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CZECH BIOIMAGING NEWSLETTER

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User-Inspired Software: Bringing Automated MRI Tissue Analysis to Clinical Research

Core Facility Magnetic Resonance at the Institute of Scientific Instruments of the Czech Academy of Sciences, Brno

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Accurate evaluation of tissue composition is essential for understanding sarcopenic obesity and monitoring patients undergoing bariatric surgery. In a pilot study conducted by the University of Ostrava, the feasibility of applying standardized diagnostic criteria based on combined dual-emission X-ray absorptiometry and magnetic resonance imaging measurements was investigated, yielding promising results. However, analysing tissue composition across the full patient database required a reliable and automated tool for tissue segmentation.

As the expertise of the Core Facility Magnetic Resonance at ISI extends beyond data acquisition to advanced data processing and software development, this need naturally led to a collaboration supported by Czech-Biolmaging.

We developed dedicated software tailored to the researchers' specific needs. A state-of-the-art deep learning segmentation model was trained to automatically identify relevant anatomical tissues from MR images, including muscle and adipose tissue compartments, providing consistent and reproducible measurements.

Importantly, the project focused not only on methodological development but also on practical usability. To make the solution accessible to clinicians, we designed a

graphical user interface that enables users to easily load imaging data, run automated segmentation, visualize results, and export outputs through an intuitive workflow.

The resulting application allows researchers to process MRI datasets independently without requiring expertise in image analysis or artificial intelligence. This project demonstrates how research

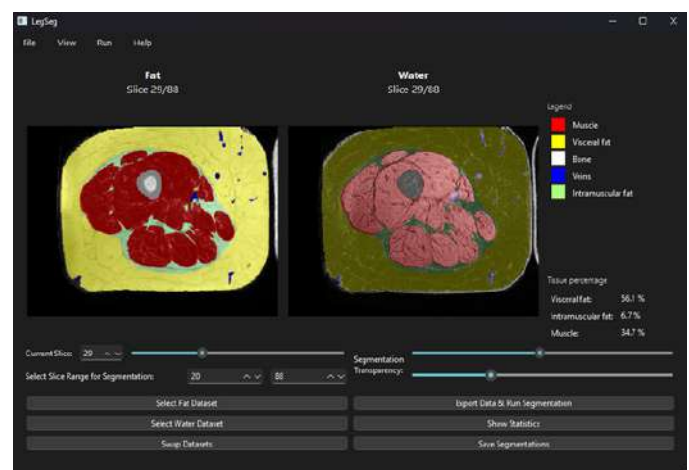
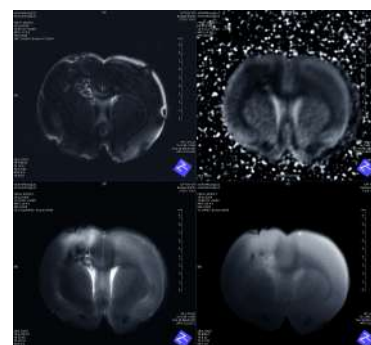


Fig. 1: Custom graphical user interface for automated deep learning-based segmentation of MRI data, allowing visualization, quantitative evaluation, and export of tissue composition results.

infrastructure can translate advanced computational methods into user-friendly tools that directly support biomedical and clinical research.



Images are courtesy of ISI MR and are not related to the technology discussed.

Get in touch with the Core Facility



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New super-resolution microscope strengthens plant imaging capabilities at the IEB IF



Imaging Facility at the Institute of Experimental Botany of the Czech Academy of Sciences, Prague

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The Imaging Facility at the Institute of Experimental Botany of the Czech Academy of Sciences (IEB CAS), led by Kateřina Malínská, has expanded its instrumentation with a new **Mirava Polyscope microscope from Abberior Instruments**. The system combines three advanced imaging methods in a single instrument:

1. superresolution microscopy,
2. fluorescence lifetime imaging microscopy (FLIM), and
3. adaptive optics.

According to IEB CAS, the STED-based superresolution microscope enables imaging of structures smaller than 100

nanometres. It allows researchers to observe details inside plant cells that cannot be resolved using conventional light microscopy (Fig. 1).

Customised primarily for plant biology applications, the microscope addresses the challenges posed by the optical properties and structural complexity of plant tissues. The second technology, FLIM (Fluorescence Lifetime Imaging Microscopy), enables the separation of unwanted autofluorescence (see Fig. 2), and the last one, adaptive optics, allows imaging deeper within tissues while maintaining high image quality.

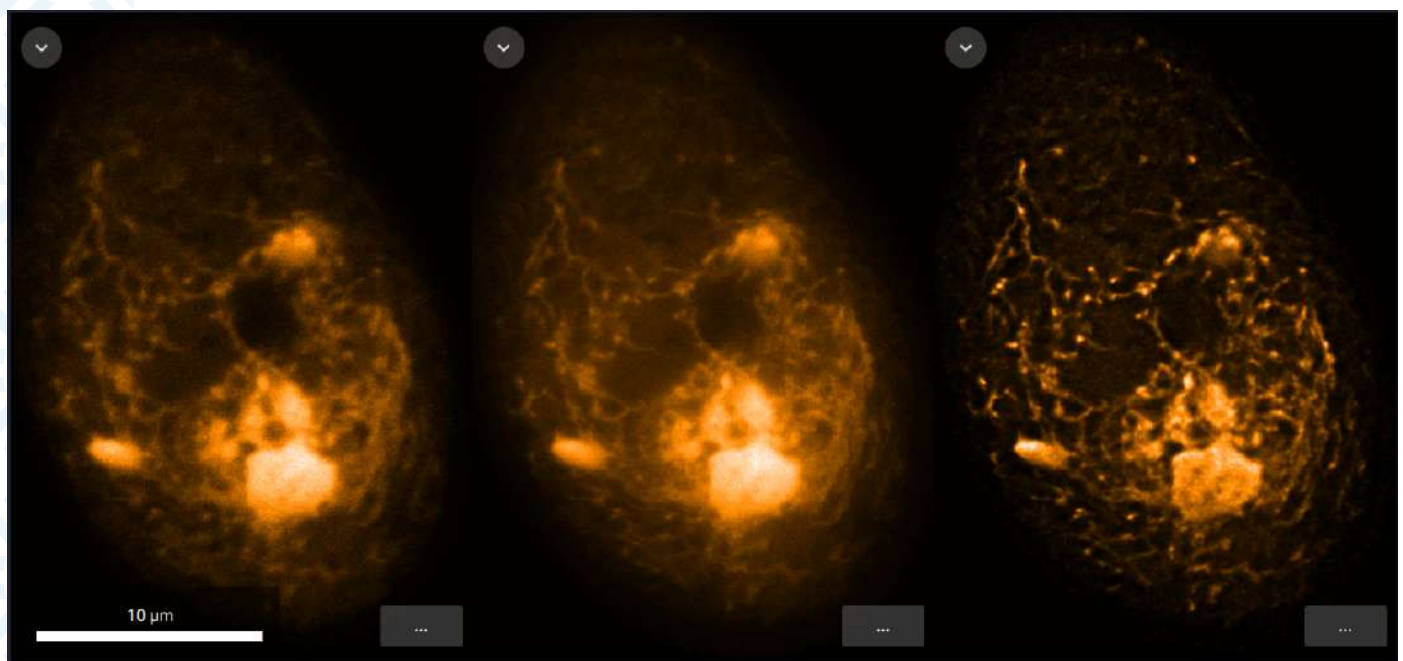


Fig. 1: Live pollen grain expressing fluorescently labelled protein imaged by classical confocal microscopy (left), STED-based superresolution (middle) and STED-FLIM approach. The gradual increase in resolution is obvious. Photo: Gero Schlötel (Abberior Instruments); Sample: Vinod Kumar IEB CAS.

The real highlight is the combination of all three technologies. STED-FLIM boosts STED superresolution microscopy with FLIM information. It pushes the resolution limit down to the tens of nanometers and provides additional information about the molecular environment and interactions within cells (Fig. 1).

According to Kateřina Malínská, at the time of installation in October 2025, the facility was the first workplace in Central Europe

equipped with this specific microscope configuration. The microscope is located at the Czech-Biolmaging core facility at IEB CAS Prague and is available through the facility's open-access services.

The acquisition was supported by the OP JAK project "Modernizace VVI Czech-Biolmaging" (CZ.02.01.01/00/23_015/0008205), focused on the modernisation of the Czech-Biolmaging research infrastructure.

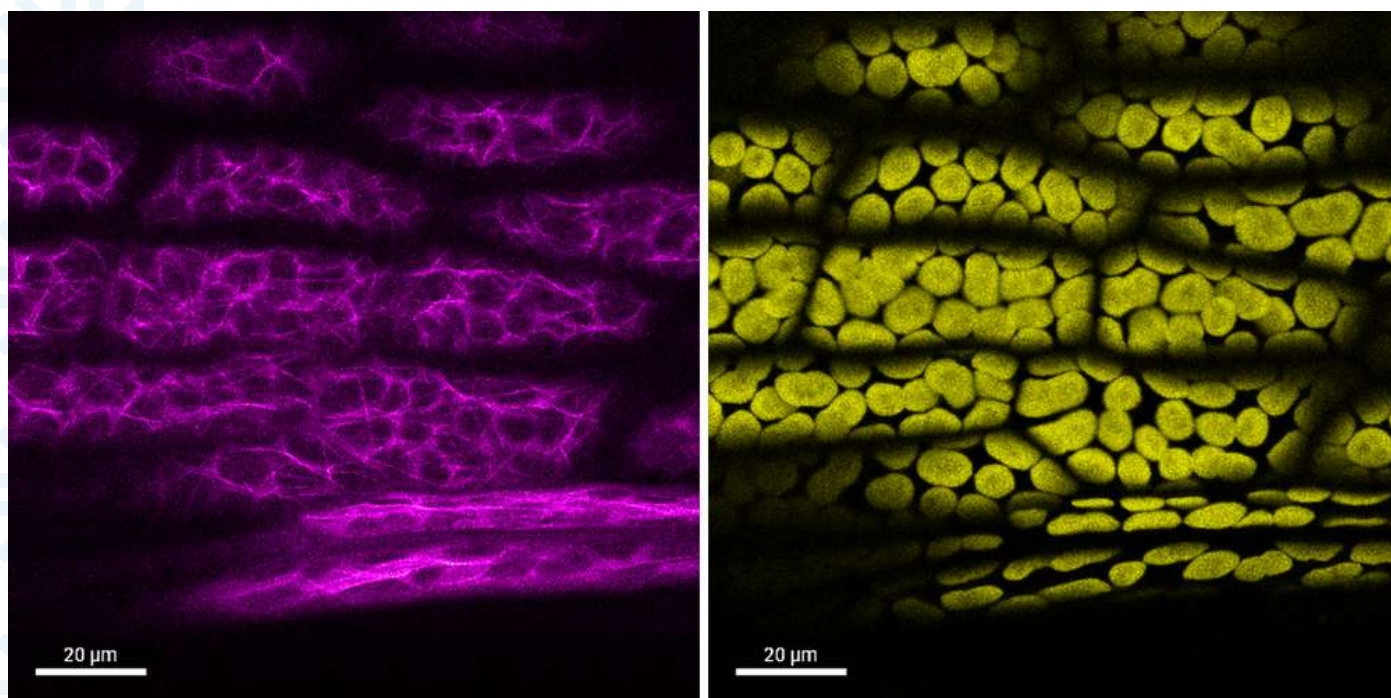


Fig. 2: FLIM technology makes it possible to distinguish fluorescence originating from different sources. The images presented in the original article show the same sample — cells from leaves of the moss *Plagiomnium affine*. The image on the left shows fluorescently labelled protein filaments called microtubules, which are important, for example, for intracellular transport and cell division. The image on the right shows fluorescence emitted by the green pigment chlorophyll. Photo: Matěj Drs; sample preparation: Chandran Kalathodi Laiju, both IEB CAS.

Get in touch with the Core Facility



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ueb.cas.cz/en/research/Core-labs/Imaging-Facility/basic-information/

Vertical Topography in EEG Microstates: Physiology or Artifact Manifestation?

Multimodal and Functional Imaging Laboratory, CEITEC, Masaryk University

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The analysis of simultaneous electroencephalography and functional magnetic resonance imaging (EEG/fMRI) data remains challenging, as residual artifacts often persist, particularly within the EEG recordings. During the analysis of EEG microstates in these datasets, a distinct topography frequently emerges: the vertical topography (VT). This VT is characterized by a prominent straight line dividing positive and negative potentials, extending from the nasion to the inion.

Since the shape of the VT does not appear to be physiological, we sought to investigate its origins further. We analyzed data from 77 healthy subjects who underwent simultaneous EEG/fMRI measurements followed by EEG recordings in a shielded cabin, ensuring the EEG cap positioning remained identical. These data were acquired at the **Multimodal and Functional Imaging Laboratory (MAFIL) at CEITEC MU**. Furthermore, in collaboration with MAFIL, we conducted several phantom measurements to examine VT characteristics under varying conditions, including different BOLD sequence settings, EEG cable positioning, helium cooling pump states (ON/OFF), and even during the ramp-down of the magnetic field. Integrating results from all measurements, we conclude that the VT primarily represents residual artifacts arising from subtle movements of the EEG cap and its metallic components within the strong magnetic field. We observed a significant correlation between the degree of

participant movement (framewise displacement) and the temporal characteristics of the VT. Moreover, the prevalence of VT in the data decreased as the magnetic field strength was reduced. Consequently, we propose that these residual artifacts remain in the data and propagate as VT during microstate analysis, thereby distorting other microstate topographies and potentially impacting their spatiotemporal parameters.

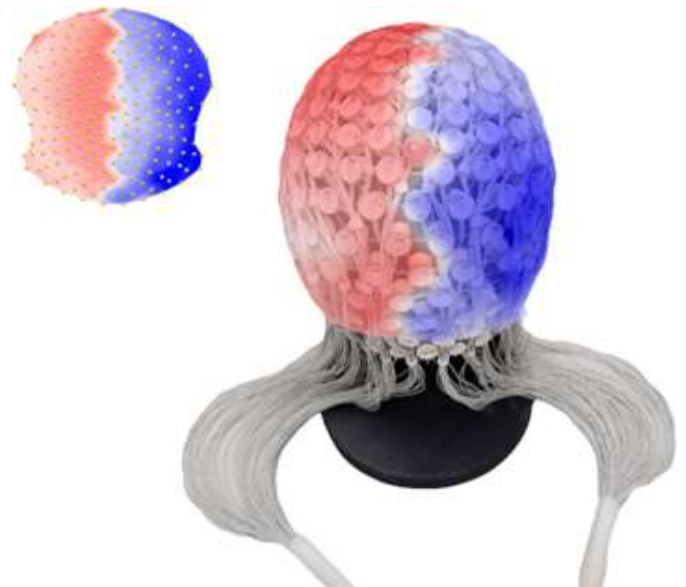


Figure 1 - The left part displays a spatially unsmoothed VT map, showing 204 electrodes, each marked by a yellow dot. The right panel presents a real photograph of the 256-channel EGI EEG cap (mainly the occipital part) with the VT mapped onto its surface. It can be clearly seen that the vertical line follows the wiring and electrode placement.

Full article:

Jordánek, Tomáš, Martin Lamoš, a Radek Mareček. 2025. „Vertical Topography in EEG Microstates: Physiology or Artifact Manifestation?" Human Brain Mapping 46 (11): e70294. <https://doi.org/10.1002/hbm.70294>.

About MUNI MAFIL CEITEC

MAFIL is an open laboratory established at Masaryk University within the scope of the Central European Institute of Technology project (CEITEC). The laboratory provides modern imaging services, particularly in the area of neuroimaging and human brain mapping, as well as imaging of other parts of human body. MAFIL activities are based on methods such as human MR imaging in a strong magnetic field (including MR spectroscopy) and electrophysiological technique (high-density EEG, simultaneous electrophysiological measurement and MRI). MAFIL expert reports focus mainly on functional and structural brain (head) mapping, because the laboratory was established to serve the needs of neuroscientific research. Since MAFIL performs measurements on live subjects, the access to offered services is governed by specific organizational and operational guidelines.

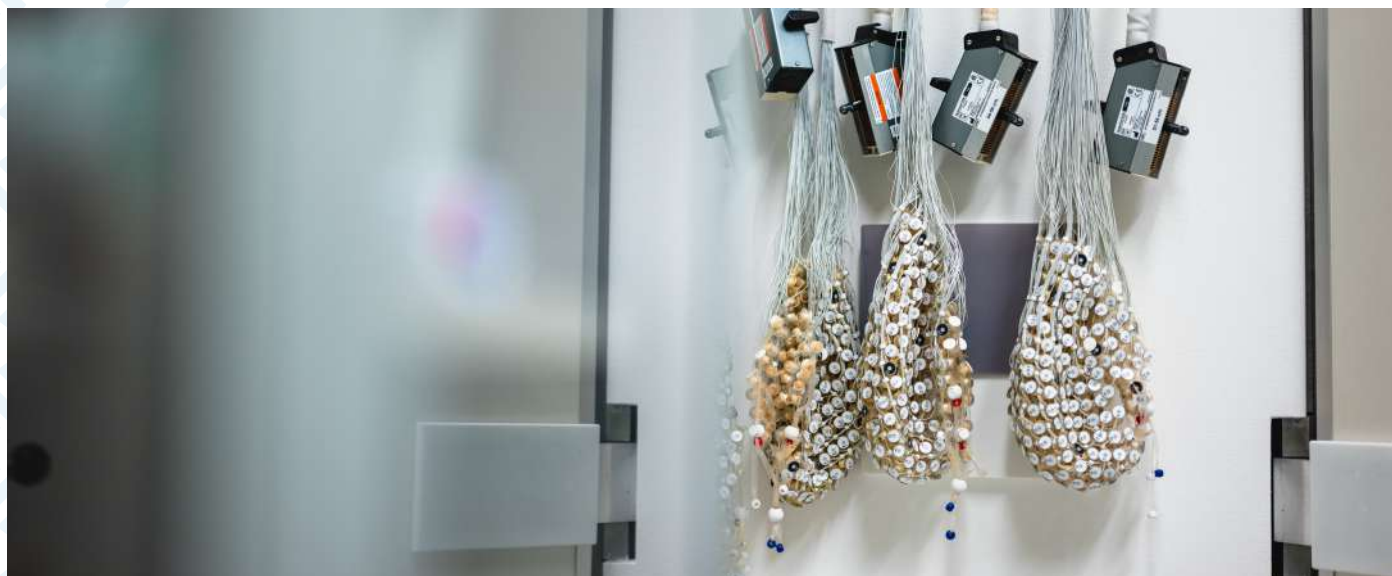


Image Courtesy of MAFIL, CEITEC, MUNI. Image not related to the study discussed above.

Get in touch with the Core Facility



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Annual Scientific Conference

Imaging Principles of Life 2026

REGISTRATION
OPEN

30 September – 1 October 2026

Institute of Molecular Genetics of the Czech Academy of Sciences,
Prague, Czech Republic

REGISTRATION DEADLINE: 15 July 2026

INVITED INTERNATIONAL SPEAKERS:

DATA



Prof. Jean-Yves Tinevez,
Head of the Image Analysis Hub,
Institut Pasteur, Paris, France

EM



Dr. Marta Carroni
Head of Cryo-EM Unit, Stockholm
University, Sweden

LM



Jun.Prof. Dr. Christian Franke,
Head of the Digitized Experimental
Microscopy Facility, Friedrich Schiller
University Jena, Germany

MI



Assoc.Prof. Dr. Martin Krššák
Clinical Division of Endocrinology
and Metabolism, Medical University
of Vienna, Austria

CONFERENCE WEBSITE

Expanding Visibility

Czech-BioImaging Launches Its Social Media Presence

Czech-BioImaging is pleased to announce the launch of its official social media presence on Instagram and LinkedIn. These new channels will help us connect more closely with researchers, facility users, collaborators, and the wider scientific community, while showcasing the vibrant activities taking place across our national bioimaging infrastructure.

Our social media platforms will serve as a window into the world of advanced biological imaging, providing regular updates from Czech-BioImaging Core Facilities and highlighting the people, technologies, and scientific discoveries that drive our community forward.

Followers can look forward to a diverse range of content, including:

- Interesting research projects and user success stories supported by Czech-BioImaging facilities
- Striking microscopy and bioimaging images
- New technologies, instruments, and imaging workflows

- Opportunities for research project support and access to facilities
- Announcements of courses, workshops, and training events
- Conference highlights and community news
- Updates on Czech-BioImaging's activities within the European bioimaging landscape, including collaborations and initiatives at the Euro-BioImaging level
- "CF visibility" features showcasing the expertise, services, and achievements of individual Czech-BioImaging facilities

By expanding our digital presence, we aim to strengthen communication within the bioimaging community, increase awareness of available resources and expertise, and celebrate the excellent science made possible through open access to state-of-the-art imaging technologies.

We invite researchers, students, facility staff, and anyone interested in bioimaging to follow us and become part of the growing Czech-BioImaging online community.



www.instagram.com/czechbioimaging

www.linkedin.com/company/czech-bioimaging

Follow us to stay informed about the latest developments in Czech bioimaging, discover new opportunities, and connect with a community dedicated to advancing life science research through imaging.

Bringing Science to the Public

VELETRH
VĚDY

Revealing the Invisible: Czech-Biolmaging at Veletrh vědy 2026

Czech-Biolmaging took part in **Veletrh vědy 2026**, the largest popular science event in the Czech Republic, held on 4–6 June 2026 at PVA EXPO PRAHA in Letňany. The event, organised annually by the Czech Academy of Sciences, brings together research institutes, universities, companies, and educational organisations to present science in an interactive and accessible way.

At the joint exhibition of the Institute of Molecular Genetics of the Czech Academy of Sciences, Czech-Biolmaging, and CZ-OPENSREEN, visitors had the opportunity to explore the fascinating world

hidden beyond the limits of the human eye. The programme invited them to “look at the world through a microscope” and discover how modern imaging technologies help scientists study cells, tissues, and whole organisms in remarkable detail.

Czech-Biolmaging presented microscopy as an essential tool for understanding life at the cellular and molecular level. Visitors could learn how researchers use advanced imaging methods to observe living cells, follow biological processes almost in real time, and ask questions such as how cells divide, how molecules move inside cells, and what changes occur during disease.



The exhibition also included hands-on and visually engaging activities. Visitors were able to observe real cells and fluorescently labelled structures, learn about sample preparation for electron microscopy through a “water laboratory”, and see how such samples appear under advanced imaging systems.

Participation in Veletrh vědy 2026 offered Czech-Biolmaging an excellent opportunity to share its mission with the public: connecting leading imaging facilities across the Czech Republic and supporting researchers with access to state-of-the-art

technologies and expertise. We were pleased to meet curious visitors of all ages and to show how bioimaging helps reveal the invisible processes that shape life and health.

We thank everyone who visited the exhibition and contributed to the lively atmosphere of this year's Veletrh vědy. Events like this remind us how important science communication is for inspiring future generations and strengthening the connection between research infrastructures and society.



Upcoming Courses

Learning opportunities for the months ahead

Before and after the summer holiday period, we continue to offer diverse educational activities, including hands-on and theory-based courses in biomedical imaging and image analysis tailored to both beginners and advanced users.

Fundamentals of Light Microscopy

Date: 23 – 25 June 2026

Location: MUNI CELLIM CEITEC, Brno

Advanced Methods in Biomedical Image Analysis

Date: 6 – 12 September 2026

Location: MUNI CBIA, Brno

Advanced Light Microscopy Methods

Date: 8 – 11 September 2026

Location: MUNI CELLIM CEITEC, Brno

Experimental Biophotonics

Date: 17 – 8 September 2026

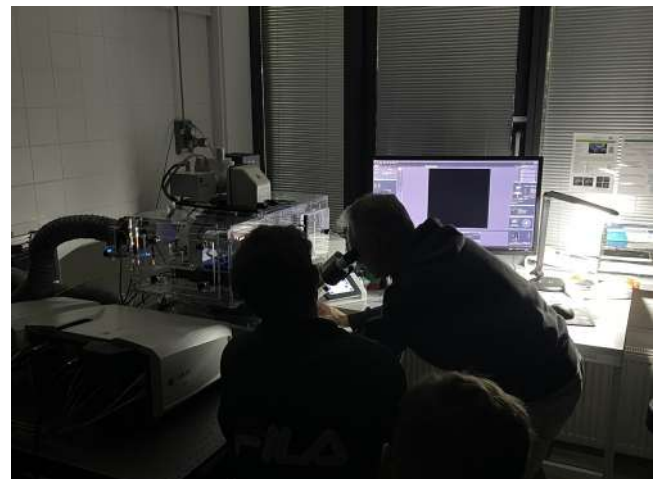
Location: BUT BCF, CEITEC, Brno

Imaging Horizons: Discover the World of Advanced Imaging Methods

Date: 8 – 13 October 2026

Location: CUNI, CAPI, Prague

VIEW ALL COURSES HERE:



Opportunities for Users

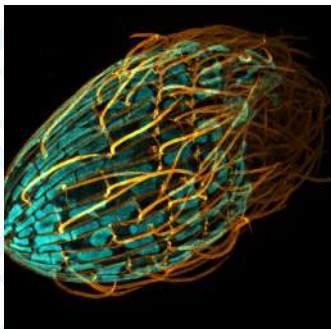
Prague Node: Participate in the Picture of the Month/Year competition

The 2025–2026 season of the Czech-Biolmaging Picture of the Year competition has now come to a close, with submissions collected from June 2025 through May 2026.

The winning image will be announced at the annual Photons, Electrons and Sausages barbecue on 25 June 2026, where the author will receive the 10,000 CZK main prize, generously sponsored by leading microscopy companies.

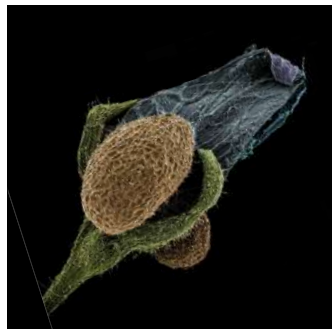
We would like to thank all participants for sharing their remarkable images and contributing to another successful year of the competition. Selected submissions may also be featured in Czech-Biolmaging promotional materials, showcasing the beauty and scientific value of bioimaging research across our community.

We look forward to launching the next competition season and discovering a new collection of outstanding images in 06/2026–05/2027.



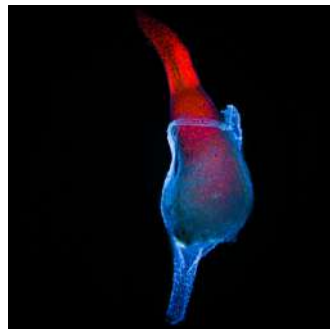
January 2026

Martina Vinopalová
Sea Giant at Large



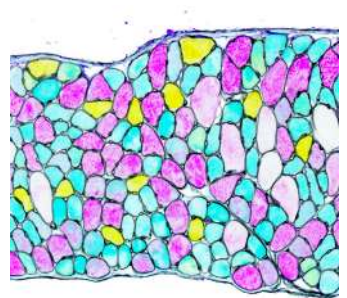
February 2026

Tomáš Figura
Dock Fruit



March 2026

Tomáš Figura
Burning Goblet



April 2026

Vera Getmanchuk
The Aquarelle of Motion

JOIN THE COMPETITION

Prague Node: Join us at the Photons, Electrons & Sausages user BBQ 2026

We are delighted to invite you to join us for an afternoon and evening of networking, relaxation, and celebration in a setting far removed from the dark microscopy rooms we know so well.

Together, we will celebrate another

successful year of collaboration across Prague's microscopy community, exchange ideas beyond the microscope, and recharge for the exciting year ahead. Expect great conversations, good food, refreshing drinks, and plenty of opportunities to connect with colleagues

from across Prague's imaging facilities.

This community event is organized by the Prague microscopy facilities united within the Czech-Biolmaging infrastructure and the Prague Node of Euro-Biolmaging ERIC, and hosted by the Institute of Molecular Genetics of the Czech Academy of Sciences (IMG).

Participating Facilities

- Light Microscopy Core Facility, IMG
- Electron Microscopy Core Facility, IMG
- Microscopy Service Center, IEM
- Bioimaging Facility, IPHYS
- Viničná Microscopy Core Facility, Faculty of Science, Charles University
- Imaging Methods Core Facility, BIOCEV – Faculty of Science, Charles University
- Laboratory of Electron Microscopy, BC
- Imaging Facility, IEB

What Can You Look Forward To?

- Delicious barbecue and refreshing drinks
- Fun microscopy-themed activities

- Announcement of the Picture of the Year Award, showcasing stunning images created at our core facilities
- Informal networking with colleagues from across Prague's imaging community

Event Details

- Date: 25 June 2026
- Time: From 4:00 PM
- Venue: IMG Pond – BBQ Area

Registration

To help us prepare the right amount of food and refreshments, we kindly ask all attendees to register in advance.

Registration deadline: 18 June 2026

We look forward to seeing you there and celebrating another great year of microscopy together!

REGISTER

BC LEM BIOCEV IMCF IMG LMCF IMG EMCF IPHYS BIF IEM MCF IEB IF VMCF

Photons, Electrons, & Sausages

Czech-Biolmaging User Meeting and BBQ



Krč Campus
25.6.2026

HW tuning 4–5 PM
Participants gathering at IMG pond BBQ area

Facility gig 5–6 PM
Facilities introduce a microscopic technique in a playful way

Food and drinks 6–8 PM
Networking over a drink and bite

Picture of the Year 7 PM
Announcement of the winners (sponsored by Nikon)

Facility closed 8 PM
Take your photons, and electrons and go home

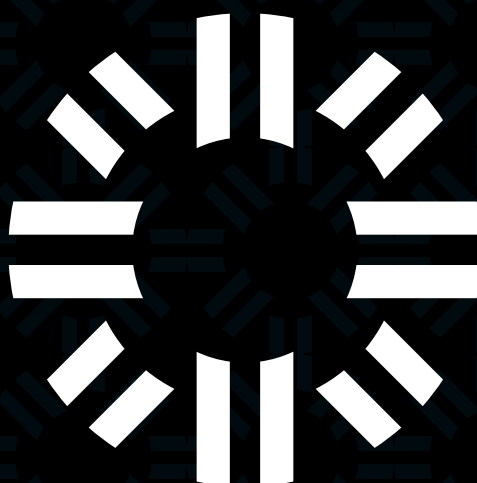
Mandatory RSVP



Register here

CZECH BIOIMAGING EURO-BIOIMAGING





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Acknowledgement

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Co-funded by
the European Union



Ministry of Education,
Youth and Sports
of the Czech Republic