CZECH BIOIMAGING

Imaging principles of life

CZECH— BIOIMAGING NEWSLETTER

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SPOTLIGHT ON A NEW CZECH-BIOIMAGING FACILITY

Vinična Microscopy Core Facility

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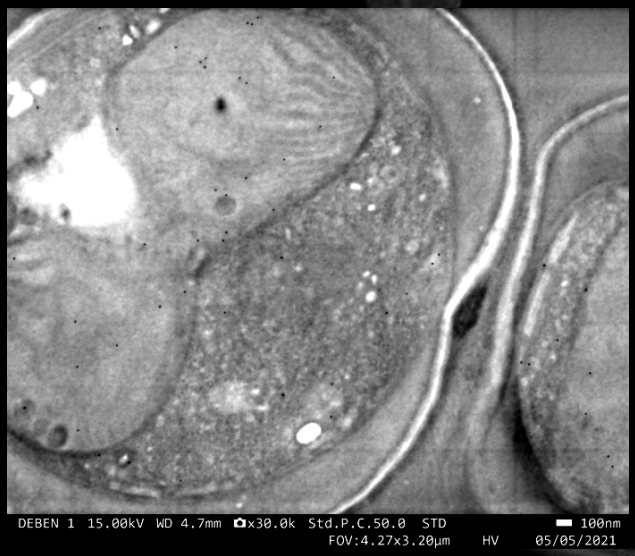
Introduction

The **Vinicna Microscopy Core Facility (VMCF)** of Faculty of Science of Charles University is a core facility founded in 2023, when it also became an official member of Czech-Bioimaging. As an open access service microscopy facility, however, it has been operating (in the form of separate units Laboratory of Electron Microscopy, Laboratory of Confocal and Fluorescence Microscopy and Laboratory of Flow Cytometry) since 2004, when it provided services for research and educational purposes, not only for staff and students of the Faculty of Science but also investigators from other scientific institutions. The facility is housed in a historic building in the centre of the capital (the former Institute of Natural Sciences of the German part of the Charles-Ferdinand University, where many world-class scientists, including A.Einstein, E.Mach, etc., worked), and where this genius loci offers favourable conditions for the visits and cooperations with local and foreign institutions or the organisation of workshops and symposia. The facility takes advantage of this to hold traditional international workshops with extensive international participation in, for example, image and data analysis. However, the dispersed location in the old premises also poses limitations in the development and instrumentation renewal of the facility,so the VMCF will partially expand into the new premises of the adjacent science centre - the Biocentrum, campus of Charles University in Prague at Albertov.

Fluorescence image of liver tissue section. Courtesy of Anna Maria Frontino and Daniel V. Oliveira. Mašek J. et al.



High-resolution SEM operating at low accelerating voltage was used to evaluate the immunolabelling of Chromera velia using rabbit anti-histone H2A primary antibodies and protein A as secondary antibodies conjugated to 10 nm AuNPs. Courtesy of Kitzberger Frantisek and Nebesarova Jana. Kitzberger, F. et al.

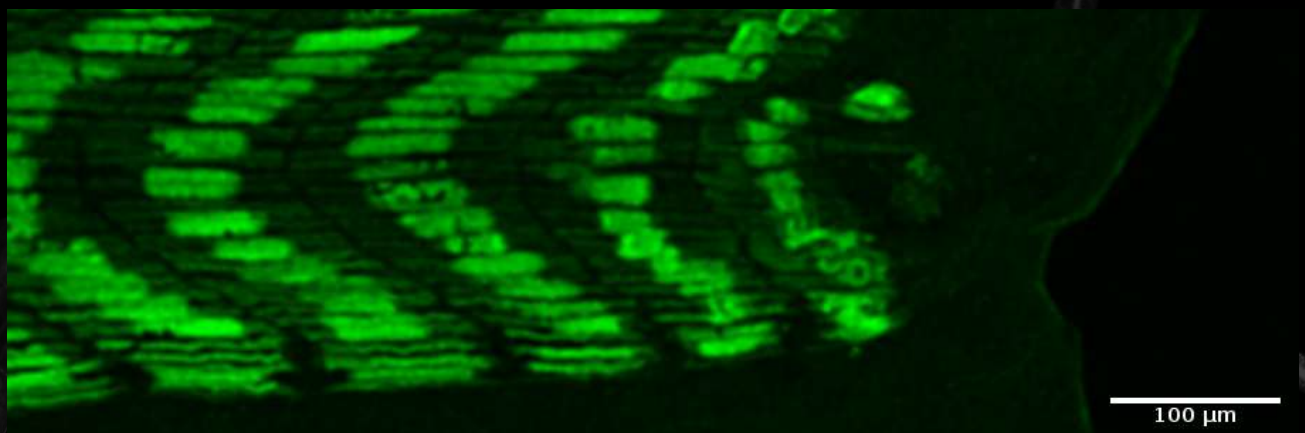
Services and equipment

VMCF operates 12 basic microscopes: Zeiss Elyra PS.1 (superresolution microscopy, SIM, SMLM, TIRF, PALM/STORM), Zeiss LSM 880

NLO (confocal microscopy, FCS, MP, FLIM), Zeiss Axioscan Z.1 (HTC imaging), Zeiss Lightsheet Z1 (lightsheet microscopy), Nikon live-cell imaging system TiE-2 (wide-field fluorescence microscopy), Olympus Cell^R system (wide-field fluorescence microscopy), OLYMPUS BX51 (upright compound microscope/digital camera: brightfield, fluorescence, phase, DIC), Leica TCS SP 2 AOBS (confocal microscopy, inverted), Leica TCS SP8 (confocal microscopy, HTC), TEM Jeol 1011 (routine TEM), SEM Jeol JSM IT- 200 (routine SEM), HR SEM Jeol JSM IT-800 (HR SEM, STEM, microarray tomography). In addition, the laboratory is equipped with instruments for the preparation and processing of samples for light and electron microscopy and overall evaluation in cytometry (Tissue Processor Leica ASP200, Leica EM AMW automatic microwave processor, OKOLAB environmental chamber, CO2 inkubator, Bal-Tec CPD 030, Bal-Tec SCD 050, cell analyzer, benchtop cytometer, magnetic and flow sorters etc.). Facility offers as well an image analysis open-source/commercial software (Zeiss ZEN software, ARRIVIS, Olympus software, NIS elements, Amira, SVI Huygens, FIJI, Matlab, Qpath etc.) service (consultation, analysis workflow development/procedure settings, code writing/manual analysis,training for AI image analysis), 3D printing MK3S and 3D modeling.

What makes us different?

Versatility and comprehensive services. Facility provides services and training in a wide range of microscopy methods and instruments based on the changing and combined needs of different users (using different types of approaches and instruments at the same site). Offers expertise and development of unique techniques for the preparation of various types of biological and non-biological samples (marine and anaerobic protists, arctic organisms, fungi, intracellular parasites, perfusion fixation). Unique methods and techniques of VMCF include: environmental light for plants in long-term lightsheet experiments, combination of lambda spectral scanning with fluorescence lifetime, confocal fluorescence anisotropy, far-red fluorescence sensing (Cy7), high throughput imaging on multi-well dishes using various techniques, automated scanning of a large number of fixed samples, motorized fluorescent stereomicroscope with microinjection system, low-voltage STEM of biological samples (multiple simultaneous immunolocalizations), microarray tomography, LM/HR SEM correlative microscopy. VMCF staff also provide and develop services and lectures on advanced image and data analysis at international forums.



Confocal image maximum projection of tail muscles in Xenopus embryo. Courtesy of Qing Zhao. Zhao Q, Mertová I, Wróblová A, Žabková S, Tlapáková T, Krylov V

How to get in touch?

Please visit our web or contact us directly via email:

- *https://natur.cuni.cz/en/biology/departments-and-work-places/service-facilities/vinicna-microscopy-core-facility*
- *https://web.natur.cuni.cz/sekce-bi/VMCF/*

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FOCUS ON TECHNOLOGIES

Introducing Carl Zeiss Lattice Lightsheet 7

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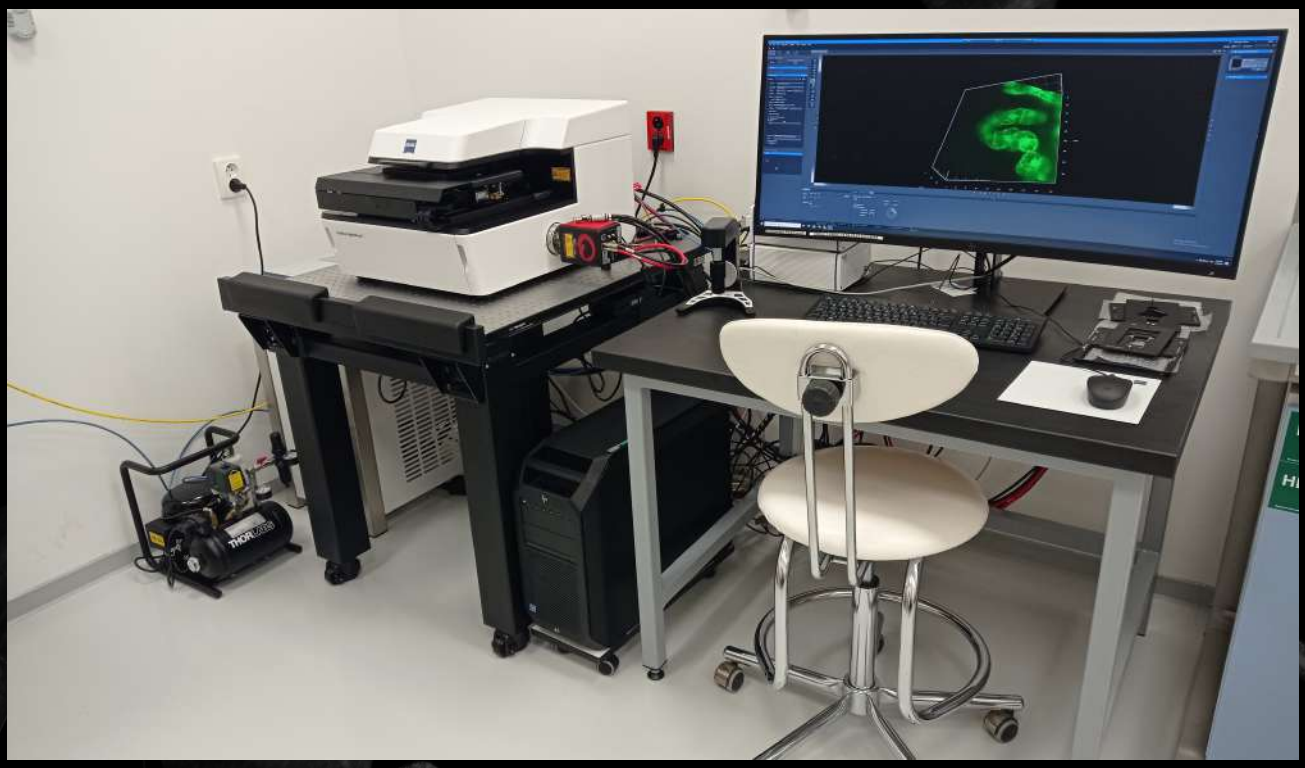
The same year Dr. Eric Betzig received his Nobel Prize for the invention of PALM, he introduced the world to lattice lightsheet microscopy. Over the next decade, this groundbreaking technology evolved into a powerful tool for fast volumetric imaging, prized for its gentle approach to living samples. Unlike other light-based methods, which are limited by phototoxicity and photobleaching, lattice lightsheet microscopy reconstructs volumetric data from tens to hundreds of raw 2D images with minimal sample damage.

In high-speed dithering mode, the sample rapidly sweeps through the lightsheet, illuminating an entire optical slice in a single step. This significantly reduces the number of steps needed to generate a complete volume. At its core, the system utilizes Bessel beams propagating through a spatial light modulator. These beams maintain their shape without diffraction, enabling the generation of ultrathin layers of light. Compared to conventional lightsheet microscopy, which produces much thicker sheets, this technique achieves subcellular resolution, making it ideal for detailed imaging of biological structures.



In January 2025, **IMCF at BIOCEV** officially launched the Lattice Lightsheet 7 from Carl Zeiss. Designed for compatibility with conventional sample carriers, it features complete environmental control and automated immersion refilling. Fast laser switching and two high-speed sCMOS cameras allow for near-simultaneous three-color imaging. The manufacturer guarantees the system's ability to perform three volume scans

per second, making it an exceptional tool for long-term live-cell imaging.
However, due to the geometry of the lattice lightsheet and the working distances of its objectives, penetration depth remains a limitation. Even in ideal, non-scattering samples, the lightsheet cannot reach beyond 200 µm. As a result, the system is best suited for imaging individual cells, smaller organoids, and early-stage embryos.
Despite this limitation, the rich 4D datasets generated by this system enable a wide range of analysis including particle tracking within cellular volumes, segmentation of cells in organoids, volume quantification, cell phenotype analysis for cancer research, and real-time observation of fertilized oocytes developing into multicellular embryos. For inspiration see link No.3.

Useful links:

1. https://spectrum.ieee.org/crafting-light-to-illuminate-life-from-single-molecules-on-up

2. https://www.teledynevisionsolutions.com/en-150/learn/learning-center/scientific-imaging/lattice-light-sheet/

3. https://www.zeiss.com/microscopy/en/products/light-microscopes/light-sheet-microscopes/lattice-lightsheet-7.html

4. https://imcf.natur.cuni.cz/IMCF/optical-microscopes/

Scan QR code to obtain a link to time lapses:

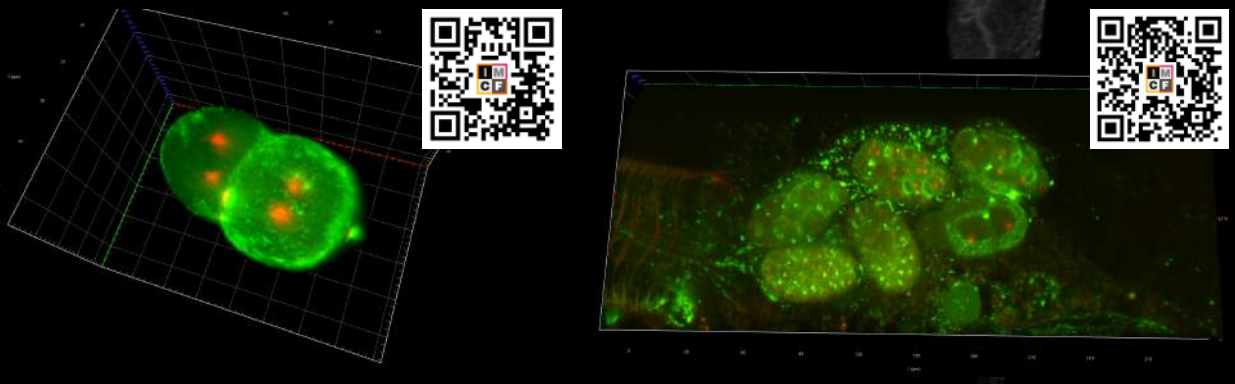


Figure 1 Development of C.elegans oocyte outside the body of worm A, and inside the body of worm B. Both images are courtesy of of Jacobus van Grootel, Middelkoop group, IMG CAS and Eliška Miková, Hons group, 1st Faculty of medicine Charles University.

How to get in touch?

Please visit our web or contact us directly via email:

https://imcf.natur.cuni.cz/IMCF/

ales.benda@natur.cuni.cz

OPEN CALL

User Project Support - Spring 2025

Do you have an innovative research project in the field of biomedical imaging? Czech-BioImaging offers funding opportunities to support the best research ideas, helping you take your project to the next level. Through our funding scheme, we provide financial contributions, such as discounts on measurement costs or the acquisition of special materials needed for your experiments.

Each year, Czech-BioImaging allocates approximately CZK 2.3 million for this scheme, divided into two calls. Many successful collaborations have led to impactful publications and joint grant applications that wouldn't have been possible without this initial support.

If you have a groundbreaking project in mind, apply now and be part of the next wave of innovation in biomedical imaging!

Eligibility

- **Academic users:** Researchers working for academic institutions and conducting independent/basic research, e.g. universities and research institutes
- **Commercial users:** only subjects conducting research included in the official List of Czech Scientific Institutions as published by the Ministry of Education, Youth and Sports of the Czech Republic (MEYS)
- **Inter/national users:** Both Czech and international applicants are welcome (EU or non-EU)

Apply

Call Timeline

Call opens	Application deadline	Results announcement	Project execution	Reporting
10 March 2025	15 April 2025	30 June 2025	1 July 2025 - 30 June 2026	15 July 2026

www.czech-bioimaging.cz/open-calls

IMAGING PRINCIPLES OF LIFE 2025

Celebrating 10th Anniversary of Czech-BioImaging with our users and staff

- **17-19 September**
- **Hotel Atlantis, Rozdrojovice, Brno**

This year's scientific conference "Imaging Principles of Life" will be special because 2025 marks the **10th anniversary of the official establishment of the Czech-BioImaging national research infrastructure**. We are excited to invite you to this event, featuring a rich scientific and social program with keynote lectures, a user meeting session, and much more. The conference will take place **17-19 September in Rozdrojovice, Brno.**

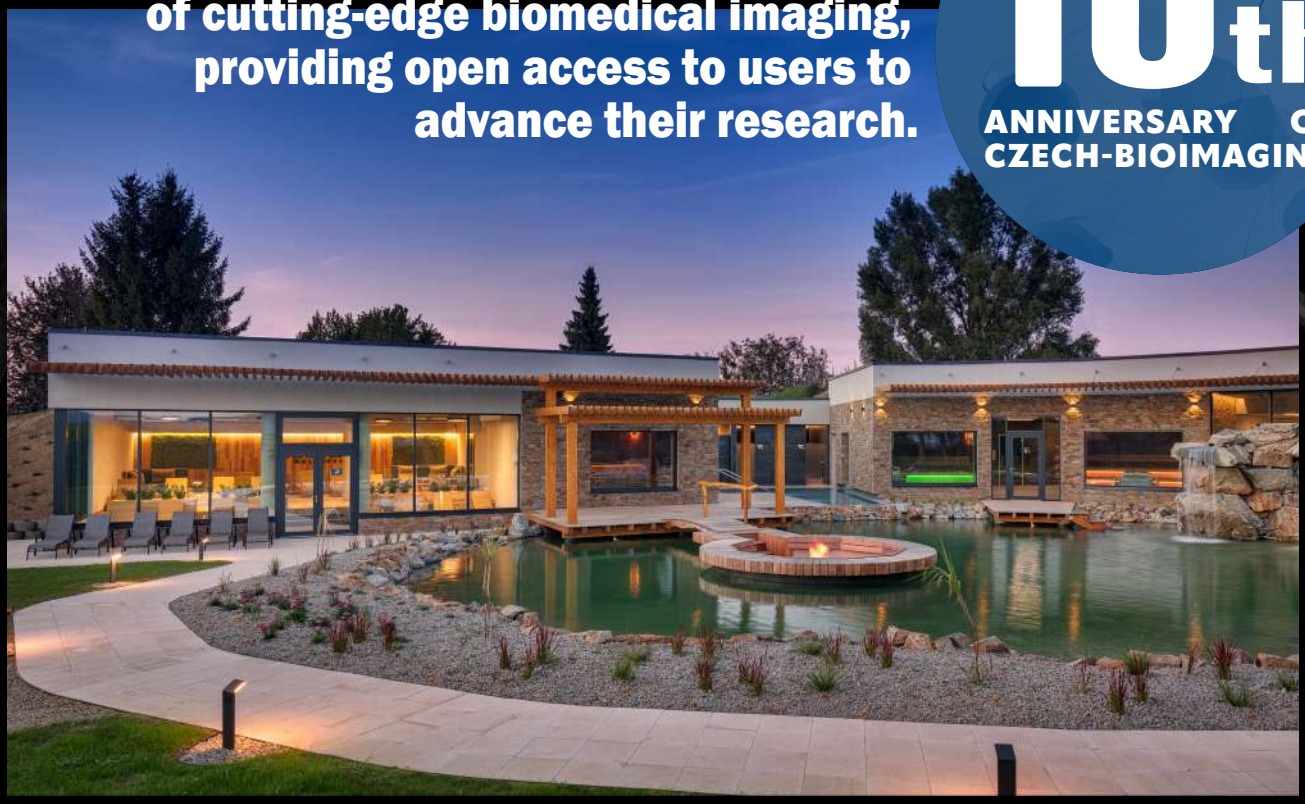
While we're still finalizing the details, rest assured that the conference will be packed with inspiring user presentations, discussions and will highlight the journey of Czech-BioImaging and the incredible progress we made over the past decade in our Core Facilities.

We look forward to celebrating this milestone together and sharing the exciting research projects we helped come true!

www.czech-bioimaging.cz/conference/

Since 2015, we have been at the forefront of cutting-edge biomedical imaging, providing open access to users to advance their research.

10th ANNIVERSARY OF CZECH-BIOIMAGING



UPCOMING COURSES

March - June 25

MOLECULAR DYNAMICS IN LIVING CELLS
March 17-19, 2025 | BIOCEV, CUNI, Vestec

PROCESSING AND ANALYSIS OF MICROSCOPIC IMAGES IN BIOMEDICINE
March 31 - April 4, 2025 | Institute of Molecular Genetics of the Czech Academy of Sciences, Prague

CRYO-IMAGING OF BIOLOGICAL SAMPLES
April 7-9, 2025 | BIOCEV, CUNI, Vestec

AI-BASED SEGMENTATION AND TRACKING
May 13-14, 2025| Institute of Molecular Genetics of the Czech Academy of Sciences, Prague

MICROSCOPY DATA PRESENTATION AND IMAGE ANALYSIS IN PLANT RESEARCH
May 14-15, 2025| Institute of Experimental Botany of the Czech Academy of Sciences, Prague

ADVANCED 3D IMAGE VISUALIZATION AND QUANTIFICATION
May 29-30, 2025| Institute of Experimental Medicine of the Czech Academy of Sciences, Prague

BIOLOGICAL SPECIMENS IN ELECTRON MICROSCOPES
June 23-27, 2025| Biology Centre of the Czech Academy of Sciences, České Budějovice

BIOLOGICAL ENGINEERING - IMAGING BIOMOLECULAR PROCESSES
June 23-27, 2025| Viničná Microscopy Core Facility, Charles University, Prague

BIOIMAGE ANALYSIS
June 30 - July 4, 2025| Viničná Microscopy Core Facility, Charles University, Prague

INVITATIONS

MUNI MAFIL CEITEC at the Brain Awareness Week

- **Friday 14. 3., 11:00; 13:00; 17:00**
- **Brno - Bohunice, Kamenice (entrance via Studentská) 5, CEITEC MU, building E35**

We invite you to a guided tour of the shared **Laboratory of Multimodal and Functional Imaging (MAFIL)** at CEITEC Masaryk University as part of the open day. Come and discover interesting facts about neuroimaging and human brain mapping and learn more about the research our scientists are engaged in. Registration not needed.

CTLS congress registration open

Join us for the Core Technologies for Life Sciences (CTLS) Congress – an essential event for core facility leaders, researchers, and life science professionals! This gathering offers a platform to explore cutting-edge innovations, foster collaborations, and highlight the crucial role of core facilities in science. The program features inspiring keynotes, interactive sessions, and discussions on Open Science, innovation, and industry partnerships.

CZECH-BIOIMAGING OPPORTUNITIES

Participate in the Picture of the Month/Year competition

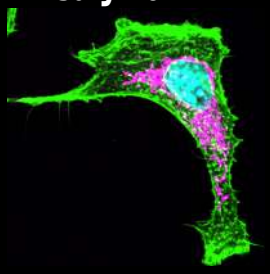
Do not miss out, the main prize for the Picture of the Year is 10 000 CZK, kindly sponsored by microscopy companies and announced at the annual barbecue Photons, Electrons and Sausages. Successful contributions will be featured in Czech-BioImaging promotional materials, giving you visibility and recognition in the scientific community.

For more information visit:
https://www.czech-bioimaging.cz/picture-of-the-month/

Monthly winners

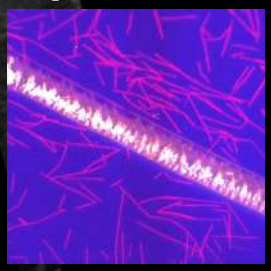
June 2024

July 2024



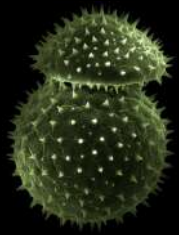
August 2024

September 2024



October 2024

November 2024



December 2024

January 2025

Join us at µLectures: Fluorophores

24 March 2025, 1PM
Online / Turquoise Auditorium, Institute of Experimental Medicine of the Czech Academy of Sciences

This months seminar will focus on fluorophores. We will begin by exploring the principles of fluorescence, including the Stokes shift and fluorophore spectra. Next, we will introduce the various types of fluorophores, discussing their advantages and disadvantages. Finally, we will examine the different properties of fluorophores and how these properties impact experimental outcomes.

Do you have any questions?

Visit our website or contact us at

info@czech-bioimaging.cz

www.czech-bioimaging.cz

MINISTRY OF EDUCATION, YOUTH AND SPORTS

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