

FROM MOLECULES TO HUMAN - BRIDGING IMAGING ACROSS COMMUNITIES AND SCALES

An international consortium of imaging scientists launched a new format for training in translational imaging research: the first-ever M2H – Molecules to Human boot camp. This unique training program brought together 24 scientists from across the globe to learn how to design and implement multimodal imaging workflows, spanning scales from molecules to entire organisms.

Imaging biological systems requires a wide range of technologies and experimental approaches, from advanced microscopy capturing molecular details to clinical imaging tools visualizing entire organs and tissues. Despite the different approaches, researchers working in either microscopy or biomedical imaging share the common goal of advancing our understanding of health and disease. Yet they often work in isolation, limiting opportunities for collaboration and transformative discoveries.

To address this divide, an international consortium (see information box below) conceptualized a two-week boot camp titled “Molecules to Humans (M2H)”. Hosted by the [Danish Biolmaging Infrastructure](#) in Copenhagen and Aarhus, Denmark, and supported by the [Chan Zuckerberg Initiative](#), the workshop aimed to build capacity and foster cross-disciplinary networking.

The scientific program was designed to introduce both clinical and preclinical imaging technologies alongside advanced microscopy techniques. It combined lectures on application and technology with hands-on sessions covering sample preparation, image acquisition setups and analysis.

“Normally when we teach, we focus on making students experts in a specific technology; how to use it to extract data,” explained Clara Prats, Associate Professor at the University of Copenhagen and Director of the Danish Biolmaging Infrastructure. But in M2H, the goal was to give a broader overview of the technologies and all the powers and limitations from both preclinical and clinical imaging, and microscopy. So that we could get a basic common vocabulary and ground to start talking about **how to create workflows across disciplines, and pass on the mindset to co-create multimodal imaging workflows.**”



Image credit: Danish Biolmaging

To bring the M2H curriculum to life, the organizers collaborated with colleagues across two institutions – many working together for the first time – and received invaluable support from post-doctoral fellow Anita Dittrich and PhD student Jon Vegara, who shared their scientific questions on two animal models as a basis for creating multimodal imaging workflows.

“One thing we’ve gained is a stronger connection with colleagues in our field,” Prats shared. “Really helpful, truly collaborative and nice people that want to contribute.”



Workshop participants gather around Anita Dittrich to see how to perform heart surgery on an Axolotl.

Imaging Techniques and Data Analysis

The participants spent the first week of the boot camp in Aarhus delving into biomedical imaging, including theoretical and hands-on training in modalities such as MRI, PET and OCT. They then moved to Copenhagen to explore advanced microscopy techniques, ranging from light-sheet to super resolution microscopy.

For Kelly Nyanchama, a junior malaria research fellow from the Kenya Institute of Primate Research, who is also obtaining her masters in Microbiology and Parasitology in Uganda, the boot camp was an eye-opening experience.

“I really fell in love with light sheet microscopy,” she said. Along with the technique itself, Nyanchama was excited to learn about the data analysis, a skill that would be invaluable upon her return to her home institution, where resources are often limited.

“I want to see if I can juggle both microscopy and data analysis when I get back,” she added. **“The biggest take away [from the workshop] for me was the analysis side, since in my masters I need to do a lot of analysis. I want to work with tissues and I need to be able to analyze the samples myself because I don’t have enough funding [to outsource the analysis].”**

The Power of Diversity

One of the guiding principles of the M2H boot camp was to include historically underrepresented communities alongside traditionally represented groups. This was reflected in the participants: 24 international scientists from around the world, from early-career researchers to experienced core facility managers, were brought together to learn, network, and innovate.

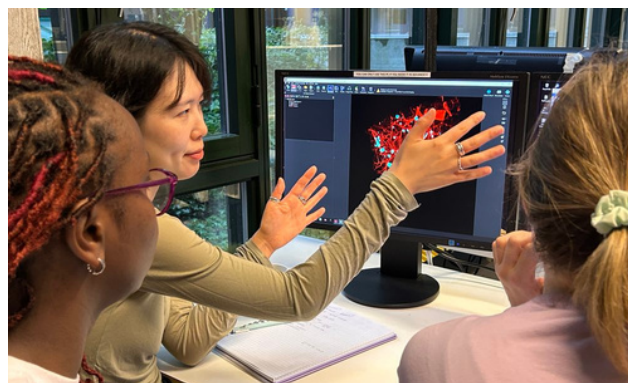
Consequently, the workshop's impact extended beyond the technical skills acquired – it also fostered invaluable personal and professional connections.

“What I really enjoyed, was the diversity of people,” reflected Brian Tse, facility manager of the Preclinical Imaging core facility at the Translational Research Institute in Brisbane, Australia. “I enjoyed mentoring people from different cultures who are from early-stage core facilities but at the same time I was being mentored by them. Knowing they are working with fewer resources and still doing fantastic work was inspiring.”

For Tse, the experience also provided new insights into the real-world challenges faced by researchers globally.

“Being aware that there are researchers from across the world who are deeply impacted community-level-wise by different conditions or infections puts me into perspective when I work with my researchers who work on malaria or other infectious diseases,” he continued. “It just gives a different perspective. I think often, [scientists at my facility] might do research rather as an academic exercise. Really good science, but driven by a different motivation.”

Tse also appreciated the balance between intense learning and social engagement. “The organizing team did a fantastic job. In addition to the high-level learning, they introduced social events that really enhanced the experience, because that allowed us to get to know each other better, so that when we did group work or data analysis sessions, we were a better team. **When you’re happy and you know the people around you, learning becomes much more effective.** It was really wonderful.”



Working on the light sheet 3D image analysis project at the Danish Biolmaging Infrastructure Image analysis Core Facility (<https://www.dbi-infra.eu/iacf>).

Nyanchama who shared similar sentiments, found the boot camp particularly impactful for her own research. “This was important for me to understand what exactly are people doing out there and try to bring back those lessons to my lab and also to my school,” she explained.

“It was quite interesting to learn about core facilities because we don’t have a lot of those here; even just the labs themselves were amazing. It was very interesting to interact with the core facility managers to see their perspective on things. Just interacting with the team opened up my thinking – like **almost every research question can be answered through microscopy.**”

Nyanchama was also introduced to practical tools that would benefit her research back home, including fluorescence microscopy. “I want to use a fluorescence microscope for some of my bench work. One of the things we learned is which types of slides to use for example; we also talked about some special dyes from the Janelia Research Campus that are more affordable for researchers.”



Workshop participants Kelly Nyanchama and Brian Tse comment on the most immediate impact of their M2H experience.

*Nyanchama: “I actually just suggested to our director to get an OpenScope because we have very limited funding and we don’t have many instruments. **If we have the OpenScope we can serve other people coming to do their imaging and also create networks to work with us.**”*

Tse: “I love light sheet, I think that’s very fascinating; I also liked learning about multiphoton microscopy, and our institute’s microscopy core facility recently purchased one. I would like to see both facilities working together, and we already agreed on that. We talked about having a shared animal ethics, which would allow us to use mice for training on multiple systems, and we’re currently arranging that.”

A Collaborative Future

Looking ahead, the boot camp's organizers and participants emphasized the importance of continuing the momentum.

“Creating this opportunity was really unique,” said Prats. “It is necessary not only at a global but also local level – we even discussed with our colleagues at Aarhus University that we would like to have a follow-up meeting if we can raise funds to do something similar at the Danish level. Because this is an essential thing. **To utilize the power of the technologies in microscopy.** We need to really understand what they can do and they need to understand what we can do to do this.”

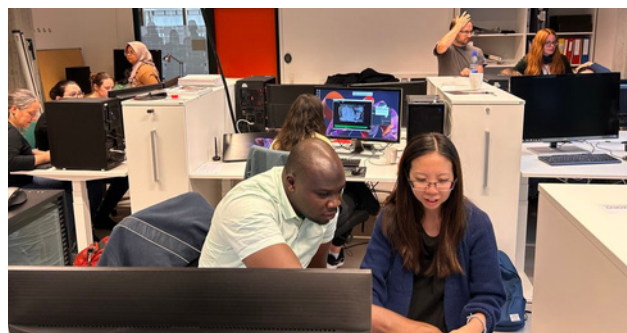
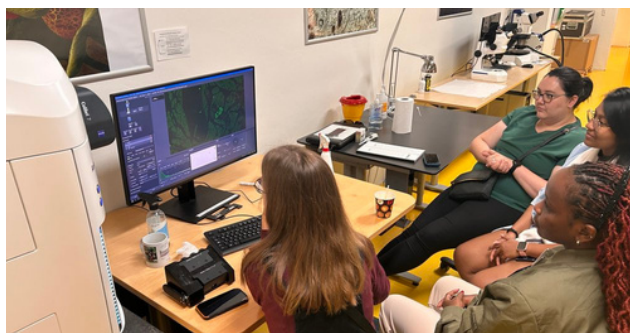
Sonia Diaz, Coordinator of the Danish BioImaging Infrastructure, noted that the positive feedback from the participants made it clear that there is a strong demand for continued collaboration. She is now helping them organize monthly online meetings to keep presenting their work and fostering collaboration.

“The students and participants, they all said they want to see it happening again,” Prats remarked, emphasizing that ongoing education will be key to making a lasting impact.

“Many of the participants from resource-limited settings said that what they need most is education within their communities,” she continued. “While infrastructure and equipment are important, we can do a lot without so much money by educating people, one can even do this remotely. It’s about organizing and making this knowledge accessible.”

Antje Keppler, Global BioImaging Coordinator and Director of Euro-BioImaging Bio-Hub, also reflected on its success and potential. “After this tremendous achievement, we’ve shown what’s possible. We’re now exploring future funding opportunities to sustain and expand these efforts, building a lasting, collaborative network to push the boundaries of imaging research across disciplines worldwide.”

Sophie L. Winter, Global BioImaging



Impressions from the M2H workshop. Participants learn how to create imaging profiles for both bright field and fluorescence digital pathology imaging in a Zeiss Axioscan 7 (top left), work on their image analysis projects (top right), and their multimodal imaging workflow presentations (bottom left). During the M2H boot camp, a Global cooking event allowed participants to share their recipes and cook together, learning from each other and sharing their culinary cultures. In the bottom right image, participants are cooking a dish from Georgia called Khinkali.

For more personal experiences and take aways from the workshop, Sonia Diaz collected pictures and video testimonials from the participants, available at <https://tinyurl.com/5dsh8hjv>.

Funding Support

The M2H boot camp was made possible through the generous support of the Chan-Zuckerberg Initiative.

In a Nutshell

- Interdisciplinary Imaging:** The boot camp demonstrated how imaging communities can collaborate to develop multimodal workflows, integrating different imaging modalities from both preclinical and clinical, and microscopy-based perspectives. This overlap enables researchers to bridge small and large scales in imaging, from molecular details to whole organisms, enhancing the capabilities of each field.
- Power of Diversity:** The program's diversity in experience levels, cultural backgrounds, and resource availability fostered a unique environment of creativity and problem-solving. Participants learned from each other's distinct approaches, showing that diversity is essential for advancing science and innovation, particularly in the global imaging community.
- Essential Role of Data Analysis in Imaging:** The training emphasized that understanding and processing imaging data is as important as the imaging techniques themselves, especially for researchers in resource-limited settings who need efficient, scalable ways to handle data.
- Networking and Community-Building for Sustained Learning:** The boot camp fostered a lasting international community of scientists who will continue collaborating through monthly virtual meetings. This commitment to ongoing knowledge-sharing underscores the importance of community in scientific advancement, enabling researchers to exchange resources and insights across borders.
- The Value of Soft Skills:** Beyond technical expertise, participants benefited from social activities and collaborative exercises. These activities strengthened teamwork and made group work more effective, demonstrating that interpersonal connections are invaluable in scientific training and can enhance learning outcomes.



Find out more about Global Bioimaging at www.globalbioimaging.org.

Information Box: From Concept to Reality - The M2H Training Workshop Team

The M2H international consortium is a network of microscopy and biomedical imaging communities and imaging facilities around the world who are supported by the Chan Zuckerberg initiative. They are: 1) Global BioImaging as project lead (European Molecular Biology Laboratory), 2) the African BioImaging Consortium (ABIC), 3) Africa Microscopy Initiative (AMI), 4) Association of Biomolecular Resource Facilities (ABRF), 5) Biomedical Science and Research and Training Centre (BioRTC), 6) Biomedical Imaging Organization for South East Europe (BIO-SEE), 7) Consortium for Advancement of MRI Research and Education in Africa (CAMERA), 8) Euro-Bioimaging ERIC, and 9) Latin America Bioimaging (LABI).

The idea and concept for the M2H training boot camp was first developed by Teng-Leong Chew (Chair of Global BioImaging from 2022 until 2024) and Udunna Anazodo (CAMERA). After it received funding from Chan Zuckerberg Initiative, it was implemented by the M2H international consortium including Antje Keppler (Global Bioimaging) as project PI, Gleb Grebnev (Global Bioimaging) as project manager, as well as Caron Jacobs (ABIC), Richard Cole (ABRC), Michael Reiche (AMI), Mahmoud Maina (BioRTC), Naira Ayvazyan (BIO-SEE), Johanna Bischof (Euro-BioImaging), Christopher Wood (LABI), Linda Chaabane (Euro-BioImaging), Narine Sarvazyan (BIO-SEE), and Iris Asllani (CAMERA).

The M2H boot camp required extensive logistics, specialized facilities in both biological and preclinical imaging, and a carefully balanced program that bridged disciplines and integrated diverse scientific perspectives. To select a suitable host, the Global BioImaging coordination team in close collaboration with the Euro-BioImaging Bio-Hub launched an open call for Euro-BioImaging Nodes. Owing to their experience in cross-institutional teaching and focus on workflow development, the Danish BioImaging Node from Euro-BioImaging was selected as hosting institution and tasked with designing the program. Together with Professor Michael Pedersen and post-doctoral fellow Anita Dittrich from Aarhus University, and Pia Nyeng from Roskilde University, Clara Prats then further developed and implemented the scientific program centered around the biomedical imaging infrastructure at Aarhus University and the microscopy facility in the Faculty of Health and Medical Sciences, University of Copenhagen. You can find more information on the M2H project [here](#).