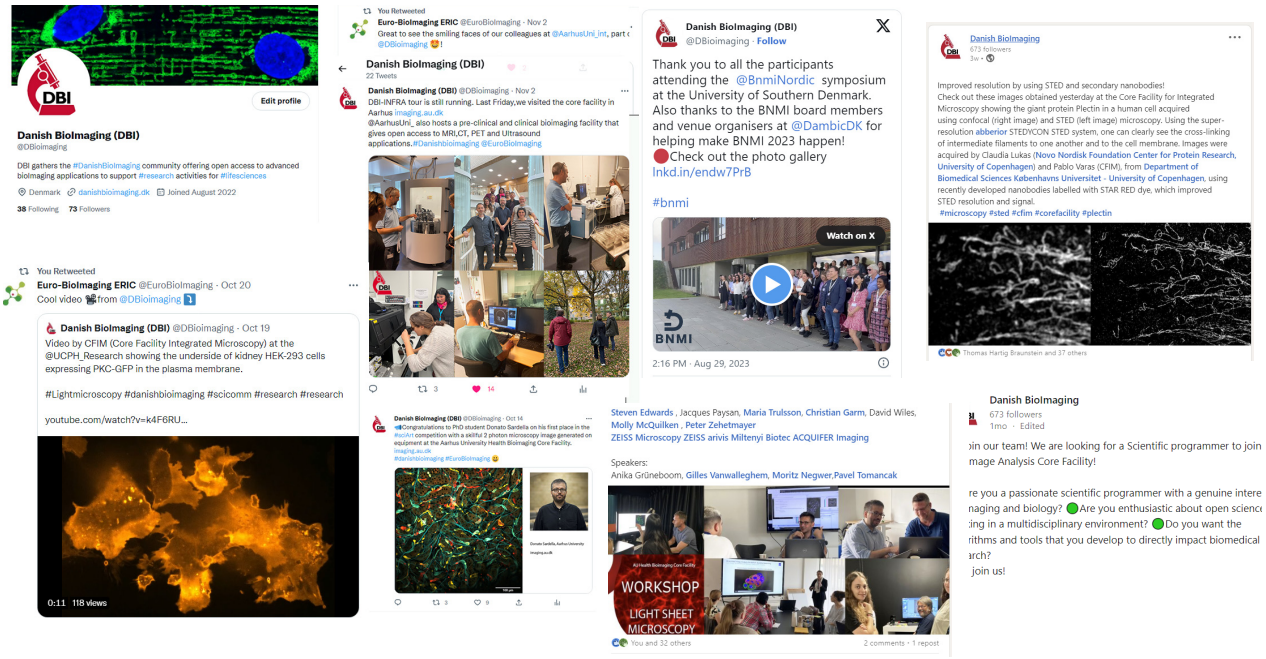


1. COORDINATION AND COMMUNICATION

The DBI-INFRA social media

The impact of the DBI-INFRA is highly dependent on the use of the implemented bioimaging technologies, and the visibility of its activities. To disseminate our services and activities, DBI-INFRA has an account on several social media platforms (Incl. Linkedin and X (twitter)).

DBI-INFRA has currently more than 673 followers in LinkedIn and more than 330 followers in Twitter (X). In addition, DBI sends out quarterly newsletters to 400 subscribers. Also through social media, DBI-INFRA is connecting with the global bioimaging communities and infrastructures. Re-sharing and liking eachothers services and activities to drive the dissemination of relevant post among the Danish bioimaging community.

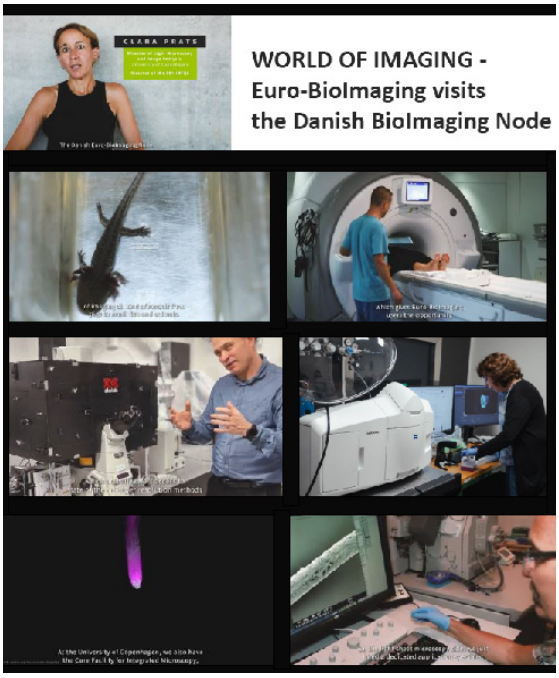


The DBI-INFRA accounts are used to disseminate new services, activities, and applications. The impact of the social media posts is easy to measure as the number of times the news have been viewed and/or shared. In 2022, the most popular stories have been the posts about the DBI-INFRA tour visits to the different danish bioimaing facilities around Denmark. To inspire life scientists and showcase the impact of open access bioimaging technologies, we have started a series called "meet the DBI-INFRA users", within which researchers using DBI-INFRA share their bioimaging research, highlighting how the use of specific technologies has impacted their research outputs.

1. COORDINATION AND COMMUNICATION

The DBI-INFRA other activities

In August 2022, Euro-BioImaging visited the DBI-INFRA to showcase technologies, expertise and services at the European level. Solveig Eriksson got a two-day tour around the DBI-INFRA facilities to collect material to produce this
DBI-INFRA promotion video- Watch the video.
The five DBI-INFRA facilities that are part of the Danish Euro-BioImaging node are the microscopy and preclinical facilities under the BioImaging Core Facility at the University of Aarhus, the Danish Molecular Bioimedical Imaging Center at the University of Southern Denmark, and the Center for Advanced BioImaging and the Core Facility of Integrated Microscopy at the University of Copenhagen. On the video the DBI-INFRA Director, Clara Prats, talks about the open access technologies available at the Danish multimodal Euro-Bioimaging node (DBI) and what Danish BioImaging has to offer.



The Danish Euro-Bioimaging node is a mixed, multi-sited node that offers access to bioimaging technologies across scales and to image analysis services to support quality data extraction from complex image-based datasets.

In the image, from left to right, DBI-INFRA Coordinator Sonia Diaz, Euro-Bioimaging Bio-Hub Director Antje Keppler and Clara Prats.

This summer, we also had the plesure to welcome Antje Keppler, Euro-BioImaging Bio-Hub Director and Chair of the ERIC Forum. Antje visited the DBI-INFRA Hub on her way to Lund, where she was to Chair the ERIC Forum and visit ESS.

During her visit, Antje was shown around some of the DBI-INFRA facilities, met the members of the DBI-INFRA Image Analysis Core Facility, and exchanged thoughts about the opportunities and challenges for research infrastructures and their long-term financial sustainability at the national and international level.

1. COORDINATION AND COMMUNICATION

The DBI-INFRA other activities

DBI-INFRA was at the Euro-BioImaging's All Hands Nodes Meeting in EMBL, Heidelberg.

"Only working together at the national and international level can we ensure excellent and sustainable open access bioimaging technologies.

Danish Biomaging was at the Euro-BioImaging's All Hands Nodes Meeting and the BioImaging and European Open Science Cloud meeting at EMBL, Heidelberg from April 17-20th, 2023. During the meeting, Sébastien Tosi presented the newly created Danish BioImaging Image Analysis Core Facility, and Clara Prats was invited to be a panelist at the "Funding for national imaging communities" panel, and present the history behind DBI-INFRA. Finally, Sonia Diaz co-chaired the session on "Increasing User Access and Funding for User Access" with Marc Van Zandvoort from NL-Bioimaging. Furthermore, Thomas Braunstein from CFIM, attended the meeting representing the panel of facilities at Danish Bioimaging. He was interviewed to explain how does a typical user project works at Danish Bioimaging and his interview was published at the Euro-BioImaging social channels.

From left to right: Timo Zimmermann, Imaging Center EMBL, Clara Prats, Danish BioImaging, and Sebastian Munck, Bio Imaging Core at Leuven Brain Institute, during a visit to the new Imaging Center at EMBL; Panelists during the "Funding for national imaging communities" session.

1. COORDINATION AND COMMUNICATION

The DBI-INFRA courses and workshops

The Danish BioImaging network has been running a yearly **DBI cross-institutional PhD course** since 2018. The course is unique as it allows Danish PhD students to visit several DBI-INFRA groups and facilities, learning about bioimaging technologies across scales, and the available Danish bioImaging infrastructures and expertise.
The course is relevant for PhD students within medicine, physics, chemistry, biochemistry, molecular biology, nano-bioscience, pharmaceutical sciences, agricultural science or biology. The emphasis of the course is a tour around bioimaging technologies available in Denmark, and it covers subjects such as advanced live cell imaging, confocal microscopy, electron microscopy, super-resolution microscopy and image analysis.

In collaboration with the GTS Alexandra Institute, the DBI-INFRA has co-organized two **Image analysis stakeholder workshops** focused on bridging bioimaging academia and TCF with industry. The focus of the two workshops was set to "How can we improve collaboration across sectors within bioimaging" and "To code or not to code- do life scientists need to learn to code?".

The Bioimaging Facility at Aarhus University has hosted a Light Sheet Microscopy workshop in collaboration with the Bridging Nordic Microscopy Infrastructures. The DBI-INFRA Image Analysis Core Facility has organized two workshops, one focused on the histopathology image analysis software QuPath, and the other focused on introducing life scientists and core facility staff to python coding for bioimage analysis and deep learning workflows deployment.

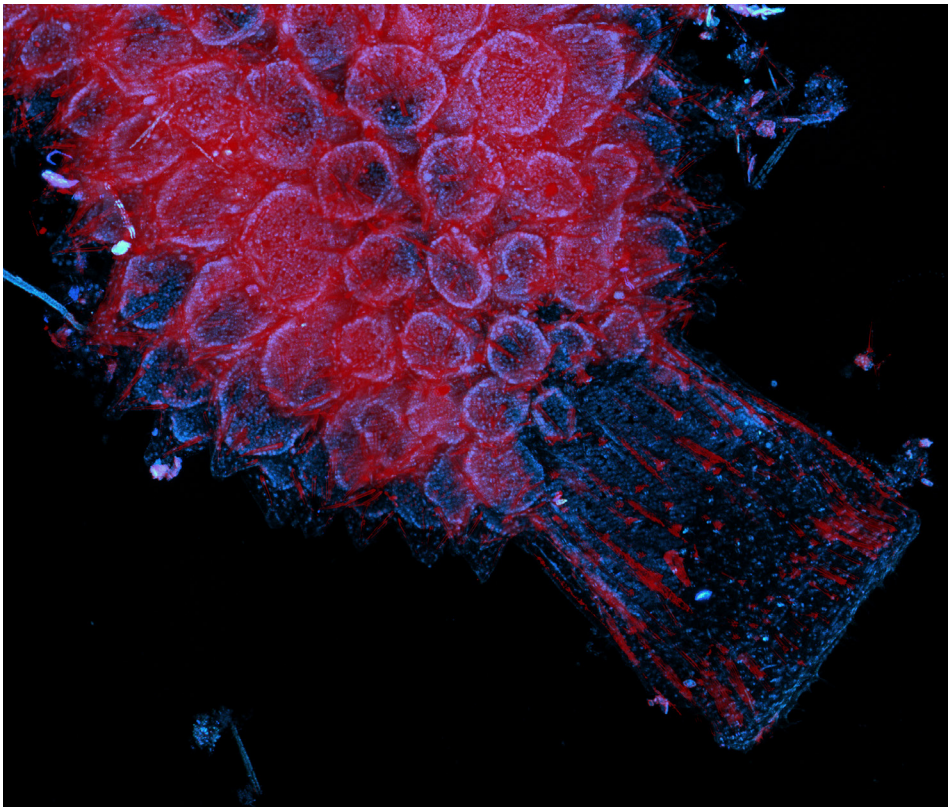
1. COORDINATION AND COMMUNICATION

The DBI-INFRA TCF organize courses and workshops tailored to the needs of the local research community, but open and disseminated through the DBI network. In order to boost knowledge exchange, a DBI course repository has been created, which gathers a list of the bioimaging relevant courses hosted at different institutions. The repository is accessible at www.danishbioimaging.dk

The list includes QIM Summer schools, PhD summer school on microscopy organized by CAB, lectures in master courses on image processing and analysis and microscopy technologies organized by UCPH-Science, master course in experimental Cell Biology, and a PhD course in light microscopy and image analysis offered by RUC and co-organized with DBI-infra image analysis Core Facillity and external partners (Danish Diabetes and Endocrine Academy, Gubra, and Bitplate), and two annual Light Microscopy PhD courses on principles and advanced light microscopy, one Image analysis PhD course and one Electron Microscopy PhD course offered by CFIM.

In addition, the DBI-INFRA TCF have offered several technology demos in collaboration with several manufacturers for the community to test relevant new technologies and/or imaging equipment (Incl. Light sheet Blaze, Light Sheet 3i, NanoLive and the HCS MICA from Leica).

2. IMPLEMENTATION OF NEW TECHNOLOGIES



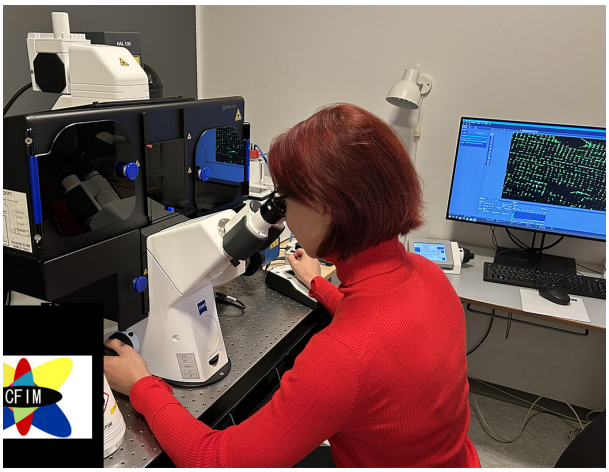
The Ministry of Higher Education and Science has granted DBI-INFRA ~30M DKK to support capital investments in hardware for the implementation of new bioimaging technologies at the DBI-INFRA institutions.

In this section, we summarize the current status of the different capital investments, and when relevant, we describe some of the applications life scientists have access to thanks to the implemented technologies. There are some of the capital investments, which are in still in progress. Moreover, some of the investments are to create new services, others to upgrade existing services. Finally, we are glad to highlight that the implementation of the DBI-INFRA has helped some existing facilities open for access to external users. DBI-INFRA works to maximize sharing of infrastructures and expertise across institutions to minimize unnecessary infrastructure redundancy.

2. IMPLEMENTATION OF NEW TECHNOLOGIES

CORE FACILITY FOR INTEGRATED MICROSCOPY UNIVERSITY OF COPENHAGEN

The DBI-INFRA has co-financed 60% of the purchase of a Carl Zeiss Elyra 7 to implement live Structured illumination Microscopy (SIM) and dual color Single Molecule Localization Microscopy (SMLM) at the Core Facility for Integrated Microscopy, Faculty of Health and Medical Sciences at the University of Copenhagen



"My PhD research focuses on changes to the structure of the mitochondrial networks in muscle fibers of mouse models. We subject the mice to different exercise regimes and analyze the mitochondrial distribution as a result of physiological changes. Conventional microscopy approaches are not good enough to get the insight we need to decipher mitochondrial organization in such thick, dense samples.

By using SIM on the Elyra 7, I could resolve the mitochondria better, while efficiently removing out of focus blur, which also resulted in sharper images. SIM has been key for my experiments because it improves the resolution in X and Y, but also critically in Z, which allows for a better reconstruction of the mitochondria in these muscle samples, being able to pick nuanced changes in the network they form.

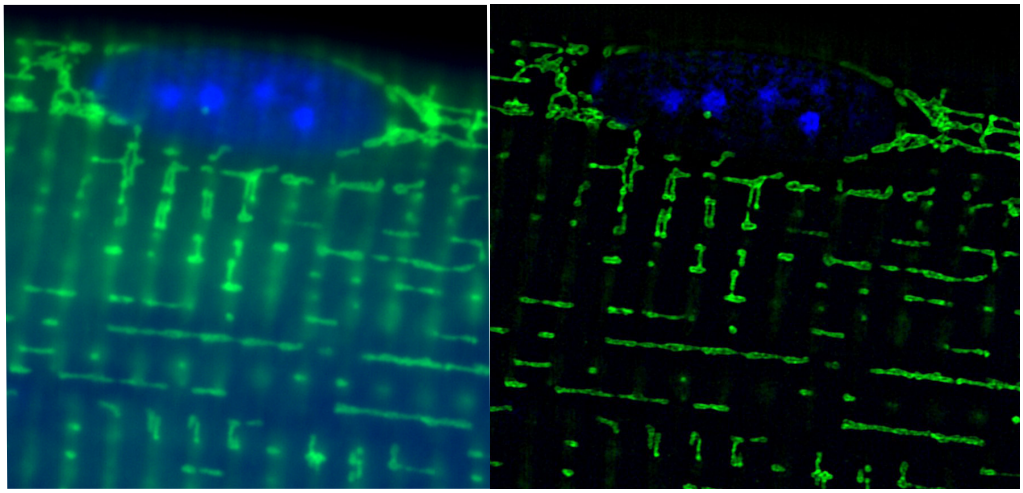
Sabina Chubanava, PhD student at
the NNF Center for Basic Metabolic Research, University of Copenhagen

2. IMPLEMENTATION OF NEW TECHNOLOGIES

CORE FACILITY FOR INTEGRATED MICROSCOPY UNIVERSITY OF COPENHAGEN

The optical resolution limit of light microscopy is close to the size of intracellular compartments. Consequently, optical microscopes allow us to visualize intracellular compartments, analyse their distribution and monitor their dynamics. However, in order to investigate whether specific proteins reside inside, in the organelle membrane, or outside and organelle, light microscopy super resolution methods are required. At CFIM, life scientists get access to the equipment and expertise needed to use a broad range of super resolution methods (Incl. Airyscan, SIM, STED and SMLM).

With the installation of the new Elyra 7 at the beginning of 2023, DBI-INFRA users have now also access to fast live super resolution imaging, and faster imaging of super resolved fixed samples. In addition, the Elyra 7 is equopped with two cameras that allow for simultaneous single molecule l ocalization microscopy. These applications were not available before, and are currently enabling experiments in twelve different research projects. These projects focuse on mitochondria biology, DNA repair, bacterial growth and division, and neuroscience.



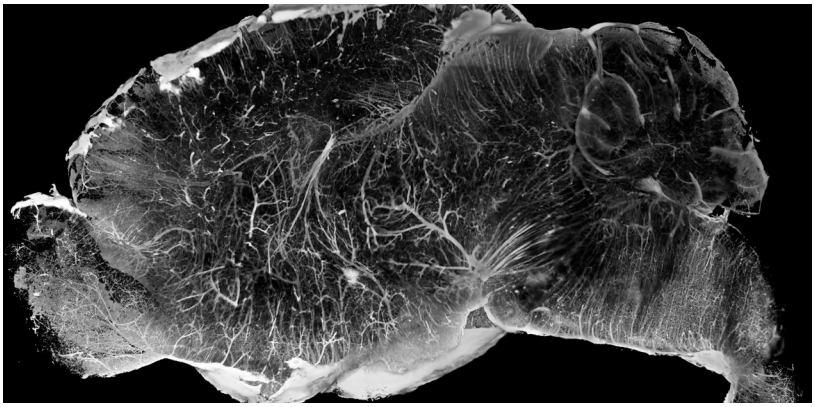
Human skeletal muscle mitochondrial networks imaged with widefield microscopy (left image) and with structured illumination microscopy (SIM, right image). With the Elyra7 we can resolve two adjacent mitochondria from eachother, allowing us to analyse mitochondrial dynamics and structural reorganization induced by physiological/pathological processes. Myonuclei are in blue and mitochondrial networks in green.

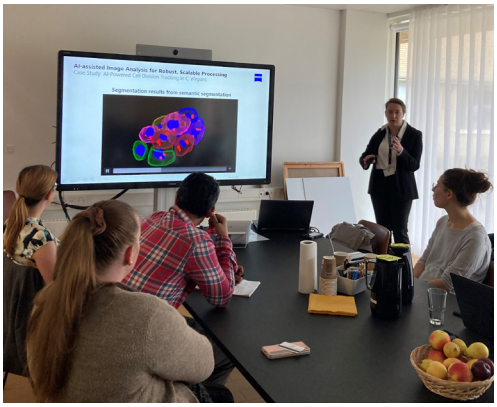
2. IMPLEMENTATION OF NEW TECHNOLOGIES

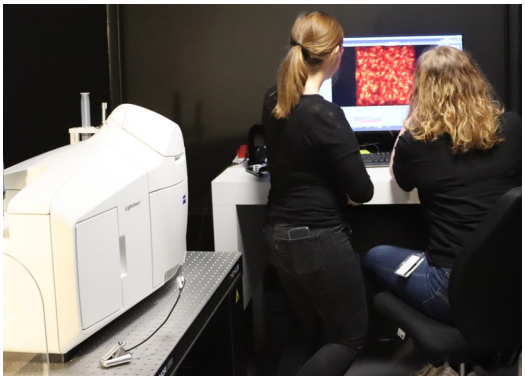
BIOIMAGING CORE FACILITY
AARHUS UNIVERSITY

Under the implementation of the DBI-INFRA, the Bioimaging Core Facility at the Faculty of Health, Aarhus University has purchased a Carl Zeiss Light Sheet 7, which allows DBI-INFRA users to image large samples live with minimal phototoxicity, or fast imaging of large fixed and cleared samples.

This system allows imaging of cleared tissue samples of up to 1 cubic centimeter with subcellular resolution. We expect this instrument to provide new opportunities in medical research in immunology, neuroscience, cardiovascular research etc. In August 2023 we launched the microscope with a one-week course on light sheet, covering the theory of light sheet imaging, tissue clearance and labeling. This meeting was made with support from Bridging Nordic Microscopy network and had in addition to local users, participants from several European countries. At presence we have approximately 10 trained users which already acquired great images from cleared brain and aorta from mice.







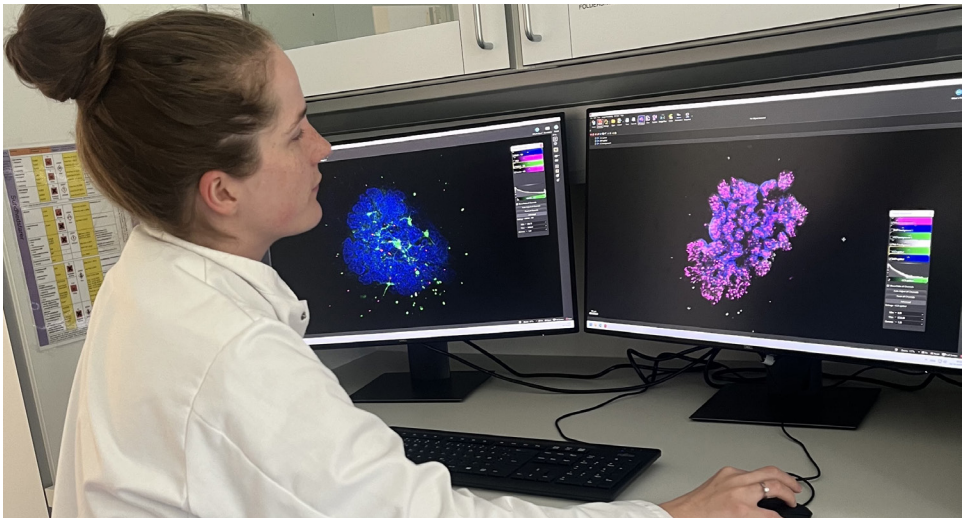
Top-left image shows capillaries in a half of a mice brain hemisphere acquired with the LS7. The top-right image was taken during the light sheet microscopy workshop, and the bottom image Nina Glöckner Burmeister, facility manager, is trainning a user on the LS7.

2. IMPLEMENTATION OF NEW TECHNOLOGIES

THE MICROSCOPE CORE FACILITY ROSKILDE UNIVERSITY

Under the implementation of DBI-INFRA, the Microscope Core Facility at Roskilde University has upgraded an existing Olympus LSM FV1200S-IX83 laser scanning confocal microscope with new objectives, and a new laser line to allow high resolution and live cell imaging. In addition, a Leica TCS SP5 multi-photon will also be upgraded in the next year.

Since its upgrade in 2022 the system has been used for several research projects with live cells and fixed tissues, including projects involving imaging of cancer cells, bacteria, organoids and whole organs.



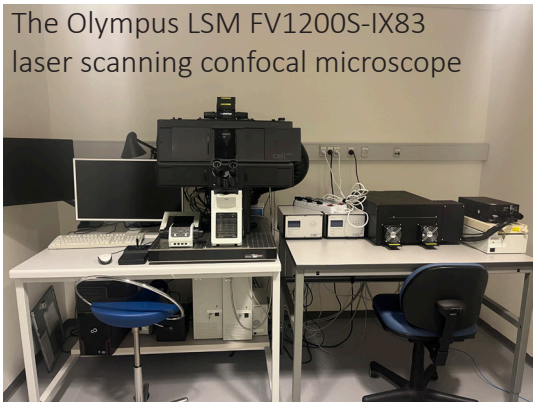
In the image
Rikke Agerskov is analysing confocal 3D images of a pancreatic organ model

"My research focuses on innervation of the pancreas during embryonic development. The pancreatic neurons are very intricate thin structures that span all dimensions. By analyzing 3D images of pancreatic samples, I can quantify changes in the neurons and in pancreatic development, that would not be visible in 2D images. Obtaining quantitative results using powerful image analysis tools rather than just getting "pretty pictures" is key to answering my research questions."

Rikke Agerskov, Research Assistant at the section for Molecular and Medical biology
Roskilde University

2. IMPLEMENTATION OF NEW TECHNOLOGIES

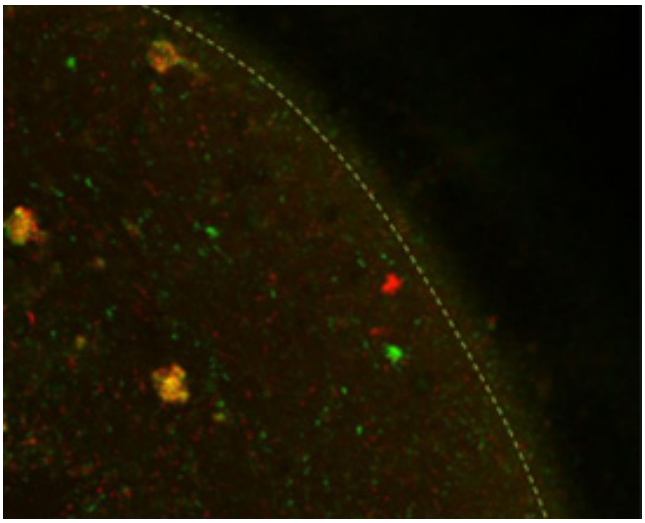
THE MICROSCOPE CORE FACILITY ROSKILDE UNIVERSITY



The Olympus LSM FV1200S-IX83 laser scanning confocal microscope

"My master project investigated the capability and performance of a chronic wound biofilm model infected with two pathogenic bacteria commonly isolated from chronic wounds. We used the confocal microscopy to identify the location of the two bacterial strains (Pseudomonas aeruginosa and Staphyloccocus areus) in the chronic wound model and the ability of the different strains to develop a biofilm. Conventional 2D light microscopy methods are limiting to study bacterial biofilms as we lack the full 3D architecture of a biofilm. In contrast, confocal microscopy allows us to choose depth and location in a sample, giving us a better understanding of the structure, composition and behavior of biofilms in various research applications.

Line Ørbech Sadolin, MSc student at Department of Science and Environment , Roskilde University



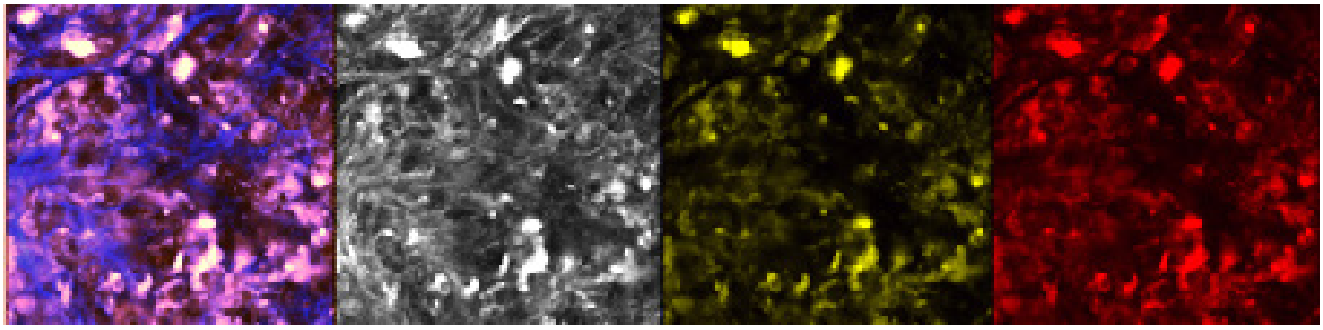
A 72-hour chronic wound biofilm model with Pseudomonas aeruginosa (green) and Staphylococcus aureus (red) stained with SYTOTM 9 and Hexidium iodide. The striped line represents the edge of the wound.

2. IMPLEMENTATION OF NEW TECHNOLOGIES

DANISH MOLECULAR BIOIMAGING CENTER UNIVERSITY OF SOUTHERN DENMARK

DBI-INFRA has allowed DaMBIC to purchase a large-fomat Nikon multiphoton microscope, which will allow life scientists to use Second harmonic generation imaging to study collagen from human fibroblasts.

The Nikon Multiphoton Microscope features ultrafast resonant scanners; high-sensitivity, low-noise GaAsP detectors; and industry-leading optics. This offers an increased level of imaging depth, and sensitivity enabling us to explore the intricacies of biological systems. It allows us to delve deep into tissues, unveiling neural networks, vascular structures, and cellular processes with great clarity.



Intra-vital Second Harmonic Generation imaging of unlabelled tissue

This makes the microscope a fantastic tool for in vivo research projects, allowing us to study biological processes within living organisms in real-time. Projects across neuroscience, cancer research, and regenerative medicine stand to benefit immensely from this advanced tool.

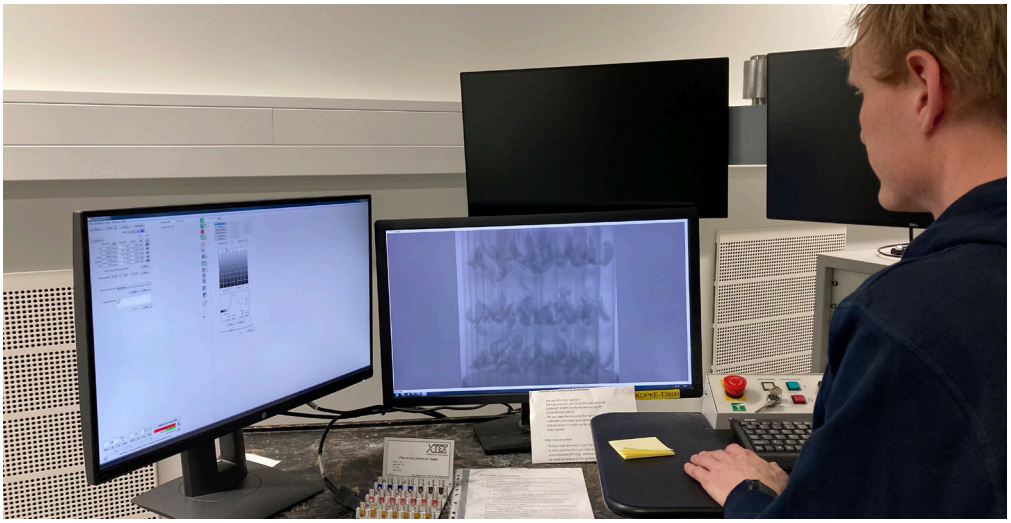
In summary, the new multiphoton microscope is a versatile and powerful imaging system that offers several advantages, making it suitable for a wide range of research applications across various scientific disciplines, particularly in the life sciences. It enables researchers to gain insights into complex biological systems and dynamic processes via in vivo imaging, while minimizing photodamage and photobleaching.

2. IMPLEMENTATION OF NEW TECHNOLOGIES

CENTER FOR QUANTIFICATION OF IMAGING DATA FROM MAX IV TECHNICAL UNIVERSITY OF DENMARK AND UNIVERSITY OF COPENHAGEN

Under the implementation of the DBI-INFRA, the QIM center is developing algorithms for quantitative image analysis and is building an image analysis platform to support bio-imaging analysis.

The QIM Center collaborates with the DBI-INFRA Image Analysis Core Facility (IA-CF) on new tool development and knowledge sharing. In addition, QIM's image analysis platform is now in version 2.1. The platform is currently being tested and has been made available for users.



In the image, Hans Martin Kjær is developing QIM image analysis tools

The IA-CF and QIM teams are regularly meeting, and are creating an overview of all relevant QIM tools to make them available on the platform. In addition, the teams are establishing new coding standards that will be used to ensure that shared codes are easily usable by bioimaging users not familiar with python tools. The QIM Center has held workshops on life science and hospital collaborations offering knowledge sparring and tutorials for live science researchers on how to analyze their data.
In 2023 we have initiated the creation of a new large 3D bio-imaging dataset that will support the creation of new AI methods for analyzing 3D image data. The dataset will be available at the beginning of 2024.

2. IMPLEMENTATION OF NEW TECHNOLOGIES

TRANSLATIONAL IMAGING CENTER TECHNICAL UNIVERSITY OF DENMARK

Under the implementation of DBI-INFRA, TIC is investing in a PET-SPECT combined with CT technologies for imaging of small animals. Currently TIC is building the needed radiochemical work zone for this new imaging equipment.

TIC allows researchers to combine the use of advanced biomedical imaging with animal research. The facility is building capabilities to offer imaging from cell to large animal using different imaging modalities alone and in combination.

In the left image, Kasper With Nielsen is training a user, in the right image surgery is performed at TIC

TIC offers open access to small animal CT imaging with the option to combine morphological imaging with optical imaging (fluorescence or bioluminescence) for e.g. localization of new material or evaluation of drug distribution. These imaging capabilities has been built within the small animal stables allowing advanced animal models and surgery to be included in the research.

2. IMPLEMENTATION OF NEW TECHNOLOGIES

CLINICAL MEDICINE IMAGING FACILITY AARHUS UNIVERSITY

Under the implementation of DBI-INFRA, the pre-clinical facililty at AU will build two pre-clinical systems, an optical lab and a micro-CT lab. The installation of the systems has been delayed due to missing parts.

The optical lab will allow for non-invasive imaging with Optical Coherence Tomography, Laser Speckle Imaging and Fluorescence-based imaging. This lab will be used to visualize microstructural soft-tissue structures with few millimeters penetration depth and with a very high resolution.

On the other hand, the new micro-CT lab will allow visualization of both hard and soft tissues with micrometer resolution. The system will be built to be able to handle very large samples, for example whole animals and whole human organs.

In the image, boxes with the parts needed to build the two pre-clinincal labs are being delivered

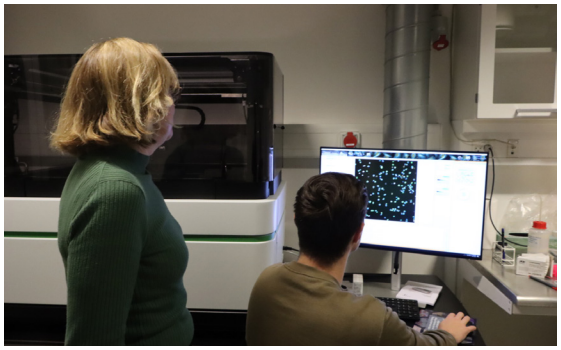
The parts needed to build the systems were ordered in 2022, however, due to very delayed delivery schedules from the vendors, the parts are currently being delivered. We expect to have both labs up and running, including ongoing research applications, from start 2024.

2. IMPLEMENTATION OF NEW TECHNOLOGIES

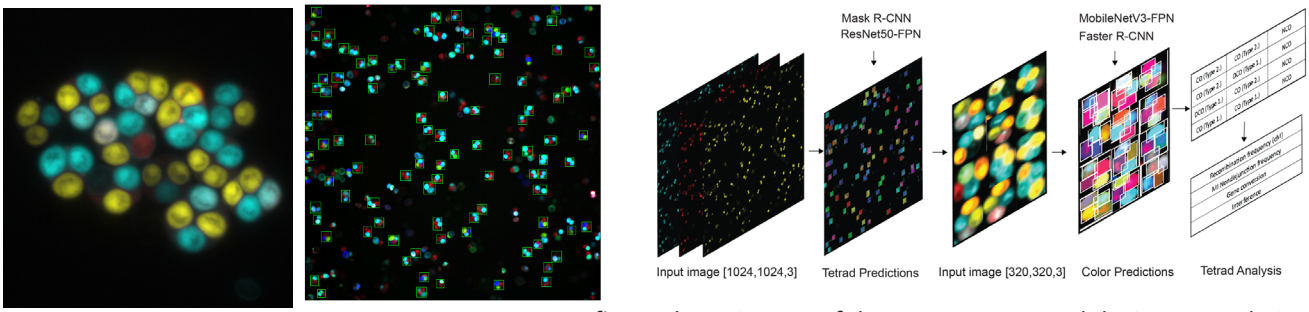
CENTER FOR ADVANCED BIOIMAGING (CAB) UNIVERSITY OF COPENHAGEN

Under the DBI-INFRA implementation, CAB has investmented into two new state-of-the art microscopes, the high-content spinning disk microscope and a transmission electron microscope (TEM), the Talos microscope.

> *The microscope was installed 4 months ago and currently 7 research groups and a biotech company collect data using the system.*
>
> Nynne Christensen
> CAB manager



The HCS system is being used to elucidate the key genes and pathways involved in meiotic recombination by conducting a genome-wide yeast screen using a modified version of a yeast gene knock-out library. Using the HSC has been a key component making it possible to gather data and quantitatively analyze morphological phenotypes based upon fluorescent markers, further extending genetic interaction studies. We have developed a custom image analysis pipeline that performs instance segmentation and classification of cells in large volumes of high-resolution microscopy image data. The results from this project will help our understanding of meiotic re-combination in yeast and humans and will further elucidate the underlying factors behind oocyte aneuploidy and crossover interference.



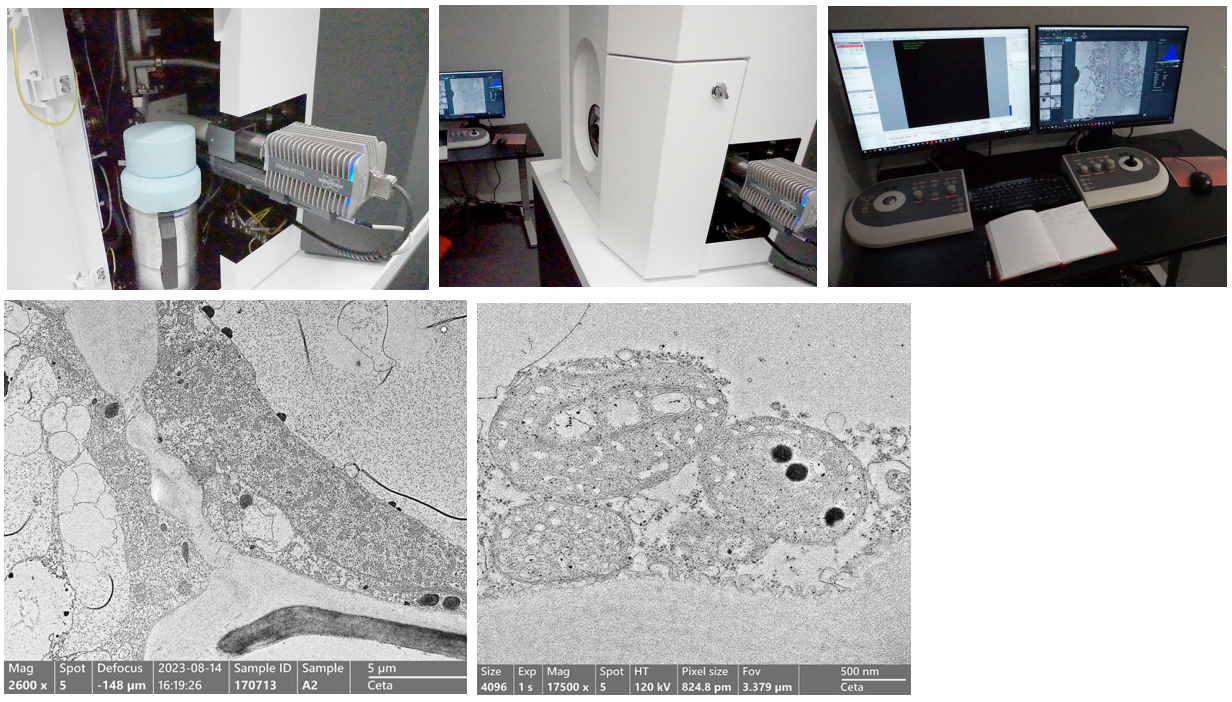
Top figure shows images of the Yeast screens, and the image analysis pipeline developed by the DBI-INFRA Image Analysis Core Facility. To the right, an image os the fibroblast screening

2. IMPLEMENTATION OF NEW TECHNOLOGIES

CENTER FOR ADVANCED BIOIMAGING (CAB) UNIVERSITY OF COPENHAGEN

In addition CAB has invested in a state-of-the-art Scanning / Transmission Electron Microscope (TEM). The Talos microscope is fully controlled by software (Pic TEM control); only change of specimen is done manually. In addition to using conventional ultrathin sectioned (see pics Plant organelles and Pine needle vascular cell contacts) or negative contrasted specimens it enables tomography by tilting the specimen 70 degree in either direction, i.e. 140 degree). In the scanning mode, a thin electron beam scans the specimen which allows both bright field and darkfield imaging. This mode is of importance for the use of the EDS detector (pics Talos with EDS detector and/or EDS X-ray detector) for analytical microscopy where element spectra are captured and quantified by the X-ray detector.

Installation of the system has started after the summer break, but due to delivery issues user access has only started recently.



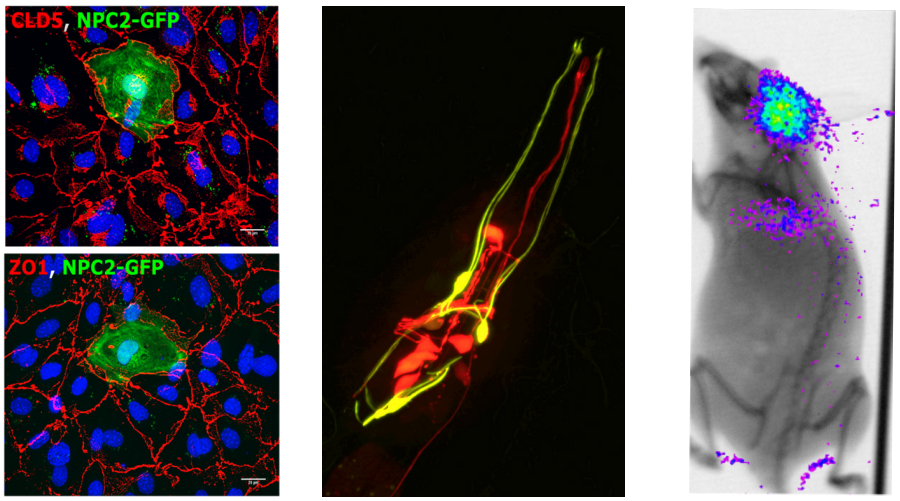
Top images are of the purchased TEM Talos system. Bottom-Left image is a TEM image of a pine needle, bottom-right image is a TEM image of plant organelles

2. IMPLEMENTATION OF NEW TECHNOLOGIES

DANISH MOLECULAR BIOIMAGING CENTER AALBORG UNIVERSITY

Aalborg University joined the DBI-INFRA consortium with the goal of supporting the creation of an open access bioimaging core facility.

Aalborg University harbors more than twenty research groups publishing research from an outset of morphology approaches. The research includes studies in several models, ranging from simple cellular systems to intact animals. For example, insects and mammalian primary cells cultured in 2D and 3D systems are studied for transport mechanisms using fluidic measures combined with cellular integrity. Small multicellular animals like C. elegans are used to study degeneration and regenerative capabilities of neurons in real time using proteins tagged with fluorescence. Rodent models are used to study blood flow and metabolism using fluorescent tracers.



Realtime imaging of cultured cells (left), dopaminergic neurons of C. elegans (middle) and intact animal (right) captured by conventional confocal, spinning disc and bioimaging and respectively.

Researchers at Aalborg University intend to achieve a significant upgrade of their infrastructure for microscopy and imaging based morphological analysis. By purchasing and implementing 2-photon imaging technology, studies of cellular interactions, simple networks and vascular branching can be performed not only at highest resolution and imaging depth, but also at high- through-put. The latter, because cellular models, organoids and small animals can be examined in high numbers in microfluidic systems with continuous monitoring of light emission.

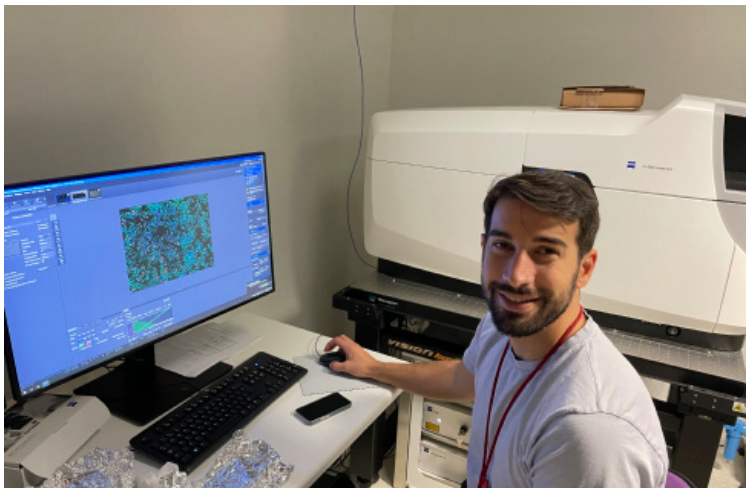
2. IMPLEMENTATION OF NEW TECHNOLOGIES

THE CORE FACILITY FOR BIOIMAGING DANISH CANCER INSTITUTE

Under the DBI-INFRA implementation, the core facility for Bioimaging at the Danish Cancer Institute has purchased a Carl Zeiss Cell Discoverer 7 for automated high-throughput microscopy.

The CD7 has become the most advanced and versatile automated microscope in the facility. The system allows for high throughput imaging with a broad range of resolutions; from widefield to super resolution Airyscan.

Several projects are already conducting large-scale multiwell drug screens to identify potential new treatments for cancer. Meanwhile, others are using the microscope to study the super-resolution morphology of subcellular organelles, such as mitochondria and lysosomes. Additionally, there are projects where researchers focus on real-time monitoring of cell division in experiments that span multiple days.

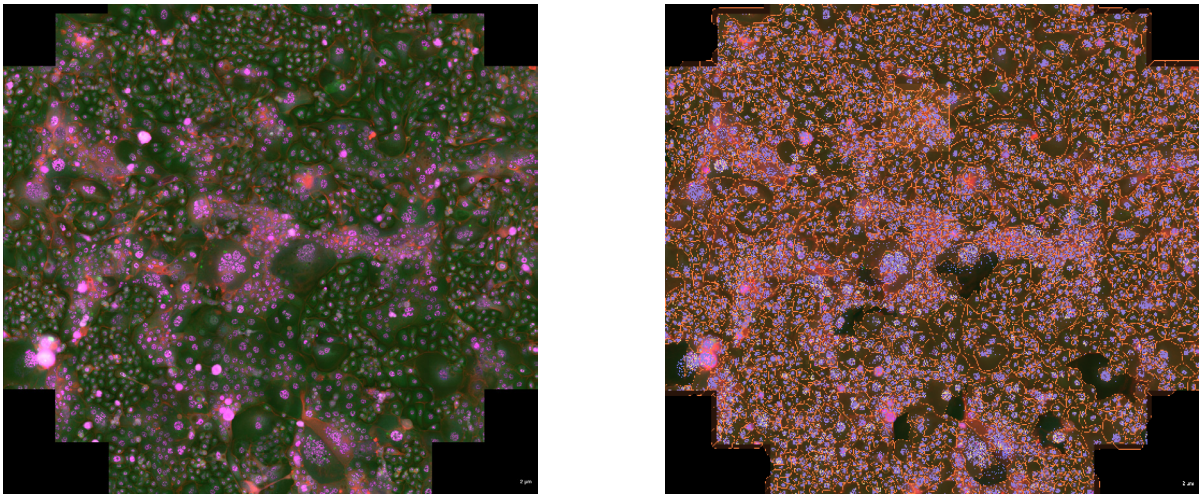


A researcher performing a high content experiment on the newly purchased, DBI-INFRA funded Cell Discoverer 7

Having had the CD7 operational for nearly a year, multiple research teams rely on it. Currently, there are more than 20 active research projects using the microscope. As a testament to its demand, we regularly see booked times exceeding 100 hours per week.

2. IMPLEMENTATION OF NEW TECHNOLOGIES

THE CORE FACILITY FOR BIOIMAGING DANISH CANCER INSTITUTE

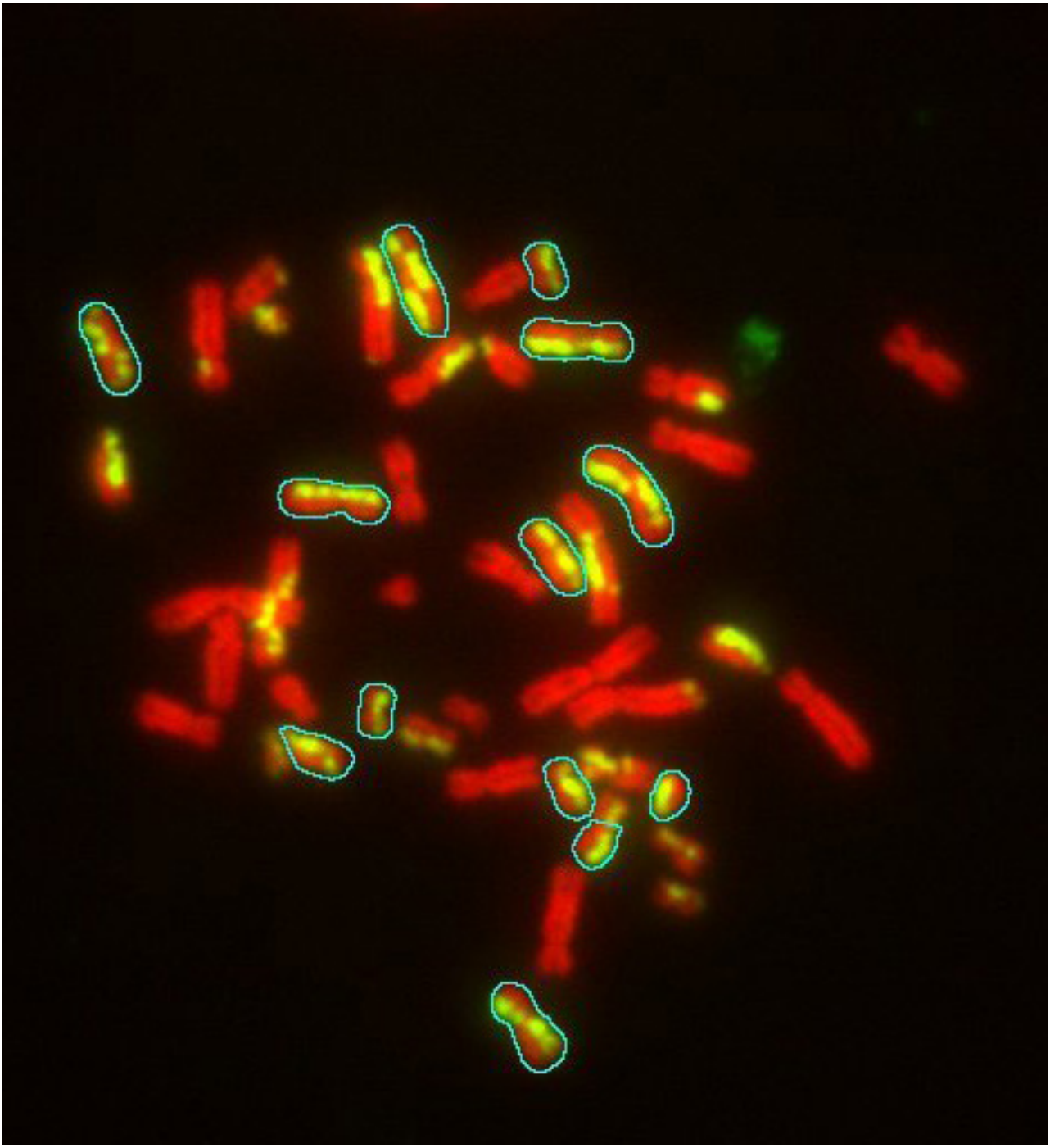


Images taken by Robert Strauss. Left image is a composite of 88 individual high resolution microscopy images of cells showing multiple subcellular structures in different fluorescent colors. Right image is the same field of view overlaid with cell segmentation results. Orange outlines delineate cell membranes, bright blue spots show intracellular accumulations of a stress protein.

"One of my research projects focusses on how cancer cells can become resistant to chemotherapeutic agents like platinum drugs. This is a big problem for many ovarian cancer patients where we often see relapses after treatment. With powerful screening microscopes like the CD7 I can screen many drugs, in many cancer cell lines with immunofluorescence staining of many target proteins to perform comprehensive analyses that would not be possible otherwise"

Robert Strauss
Senior Scientist at the Genome Integrity Unit
Danish Cancer Institute

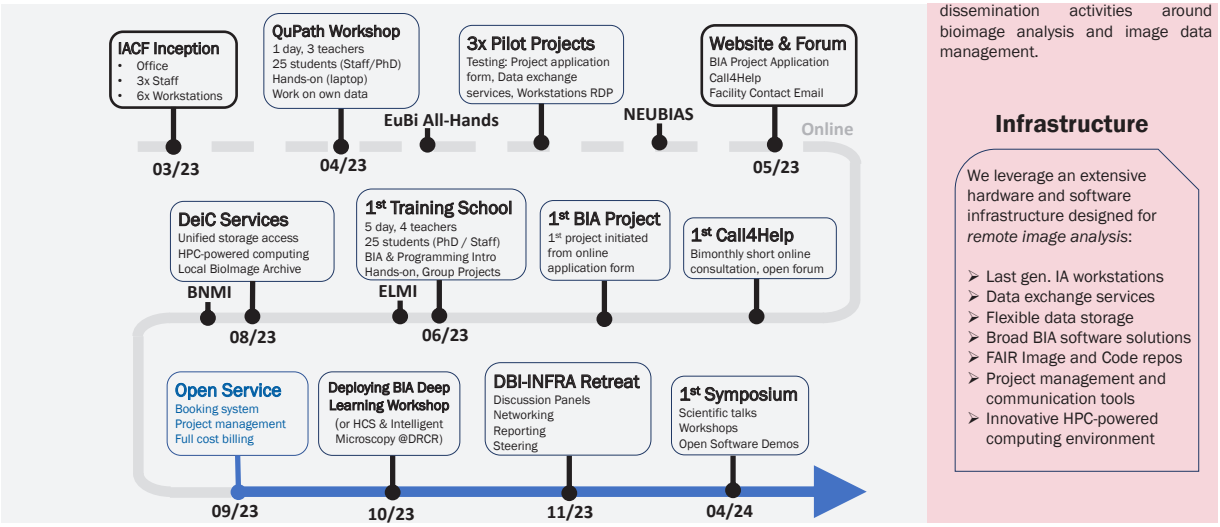
3. DBI-INFRA IMAGE ANALYSIS CORE FACILITY



3. DBI-INFRA IMAGE ANALYSIS CORE FACILITY

Under the DBI-INFRA implementation, Denmark has taken the lead at the international level, by creating a nation-wide open access image analysis core facility (DBI-INFRA IACF) to bridge computer and life sciences. Bioimaging data sets are becoming increasingly complex and big, making image analysis and data management extremely challenging for life scientists. During the last decade, image analysis, data storage and computing power have become one of the biggest bottlenecks for research productivity within bioimaging.

DBI-INFRA is implementing an open access image analysis core facility to make sure that users at any of the DBI-INFRA TCF have access to the computing power and image analysis tools to to extract quantitative measurements from their imaging data sets.



March 2023, DBI-INFRA hired a complementary team of bioimage analysts who actively started planning and testing the implementation of open access image analysis services. Since then, the team has focused on: 1) identifying existing computing and data storage infrastructures at the national level, to support user on-boarding and controlled remote access to the services, 2) designing project management workflows to efficiently support life scientists coming from different institutions and a broad range of life science disciplines, and 3) setting up a consistent bioimage analysis software stack and code repositories.

In this report, we highlight several training and divulgation activities organized this year, and present the four pilot projects the facility has used as prof of concepts to test its service pipeline.

3. DBI-INFRA IMAGE ANALYSIS CORE FACILITY

DBI-INFRA IACF TEAM

Sébastien Tosi
Head of the DBI-INFRA IACF

Sébastien is excited to lead the creation of the DBI-INFRA IACF, a unique opportunity to build a world-wide first class image analysis core facility from the ground.

Sébastien started his professional career path in the telecommunication industry, but has now accumulated over 12 years' experience as BioImage Analyst and Research Engineer. He authored several book chapters and over 30 scientific articles, and has been especially active in developing open source software dealing with large image datasets (LOBSTER, Mosaic-ExplorerJ, LIA-J) and image analysis based instrument control (AutoScanJ, LegoLish). He also helped consolidate the bioimage community, notably by leading a workgroup from the network of European BioImage Analyst (NEUBIAS) fostering community benchmarking and FAIR workflow sharing (BIAFLOWS), and by organizing numerous international workshops and training schools for Life Scientists. He was also involved in the design and interfacing of several multimodal lightsheet microscopes that were customized to the needs of specific research projects.

Tricia Loo Yi Jun
BioImage Analyst and Programmer

Tricia has an academic background in biological sciences, but during her research she became proficient in programming and bioimage analysis. Tricia is excited to continue working at the interface between life and computer sciences.

Tricia recently completed her PhD at the Mechanobiology Institute (MBI) in Singapore working on biophysical modeling of spatial constraints on development patterning. While doing so, she became increasingly involved in bioimage analysis support within her own lab, and organized several peer-led workshops on this topic through the MBI Graduate Student Committee.

Martin Baiker-Sørensen
BioImage Analyst and Programmer

Martin joined the team eager to provide image analysis and software development support to life scientists in DBI-INFRA.

Martin has a background in Biomedical Engineering and Medical Image Analysis. Martine joined the team March 2023, but resigned September 2023 to join Novo Nordisk. A new member with strong programming background is currently been recruited to fill in the position.

3. DBI-INFRA IMAGE ANALYSIS CORE FACILITY

IACF bioimage analysis services have been publicly available since September 1st 2023, and can currently be accessed from the facility's webpage: https://www.dbi-infra.eu/iacf.

The common goal is to help life scientists become autonomous in addressing concrete BIA needs within their research projects by focusing on three axes: open consultation, skills training, and on-demand software customization and development.

Some of the currently offered services are:

Poster officially announcing that the DBI-INFRA bioimage analysis services are publicly open

- Call4Help - A free, bimonthly, open, online consultation (registration on webpage)
- The development of customized image analysis scripts (project submission on webpage)
- On demand trainings in selected software for routine BIA tasks (request on webpage)
- Quarterly hand-on workshops targeting a BIA techniques, a software tool or a broader topic
- Biyearly PhD training schools (5 days) taking the students from the ground up in bioimage analysis, introductory programming, and the usage of standard BIA tools. The course includes hands-on, group projects and supervised sessions where students work on their own images.

3. DBI-INFRA IMAGE ANALYSIS CORE FACILITY

IMAGE ANALYSIS SERVICE PROVISION

For service provision, IACF purchased and set up three dedicated image analysis workstations. The workstations run the same disk image and come equipped with a software stack including programming scripts developed by IACF and compatible runtime packages.

The DBI-INFRA IACF is physically located at the DBI-INFRA Hub (UCPH-Health and Medical Sciences), but the services are being designed to be accessible from anywhere. Together with IT department at UCPH, the IACF team has set up a local network that it fully administers, and to which it can add new workstations and flexibly grant access to DBI-INFRA users. The workstations and/or personal training/support can be booked autonomously by the users through the DBI-INFRA IA-CF booking system (https://unicop.agendoscience.com). All workstations and training/support trainings can be accessed in person or remotely through VPN connection.

PROJECT MANAGEMENT, OPEN SCIENCE AND FAIR IMAGE-BASED DATA SHARING

All the documents generated by IACF (notes, guides, work documents, project reports, etc.) are organized on Trello boards to simplify project management and secure efficient communication, and expectation alignment with the researchers. To further streamline project management, IACF has set up a set of custom automations including registration forms (Squarespace, Google App Script), project document creation, linking, and automated user notification upon update (Make, ZCal, Google)

To promote the best reproducibility practices, IACF commits to sharing all relevant developed scripts and tools with detailed instructions (GitHub workspace). IACF will also explore more advanced reproducibility solutions such as publishing workflows in HPC-backed workflow management systems (WMS) such as DeiC UCloud, and DTU QIM platform.

Finally, IACF is actively collaborating with DeiC and Euro bioimaging to steer and promote the development of national and international FAIR image-based repositories to potentiate key and published scientific image datasets. These repositories may also be used as data sources by the workflows packaged in the aforementioned WMS to ensure the highest reproducibility standards.

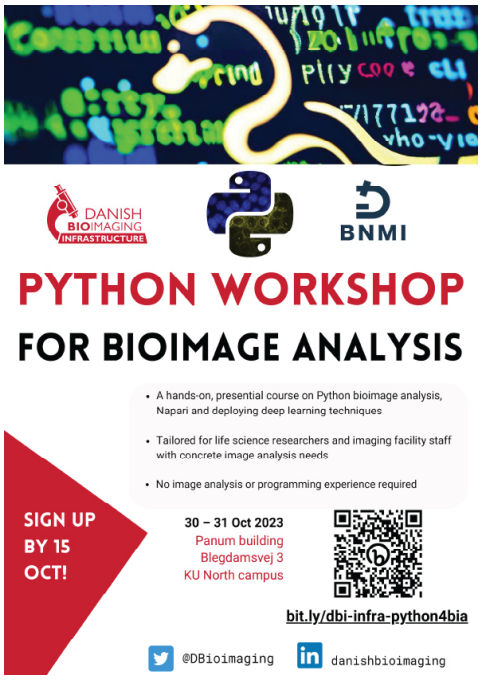
3. DBI-INFRA IMAGE ANALYSIS CORE FACILITY

ACTIVITIES AND SERVICE PROMOTION

The DBI-INFRA IACF has actively promote its infrastructure and services through the DBI-INFRA social media channels, posters hanged in strategic locations, live talks/posters, and as (co-)organizers of the following past and planned events:

*Stakeholder meeting (28/10/2022, Aarhus)
Cancer Research Institute seminar (09/02/2023, Copenhagen)
Qupath workshop (12/04/2023, University of Copenhagen)
*EuBI All hands-node (17-20/04/2023, EMBL, Heidelberg)
NEUBIAS Defragmentation workshop and conference (8-12/05/2023, i3S, Porto)
*European Light Microscopy Initiative (6-9/06/2023, Noordwijkerhout, Netherlands)
CFIM Image Processing PhD Course (16-23/06/2023, University of Copenhagen)
Bridging Nordic Microscopy Infrastructure Symposium (22-25/08/2023, SDU, Odense)
*Spatial transcriptomic and ultra-high content imaging PhD course (27-29/09/2023, BRIC)
Python workshop (30-31/10/2023, University Copenhagen)
Quantitative 3D Bioimaging PhD Course (15-19/01/2024, University of Roskilde)

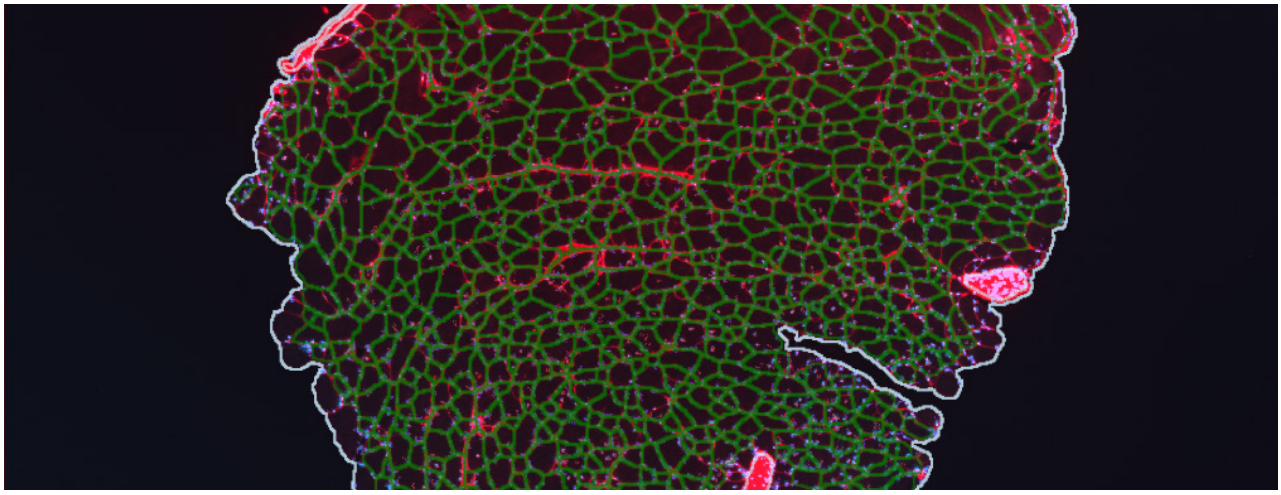
Participants attending the DBI-INFRA workshop



Poster announcing the Pyhon workshop

3. DBI-INFRA IMAGE ANALYSIS CORE FACILITY

PILOT AND ONGOING IMAGE ANALYSIS PROJECTS



Before publicly promoting its service, IACF opened an internal call for DBI-INFRA facilities, and the research groups they serve, to identify representative image analysos pilot projects that could be used to test different aspects of the envisioned service provision..

A total of four projects were processed, which included UCPH internal users, external users that needed physical access to the IACF premises, and external users that needed fully remote access to support, training and the use of workstations. The pilot projects were used to test the IACF booking system, the workflow for project submission and management, administration of physical and remote access to the services, monitoring of used resources, and service evaluation.

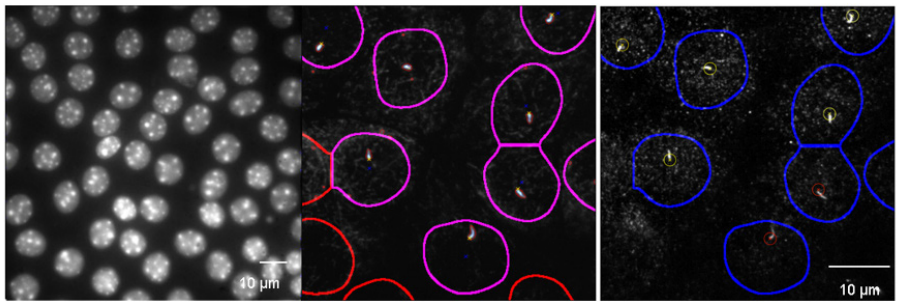
In this section, we give an overview of four selected projects to showcase the kind of services and projects the DBI-INFRA IACF works on.

3. DBI-INFRA IMAGE ANALYSIS CORE FACILITY

Protein expression in kidney epithelial cells primary cilium

Collaboration: M. Chamlali, L. Bang Pedersen, Department of biology , UCPH

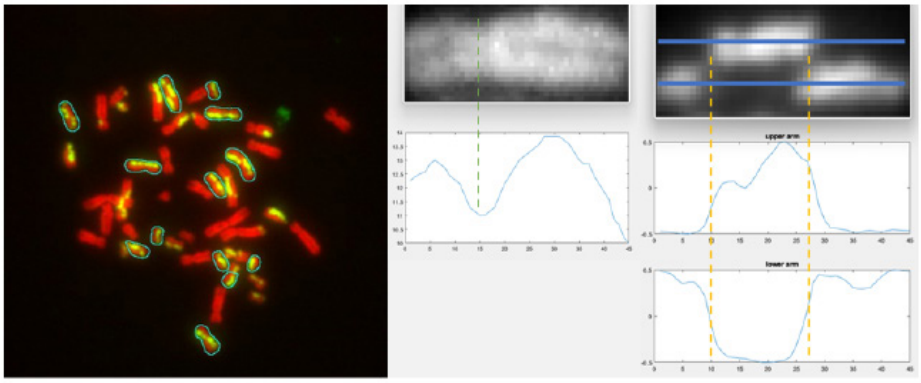
Context: Several key complexes regulate the transport of critical proteins to the primary cilium of kidney epithelial cells to ensure their activity, which dysfunction is related to numerous serious human diseases.
Goal: To improve the accuracy and throughput of manual 2D only measurements.
The project consists in automating these steps: 1) 3D segmentation of the primary cilia when present in a nucleus (cilium marker), 2) 3D detection of the ciliary bases (no marker, geometry criterion), and 3) 3D measurement of the relative intensity of target proteins in the cilium and base region, to measure the size of the micronuclei and their degradation rate/time from last division.



Identifying Sister Chromatid Exchanges (SCE) in Metaphase Chromosome Spreads

Collaboration: Park Sohyun and Michael Lisby, Department of Biology, UCPH

Context: Identical sister chromatids may exchange (SCE) genetic materials during DNA replication. The frequency of these events is a direct measure of genome instability.
Goal: This project consist in improving the throughput and accuracy of manual measurements performed on a large set of images by: 1) Finely segmenting the chromosomes, 2) Detecting and reporting SCEs and centromere swaps per chromosome and per image.

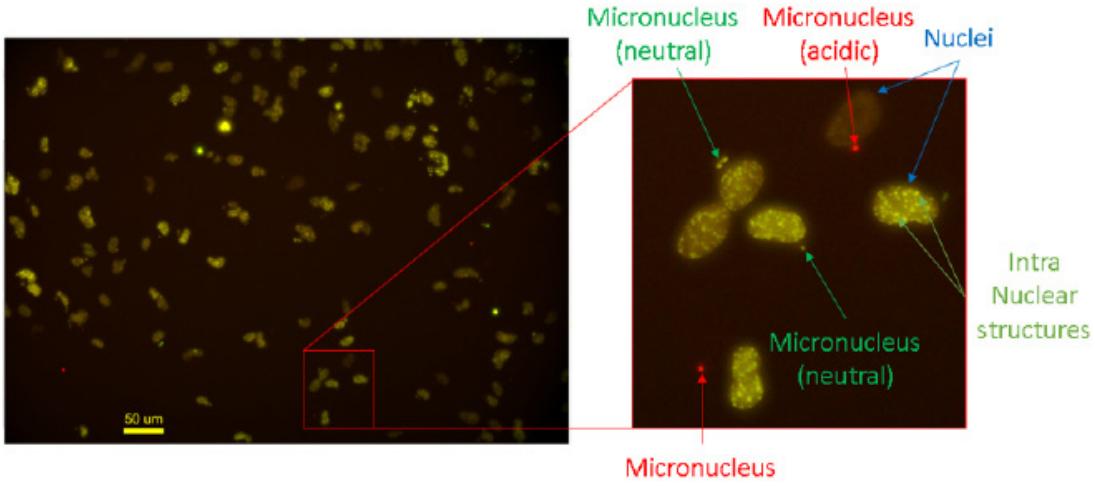


3. DBI-INFRA IMAGE ANALYSIS CORE FACILITY

Micronuclei Degradation

Collaboration: Nikolaus Watson, Danish Cancer Institute

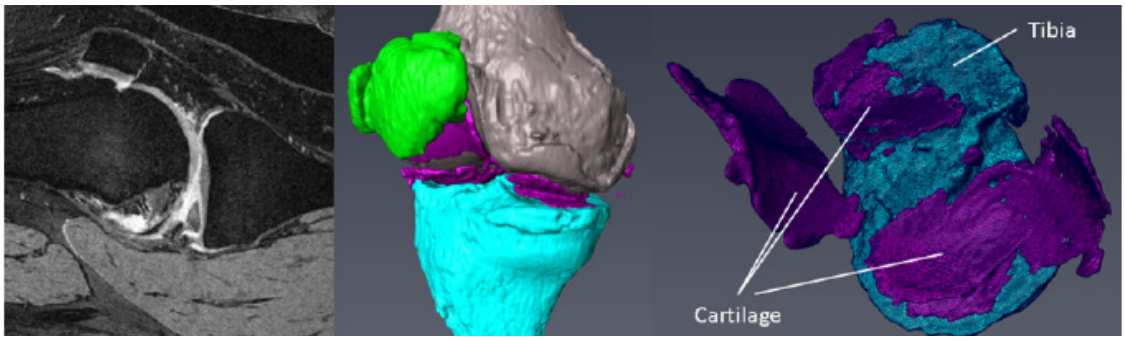
Context: During cell mitosis, micronuclei can escape from nuclei and roam in the cytoplasm. This study consists in systematically measuring the rate and dynamics of the degradation (acidification) of these micronuclei, especially in relation to their size.
Goal: Time-lapses are notoriously hard to quantitatively process manually, this project consists in automating these tasks: 1) Accurate micronuclei segmentation (robust to debris and nuclei irregularities), and 2)Measuring the size of the micronuclei size and their degradation rate/time from last division.



Osteoarthritis (OA) knee cartilage stem cell therapy

Collaboration: Rasmus Aabling, Michael Pedersen (Dept. of Clinical Medicine, Aarhus University)

Context: Severely impaired cartilage from OA patients can be partially healed by stem cell therapy. The effect of this treatment under different conditions can be studied from MRI imaging.
Goal: This project consists in developing a tool to:
Accurately 3D segment the cartilage and neighboring bones from MRI images
Estimate the cartilage recovery from longitudinal MRI imaging



3. DBI-INFRA IMAGE ANALYSIS CORE FACILITY

BRIDGING LIFE AND COMPUTER SCIENCES

One of the main strategic goals for the creation of the DBI-INFRA IACF is to bridge the professional gap between image-based computer scientists developing new image analysis tools and software, and the needs of the bioimaging life scientists. The DBI-INFRA IACF team has collaborated with computer scientists at QIM (DIKU and DTU) testing the tools from the QIM repository, to defined a roadmap to improve the reusability and visibility of the QIM tools. Martin Baiker-Sørensen (IACF) and Felipe Deletro Matos (DTU/QIM) have revised and tested several tools, and contacted the authors when information in order to make the tools reusable.

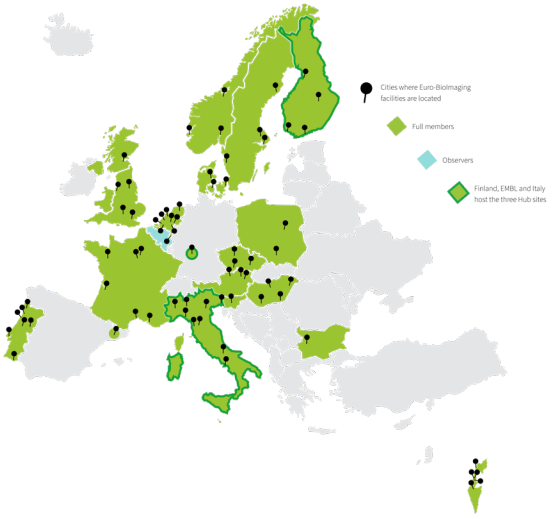
The IACF team has participated in several QIM events and workshops (Lund workshop, QIM day, QIM workshop), and organized several code peer review events with Jon Sporring (DIKU/QIM), where the code of the tools developed was co-reviewed to optimize it, improve the documentation and avoid user misuse or misinterpretation of the results.
In addition, the close collaboration between the IACF team and the computer scientists at DIKU/QIM was key for one of the presented pilot projects, the knee cartilage segmentation project, which will be tackled with the use of a multiplanar U-NET implementation developed by Chenhao Wang, computer scientist at DIKU.

DBI-INFRA COLLABORATIONS

INTERNATIONAL COLLABORATIONS

EURO-BIOIMAGING ERIC

The DBI-INFRA is the Danish Euro-BioImaging node. Euro-BioImaging is a European Research Infrastructure Consortium (ERIC) that offers open access to imaging technologies, training and data services in biological and biomedical imaging. Euro-BioImaging links the DBI-INFRA TCF with the best biological & biomedical TCF in Europe, giving DBI-INFRA users access to state-of-the-art bioimaging technologies available in Denmark, or in other European countries. In addition, being part of the European bioimaging technology landscape brings visibility to the Danish infrastructures, and facilitates professional development and technology knowledge exchange.



Through Euro-BioImaging, the Danish bioimaging TCF are connected to a big network of European bioimaging TCF, boosting collaborations, and knowledge exchange. Under these lines, a group picture taken during the hybrid meeting "Euro-BioImaging All Hands Nodes" and the “BioImaging and the European Open Science Cloud” workshops, April 17-20th, EMBL, Heidelberg.

DBI-INFRA COLLABORATIONS

INTERNATIONAL COLLABORATIONS

BRIDGING NORDIC MICROSCOPY INFRASTRUCTURES

The overall objective of Bridging Nordic Microscopy Infrastructure (BNMI) is to strengthen the international competitiveness and facilitate the development of world-leading Nordic advanced microscopy environments, by organizing scientific and technical Symposia, workshops and knowledge-exchange seminars, shadowing programs for facility staff and short-term scientific mobility grants for researchers and increase the training and innovation activities among the participant Nordic countries. The participating countries in this infrastructure are Denmark, Iceland, Finland, Norway and Sweden (Image): 150 participants attended the second meeting of the Bridging Nordic Microscopy Infrastructures (BNMI) at the University of Southern Denmark in August 2023. The event was organised by the DBI-INFRA node in Odense, the Danish Molecular Biomedical Imaging Center (DaMBIC) at the Syddansk Universitet- University of Southern Denmark.

DBI-INFRA COLLABORATIONS

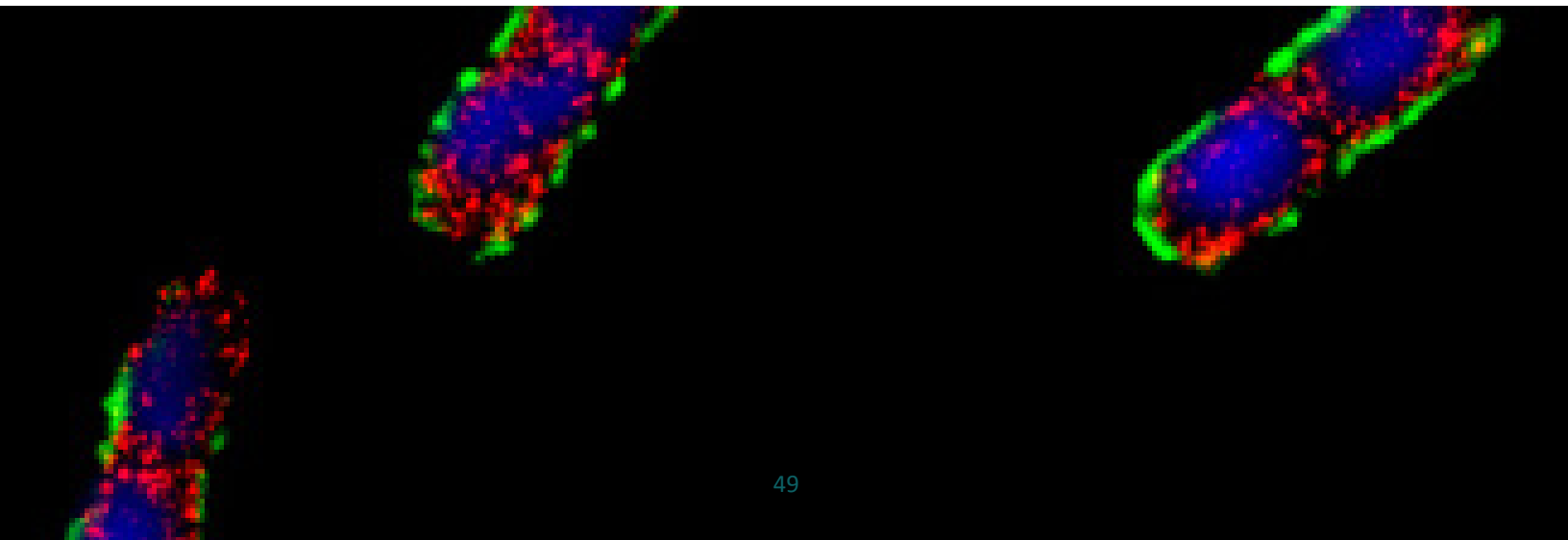
NATIONAL COLLABORATIONS
DANISH E-INFRASTRUCTURE COOPERATION (DEIC)

DBI-INFRA has collaborated with DeiC during the last year with the common goal of increasing FAIR research data management practices, as an integral part of the bioimaging-based research process.

DeiC has introduced the DBI-INFRA IACF team to several tools, including the F-U-J-I tool, which is designed to help assess the FAIRness level of data, and how to progress towards guidelines for FAIR share of data. Currently, DeiC is working on a meta-data for machine reading (M4M) tool, which will be tested with the bioimaging community, to test the usability of the tool for a broader dissemination and implementation. DeiC and the DBI-INFRA IACF will continue collaborations towards the common goal of alignment of FAIR processes.

> “DeiCs upcoming repository DeiC Dataverse will be an important tool for storing large amounts of data in a FAIR way.

Anne Sofie Fink – Head of Data Management – DeiC

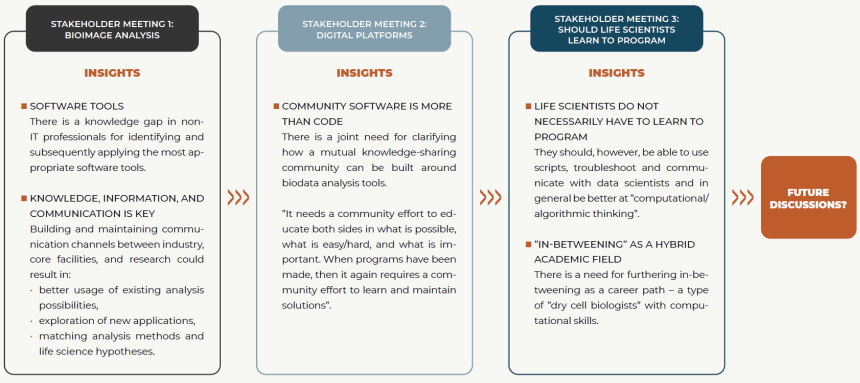


DBI-INFRA COLLABORATIONS

NATIONAL COLLABORATIONS
ALEXANDRA INSTITUTE

During the past two years, the Alexandra Institute has facilitated a series of stakeholder meetings in collaboration with Danish BioImaging Network and QIM.

The meetings are part of a larger ongoing project on how to create better access to AI for researchers and companies in the field of biodata analysis. The purpose of the stakeholder meetings is to further a collaboration space between researchers, developers, facilities and companies. This is to be achieved by sharing experiences and views on how we can work together for better science and innovation by addressing and finding solutions to the main challenges people from all groups face in their biodataanalysis work. Each meeting has fostered interesting discussions on shared needs and challenges across the different stakeholder positions, including bioimaging analysis needs, access to digital platforms, and whether life scientist should learn to program (see figure under).



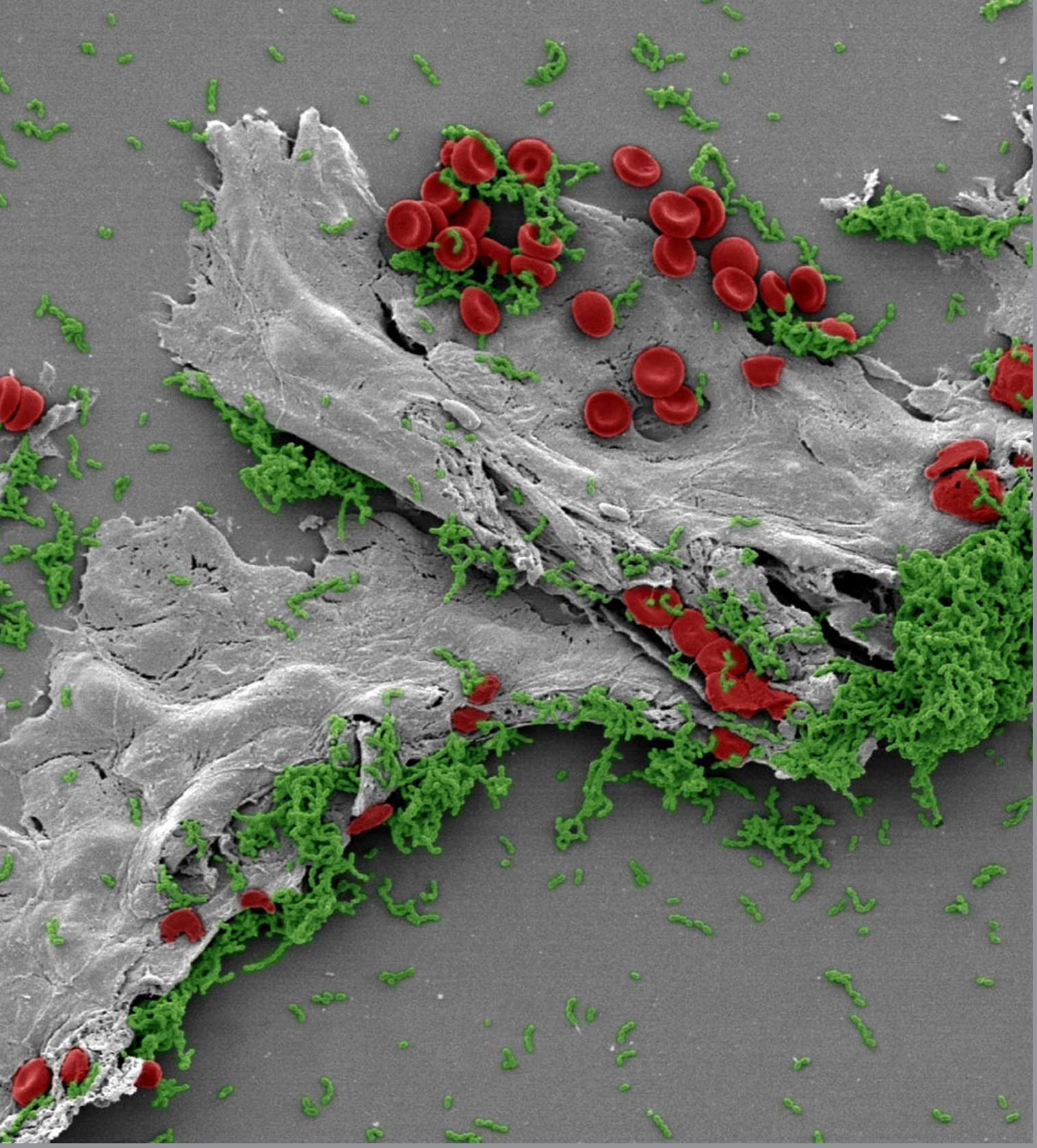

Stakeholder meeting in Aarhus on October 2022


Stakeholder meeting in Copenhagen on May 2023

ACKNOWLEDGMENTS

The Danish BioImaging Infrastructure is under implementaton with financial support from the Danish Ministry of Higher Education and Science, with co-financing from the infrastructure hosting institutions.

We are thankful for your support and engagement.



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