

NEWSLETTER AUTUMN 2023

FOCUS ON TECHNOLOGIES

PERFLAB – ONLINE TOOL FOR DCE-MRI PERFUSION ANALYSIS

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Dynamic Contrast-Enhanced Magnetic Resonance Imaging (DCE-MRI) is an experimental MRI technique used for measurement of perfusion parameters. These quantitative biomarkers, such as blood plasma flow [ml/min/ml tissue], plasma volume fraction [ml/ml tissue], extravascular-extracellular volume fraction [ml/ml tissue] and permeability-surface-area product [ml/min/ml tissue], describe tissue microvasculature, and quantify the level of vascularization, vessel wall permeability and microvascular structure.

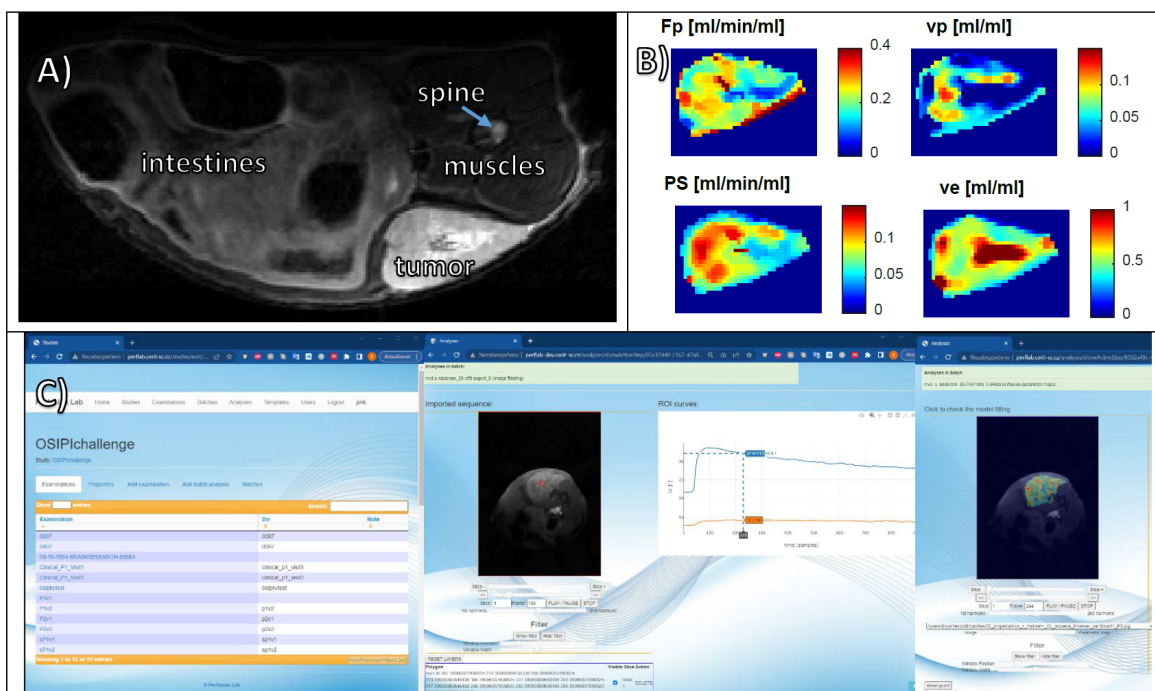


Fig. 1. A) Anatomy MR image, axial slice, mouse with a subcutaneously implanted tumor. B) Example perfusion-parameter maps of the tumor (Fp – plasma flow, vp – plasma volume, PS – permeability-surface-area product, ve – extravascular extracellular space volume). C) Screenshots of Perflab.

An example application of DCE-MRI is early quantification of tumor response to therapy. The perfusion parameters are known to change in days/weeks while the commonly measured tumor size changes within months. Other applications include assessment of blood-brain-barrier opening in neurodegenerative diseases and diagnostics of ischemic diseases. DCE-MRI is an *in vivo* technique applicable both in patient diagnostics and animal experiments when developing new treatment strategies. It can be used repeatedly during patient or animal treatment to map the temporal development pattern of the disease and can give complex and specific information on the effect of the treatment.

DCE-MRI is still an experimental technique due to the complexity of the image processing chain (includes image registration, conversion to contrast-agent concentration, fitting a pharmacokinetic model) and high demands on MRI hardware. At ISI-MR core facility of the Institute of Scientific Instruments of the Czech Academy of Sciences, we have been developing an online DCE-MRI processing system, PerfLab, providing novel perfusion-analysis approaches based on our methodological research. Recently, PerfLab ranked 3rd in the OSIPi DCE challenge, organized by the international society ISMRM. In frame of CzBI, at ISI-MR facility we provide access to this online software system and the corresponding consultation and/or data-processing service, as well as access to own compressed-sensing DCE-MRI acquisition methods implemented at our small-animal MR scanner.

SPOTLIGHT ON A NEW CZECH-BIOIMAGING FACILITY



THE MICROSCOPY SERVICE CENTRE (MSC) OF THE INSTITUTE OF EXPERIMENTAL MEDICINE OF THE CZECH ACADEMY OF SCIENCES (IEM)

Author: Štěpán Kortus, Ph.D. | Microscopy Service Centre, IEM | [✉](#)

Introduction

The microscopy service centre (MSC) of the Institute of Experimental Medicine CAS (IEM) is a new core facility founded in 2022, that offers open access to imaging methods and analysis services. From 2023, we are officially a member of the Czech-Bioimaging. The department's core consists of three people with a background in biomedical engineering, physics, and neuroscience. The history of the facility dates back to the early 2000's, when the first confocal microscope was offered as a shared equipment.

Services and equipment

MSC operates 7 microscopes: 2 advanced confocal microscopes – laser scanning and spinning disc, both offering super-resolution (SR) compatible with life-cell imaging; 2 laser scanning microscopes with two-photon excitation; 2 basic microscopes for routine wide-field and confocal imaging; and a light sheet microscope providing cellular resolution of cleared samples. We also provide support in data acquisition, analysis, and custom software development, using Matlab, Python, ImageJ, etc.



What makes us different?

The common techniques of fluorescent imaging are well accessible at most of the facilities within the CzBI. As a new member, we searched for the least covered fields where to specialize. We identified a lack of **super-resolution methods compatible with life cell imaging**. We offer two confocal microscopes with SR mode, that provide significant improvement in resolution while keeping a gentle dose of light and thus allow for long-term imaging of living cells. These SR techniques are derived from structured illumination microscopy, with the benefit of absolute simplicity of usage.

Figure 1A shows a series of SR images obtained from the same living neuron, that are transformed into a 3D model using a custom-made software. The image captures the dynamics of dendritic spinules over time. Note that the width of protrusions < 150 nm makes them practically invisible for regular confocal microscopes, while the changes over time would not be possible to capture with other SR techniques such as STORM or STED due to fixation or high phototoxicity.

The second field we specialize in is **intra-vital microscopy**, a technique offering sub-cellular resolution within behaving animals, that has a history at IEM starting in 2010 with the first two-photon microscope and the first cranial window surgery. Today, we do routine two-photon functional imaging of awake mice through the cranial window using GCaMP calcium probe (Fig 1B).

We plan to open the intravital lab in a fully open-access mode like any other imaging technique. Users will be provided with on-site animal housing, surgery and imaging service, viral injections at the stereotactic device, and access to the advanced two-photon microscope, the Femtonics FEMTO3D Atlas. This microscope offers unparalleled speed and random-access 3D scanning allowing to study multi-layer interactions in real time.

Vision

Our vision is to offer easy access to state-of-the-art tools to support research excellence and to have fun while doing it 😊.

How to get in touch? Please visit our web or contact us directly via email:

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Štěpán Kortus, Ph.D.

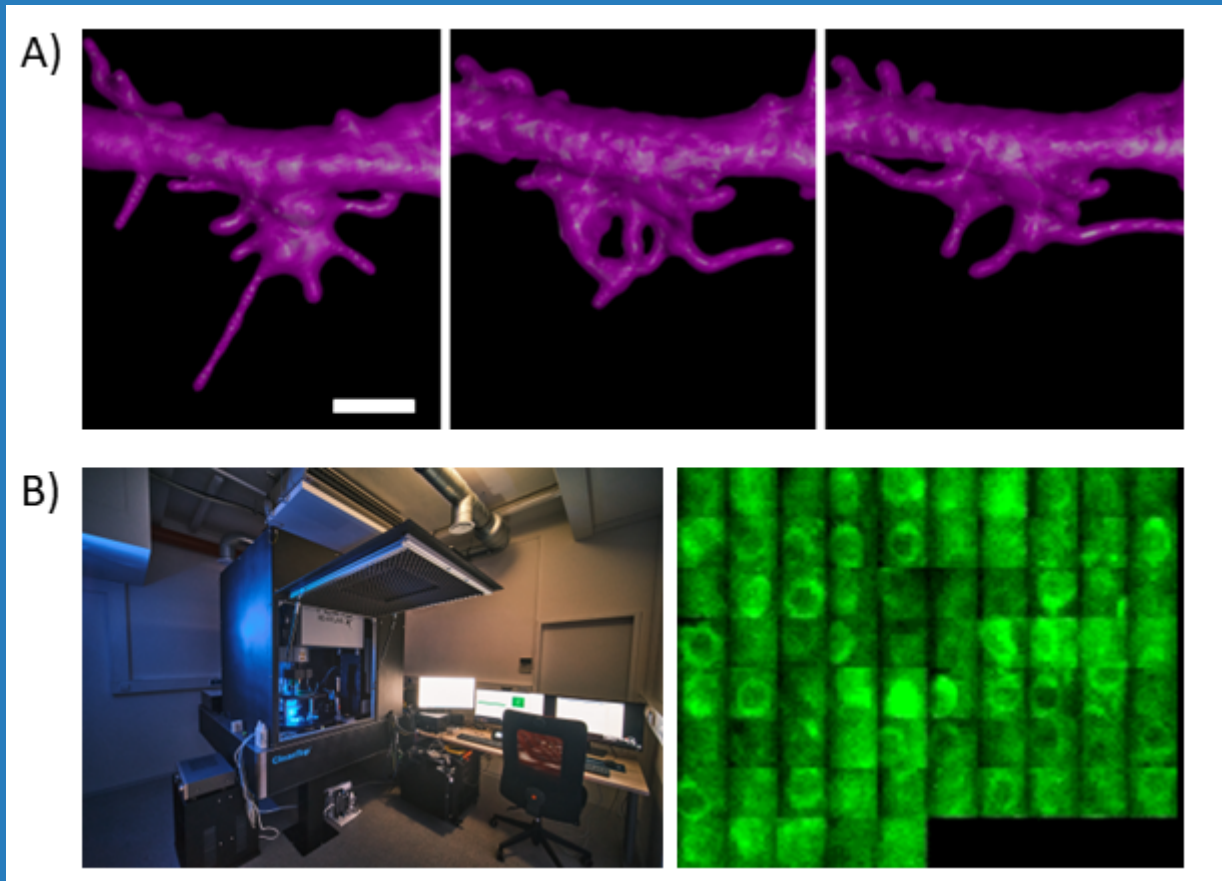


Figure 1: Application examples. A) Example of live cell super-resolution microscopy. Dendritic protrusions (spinules) were captured with Olympus SpinSR10 microscope over a time span of one hour. A 3D model was subsequently generated for each time point using a custom-made software developed in Matlab and Python. Three selected time points are shown with intervals of 10 minutes, scale bar 1 μm . B) Two-photon microscope Femtonics FEMTO3D Atlas dedicated for intravital imaging of behaving mice (left) and example of a population ($n > 70$) of GCaMP expressing neurons recorded at frequency of 100Hz at different depths ranging from $-320 \mu\text{m}$ to $-120 \mu\text{m}$ bellow skull.

PAST EVENT

USER MEETING: PHOTONS, ELECTRONS & SAUSAGES BBQ 2023

Czech-BioImaging has always been very involved in Euro-BioImaging and always welcomes new and returning users from all over Europe. This year, the Prague node of Euro-BioImaging, consisting of a number of Czech BioImaging facilities, decided to bring their users together and organise an open event called **Photons, Electrons, & Sausages 2023**.

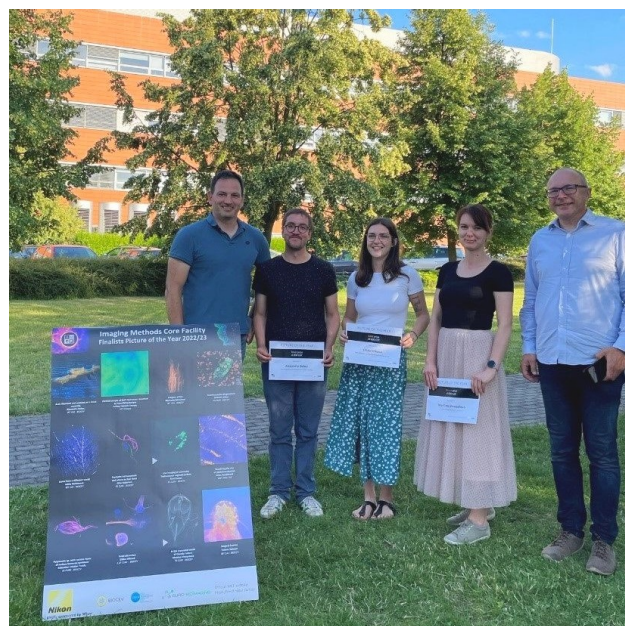
The event took place on the 29th of June 2023 at the Krč campus near the IMG building and hosted about 50 participants who came to enjoy a lot of sun, networking and fun with us. The programme included a small competition for the best performance by a facility, in which **EM CF IMG led by Vlada Filimonenko** won.



Another part of the official program was an announcement of 3 best microscopic **Images of the Year competition**, which received gold, silver and bronze awards, generously sponsored by Nikon in cooperation with CSMS.

Winners of Picture of the Year 2022/2023 competition:

1. Eliška Miková
- Fatal attraction (March 2023)
2. Alexandre Beber
- Actin filaments and proteins on a dried coverslip (June 2022)
3. Martina Vinopalová
- In the expanded world of Giardia (April 2023)





Along with our congratulations to all winners, we see the event as a success and we will definitely repeat it again next year. Stay tuned.



UPCOMING COURSES

MICROSCOPY METHODS IN BIOMEDICINE

Course | October 16-20, 2023 | IMG, Prague

ADVANCED MICROSCOPY METHODS IN BIOLOGY

Course | October 17-19, 2023 | CEITEC MU, Brno

MULTI-MODAL LIGHT MICROSCOPY IMAGING IN PLANT RESEARCH

Course | October 18-19, 2023 | IEB, Prague

NEUROIMAGING: MAPPING THE FUNCTION AND STRUCTURE OF BRAIN

Course | November 7-8, 2023 | CEITEC MU, Brno

MECHANICAL CHARACTERIZATION OF BIOLOGICAL SAMPLES USING CORRELATIVE METHODS

Course | November 10-11, 2023 | IPHYS, Prague

3D-CLEM IMAGING FUNCTION AND ULTRASTRUCTURE

Course | November 13-16, 2023 | UK, BIOCEV, Vestec

[View all courses !\[\]\(0d7ca0919e6c47bbd874bfa0189fe22e_img.jpg\)](#)

UPCOMING EVENT



EURO-BIOIMAGING USER FORUM: UNDERSTANDING PLANT BIOLOGY

IF IEB

The next Euro-BioImaging User Forum will take place online on Thursday, October 12, 2023, from 2 pm-5 pm CEST. The topic is "Understanding plant biology."

This event will highlight how cutting-edge imaging technologies can support research into the structure and function of plants, shed light on plant health, resilience and adaptability, and help answer agroecology research questions. Applications of diverse imaging technologies and plant biology research contexts will be highlighted by two keynote speakers and presentations from users of the Euro-BioImaging services, showcasing the specific expertise available at the Euro-BioImaging Nodes. We will also provide information on funding opportunities to access Euro-BioImaging services for agroecology-related research projects.

EURO-BIOIMAGING USER FORUM

Understanding Plant Biology

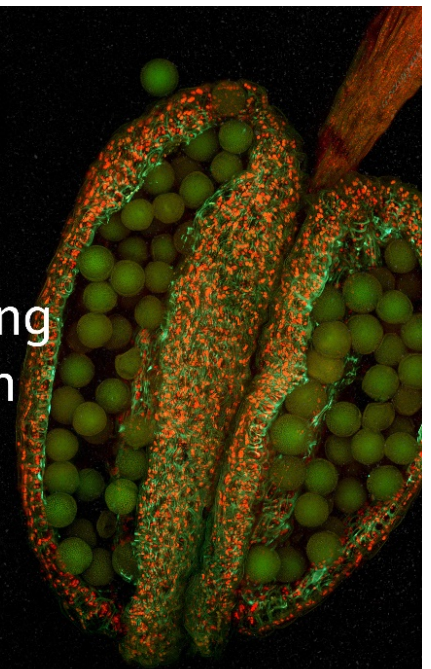
Closer look at the battlefield: imaging of the interactions of plant cells with fungal pathogens

Tetiana Kalachova

Institute of Experimental Botany
of the Czech Academy of Sciences

Kateřina Malínská

Advanced Light and Electron
Microscopy Node Prague



Hubb, Purvis, Collins & Microscopia

[Full program & registration](#)

[X \(Twitter\) post](#)

[LinkedIn](#)

EUROPEAN COMMISSION SURVEY ON EUROPEAN 'EXPORT CHAMPIONS'



Dear Business partners,

we would like to announce that Czech-BioImaging supports a newly-launched European Commission economic study to assess the current state of **competition in the EU**.

A part of this study is an **external quantitative survey** being conducted together with Kantar Group marketing agency. This multi-country survey is carried out among businesses in Europe's top export sectors and as a potential respondent, you may get contacted to complete the survey for this study.

All information you provide in the survey will be handled with strict confidentiality and used only for the sole purpose of this study.

USEFUL LINKS

[Czech-BioImaging website](#)

[Czech-BioImaging – pro veřejnost](#)

[Euro-BioImaging website](#)

[Velké výzkumné infrastruktury v České republice](#)

The National Infrastructure for Biological and Medical Imaging, Czech-BioImaging, is supported by the Ministry of Education, Youth and Sports of the Czech Republic (project No. LM2023050) and by European Regional Development Fund (project No. CZ.02.1.01/0.0/0.0/18_046/0016045).

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