



# Plant Sciences Core Facility

<https://plants.ceitec.cz/en/>

Petr Mokroš, CF Day Life Sciences, 7 October 2026

# Plant Sciences CF overview

- CF offers to academic institutions and industrial partners access to the research infrastructure for:
  - large-scale cultivation of plants cultivation under standard conditions
  - cultivation under specific conditions - environmental simulation
  - phenotyping analysis

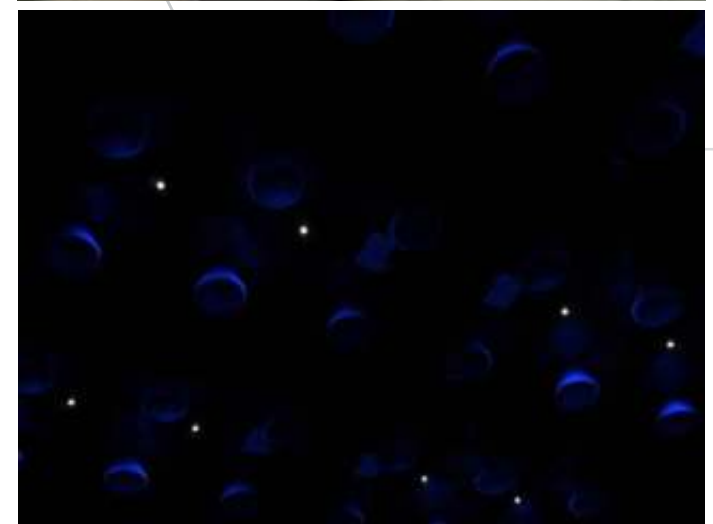
# Plant Sciences CF overview

- Large-scale cultivation of plants cultivation under standard conditions
  - 10 individual greenhouse sections
  - 5 individual phytotrons with shelves



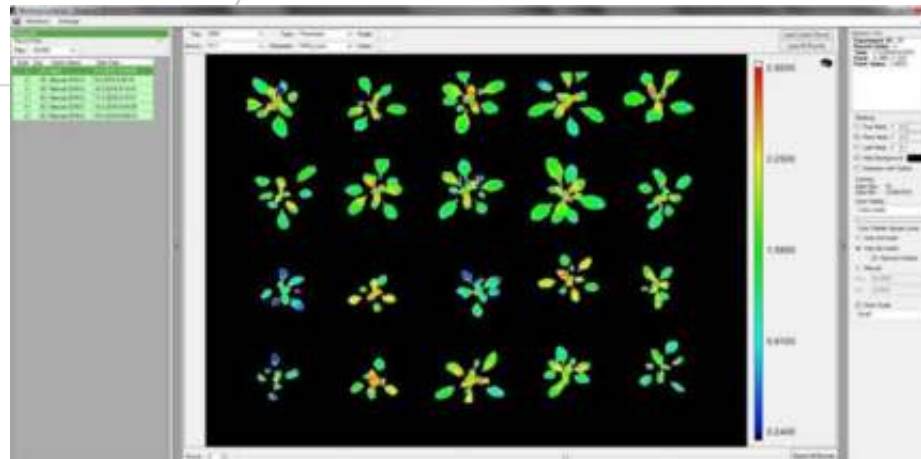
# Plant Sciences CF overview

- Cultivation under specific conditions
  - 10 phytotrons with 120 individual closed banks
  - small growth chambers
- temperature range 0°C up to 50°C
- variable day/night length with adjustable cultivation light
  - standard - variable ratio white/red/far-red, max intensity 300  $\mu\text{mol m}^{-2} \text{s}^{-1}$
  - high light illumination up to 2000  $\mu\text{mol m}^{-2} \text{s}^{-1}$
  - multi-channel LEDs



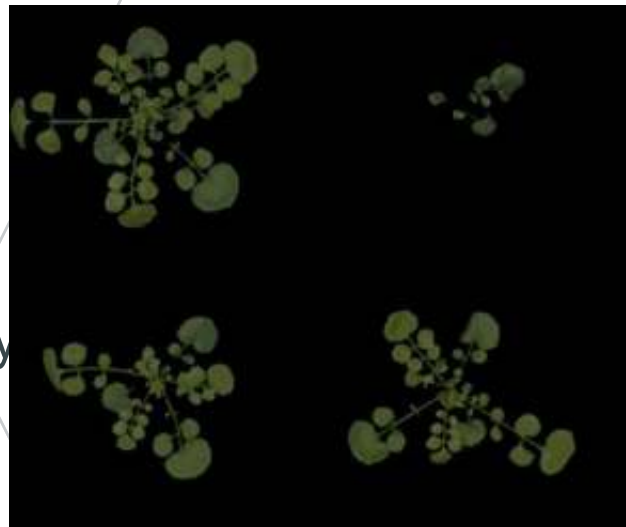
# Plant Sciences CF overview

- PlantScreen™ phenotyping system
  - designed for high-precision low-throughput phenotyping of small and mid-size plants, e.g. *Arabidopsis* or *Brassica*
  - RGB and morphometric imaging, top and side camera
  - kinetic chlorophyll fluorescence imaging
  - root phenotyping



# Plant Sciences CF overview

- RGB digital imaging for in-depth analysis of plant morphology, architecture and colour index analysis
- Morphological parameters
  - area
  - perimeter
  - compactness
  - roundness
  - eccentricity
  - RMS rotational mass symmetry
  - SOL Slenderness of leaves
  - isotropy
  - greenness



# Plant Sciences CF overview

- Root imaging module



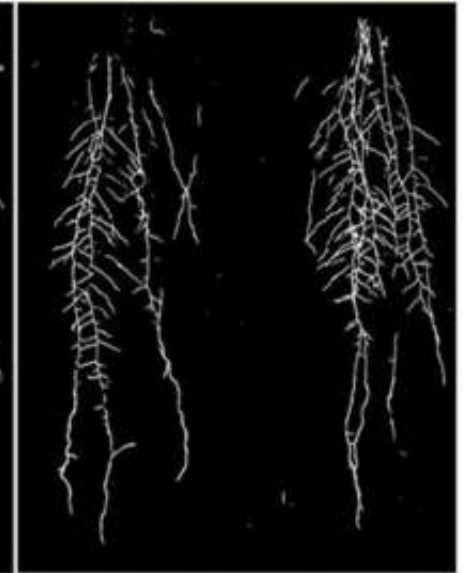
Original mini-rhizotron image



Thresholding segmentation  
(legacy)



Smart segmentation



# Plant Sciences CF users

- [plants@ceitec.muni.cz](mailto:plants@ceitec.muni.cz)
- <https://plants.ceitec.cz/en/>



- „Plant Sciences Core Facility of CEITEC Masaryk University is gratefully acknowledged for the obtaining of the scientific data presented in this paper.”



ceitec\_brno



CEITEC\_Brno



CEITEC



CEITEC -  
Central European  
Institute of Technology

# Thank you for your attention! Questions?

[core.facility@ceitec.muni.cz](mailto:core.facility@ceitec.muni.cz)

[ceitec.eu/core-facilities/](https://ceitec.eu/core-facilities/)



CEITEC



# CEITEC MUNI Core Facility Nanobiotechnology (Nanobio)

Jan Příbyl · CF Day Life Sciences 2026 · 7 October 2026 · CEITEC MUNI, Building E35

# Why bring your samples to Nanobio?

68 → 118 users · 63 publications citing CF access · 74% user growth in four years (2022-2025)

# CF Nanobio at a glance

Open, expert-supported access to nanoscale imaging, force spectroscopy, correlative Raman-AFM and electrophysiology — turning technically demanding instruments into decision-ready evidence for your project.

**118 users**

in 2025, up 74% from 68 in 2022

**4.70 FTE**

specialist team, up from 2.17 in 2022

**€321k**

annual resources in 2025 — budget  
balanced every year

**63 papers**

cite CF access; 37 with a Nanobio co-  
author

A hybrid core: experienced users work independently after competency-based training; complex or non-routine projects are delivered jointly with CF specialists, from experimental design and sample preparation through acquisition, analysis and interpretation.

# What we offer

AFM

## See it, measure it

- JPK/Bruker NanoWizard 3 & 4XP — AFM integrated with optical/fluorescence microscopy
- Bruker Dimension FastScan Bio — rapid, high-throughput imaging
- Bruker MultiMode 8-HR — highest-resolution biomolecular imaging
- Near-physiological, liquid-cell conditions — topography, stiffness, adhesion



## Correlate it

- Renishaw inVia confocal Raman — 2024-upgraded, fully AFM-integrated
- NT-MDT NTegra Vita — second Raman/AFM correlative route
- MEA2100 electrophysiology — cardiomyocytes & excitable cells
- FluidFM & nanoindentation — targeted manipulation, local force

**Best fit:** soft, living or hydrated samples studied close to their natural state.

**Less suited to:** bulk chemical ID without topographic correlation, or very hard/stiff engineering materials outside AFM's force range.



## Bruker/JPK NanoWizard 3 and 4XP

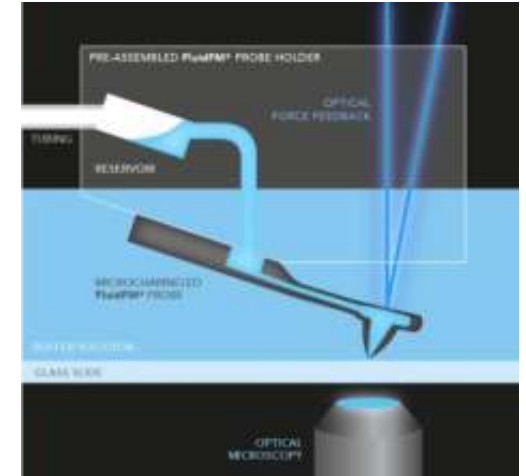


### Combined with

- Optical microscopy
- Microfluidics
- Cellular electrophysiology
- Nanoindentation

### Key features

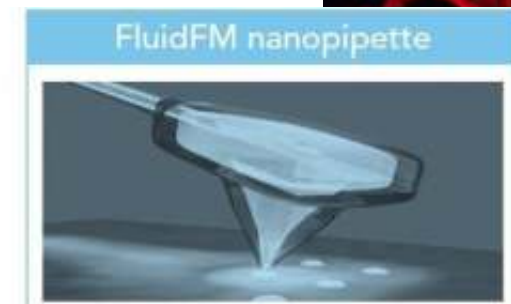
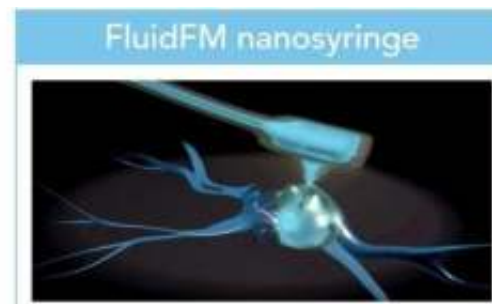
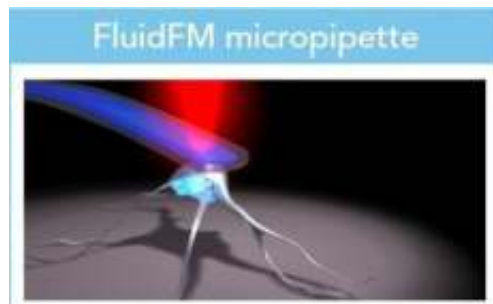
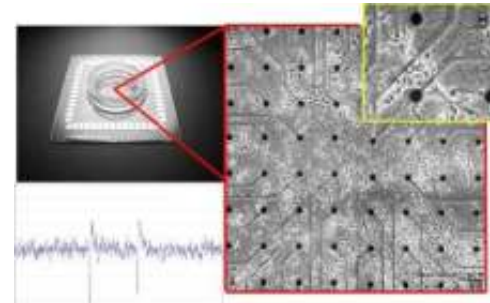
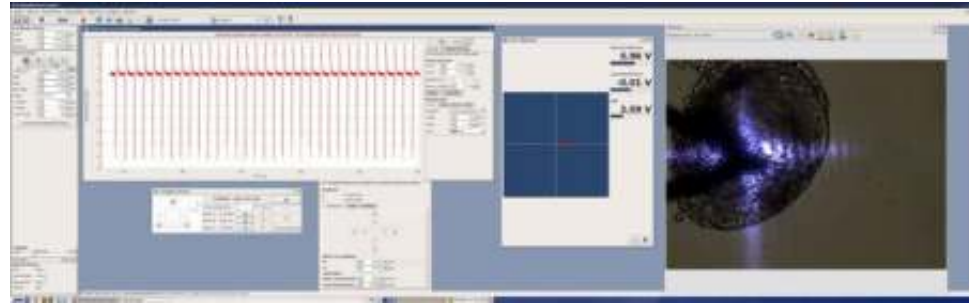
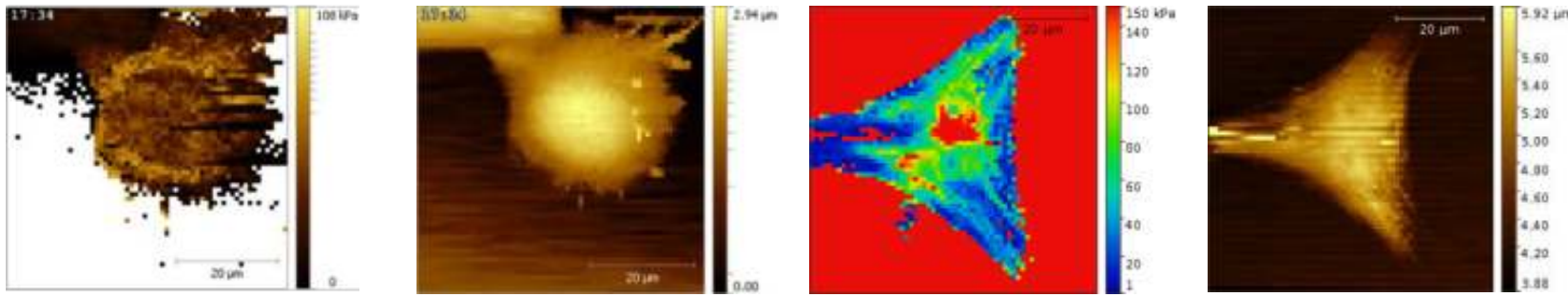
- Near in-vivo conditions
- Topography, stiffness, adhesion, ...



### Typical samples

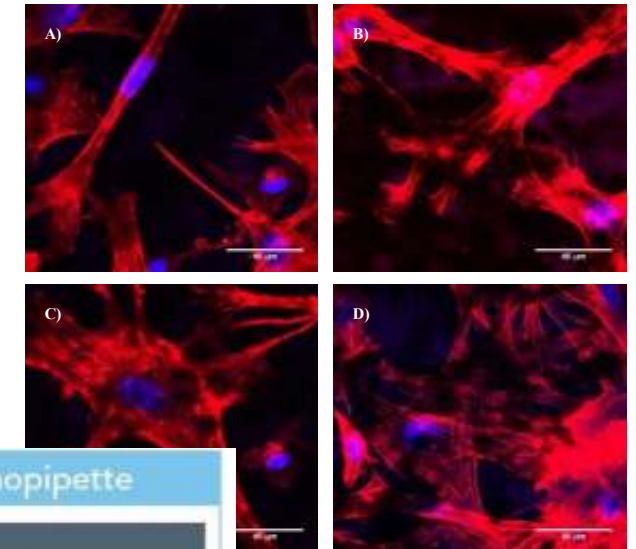
- Tissue cultures
- Organoids
- Hydrogels
- Tissue sections
- Nanoparticles
- Liposomes





## Example applications

- Mapping of **mechanical** properties
- **3D** topography
- Cell **adhesion**
- Combination with **other techniques** (microfluidics, electrophysiology, ...)



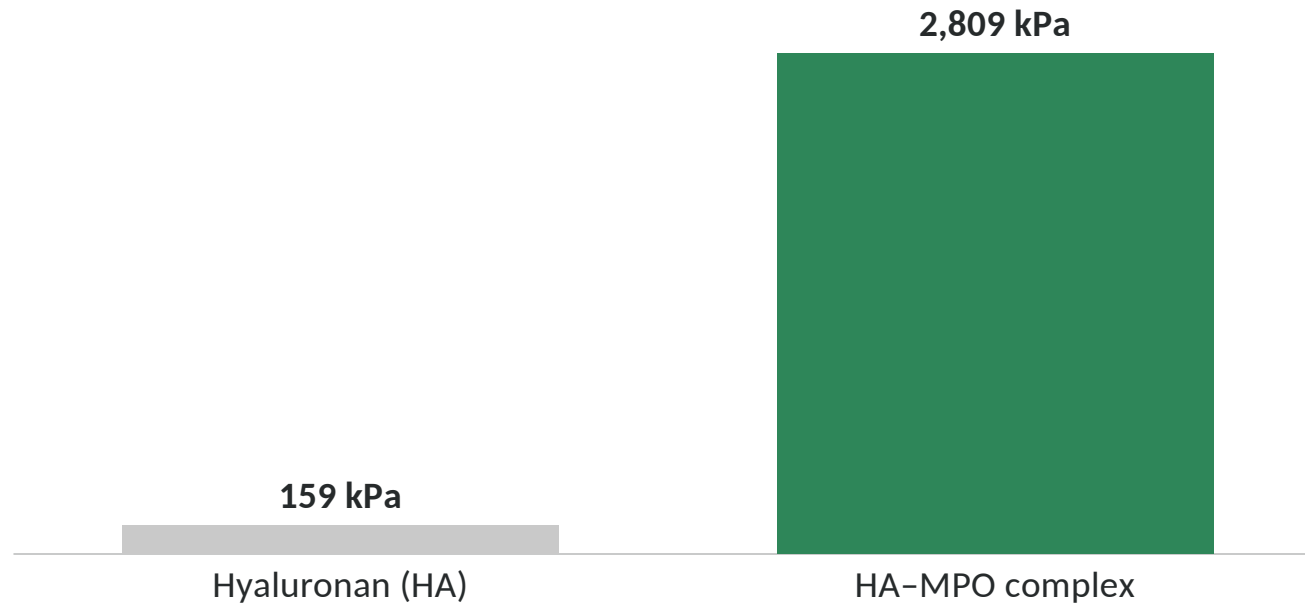
# What AFM adds to light and electron microscopy

| Technique                      | Resolution                   | Sample state                         | What it reports                                 |
|--------------------------------|------------------------------|--------------------------------------|-------------------------------------------------|
| Confocal fluorescence          | ~200 nm (diffraction limit)  | Living cells, fluorescently labelled | Where labelled molecules are                    |
| Super-resolution (STORM)       | 20–50 nm lateral             | Labelled, photo-switchable dyes      | Nanoscale position of labelled molecules        |
| Electron microscopy (TEM, SEM) | Molecular level              | Fixed, in vacuum                     | Grayscale structure, no chemistry               |
| Raman microscopy               | Optical, diffraction-limited | Label-free                           | Chemical fingerprint                            |
| AFM                            | Tip radius 5–10 nm           | Liquid, near-native, label-free      | Topography, stiffness, adhesion, binding forces |

**Light and tip on one sample.** Raman and fluorescence give chemistry and labelled targets; the AFM tip adds nanoscale topography and mechanics on the same sample, in liquid.

# AFM images a molecular complex and measures its stiffness

Young's modulus from AFM force curves



**~18×**

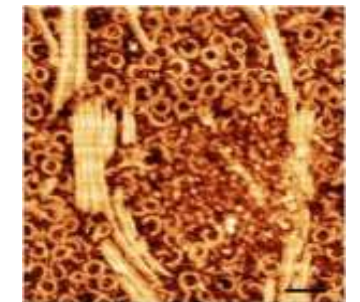
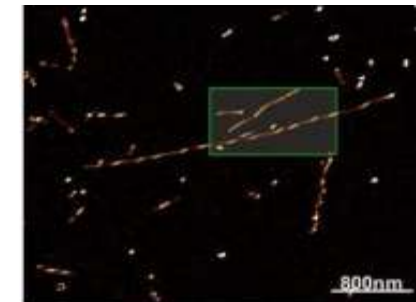
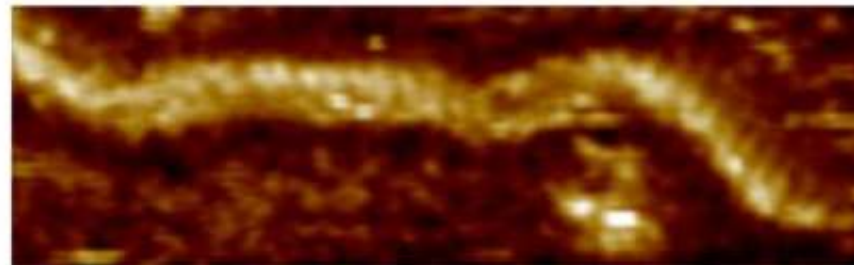
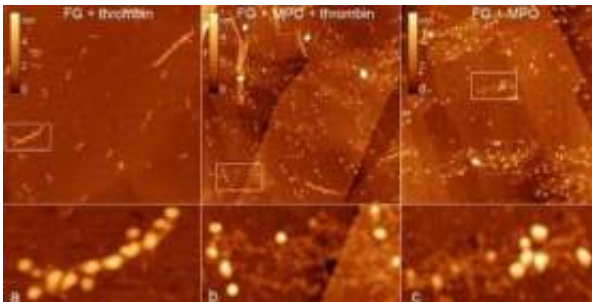
stiffer: the hyaluronan–myeloperoxidase (HA–MPO) complex compared with hyaluronan alone

## How we get there

- Imaging shows the complex on a flat surface
- Gentle force–distance curves give Young's modulus of each sample

*Context: MPO thins the endothelial glycocalyx in a charge-dependent way (Manchanda et al., 2018).*

Single biomolecules imaged by AFM (examples)



# What AFM tells you about living cells

## Stiffness *Nardone et al., Nat Commun 2017*

Single-cell stiffness maps matched to confocal images of nucleus and actin showed that YAP sets cell mechanics via focal adhesions.

## Dynamics *Golan et al., IEEE Trans Nanobiosci 2018*

Repeated maps over 12 hours follow the stiffness and height of fibroblasts after thawing.

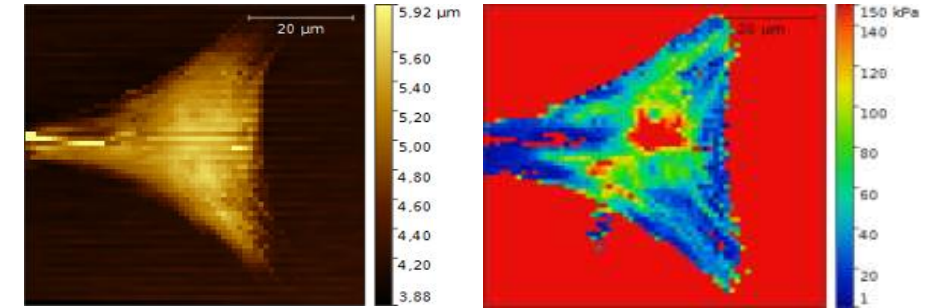
## Adhesion *Černochová et al., Sci Rep 2020*

Scratching cells off a surface measures how strongly they stick. Adhesion to amine plasma polymers depended on cell type.

## Function *Pesl et al., Heart Vessels 2013*

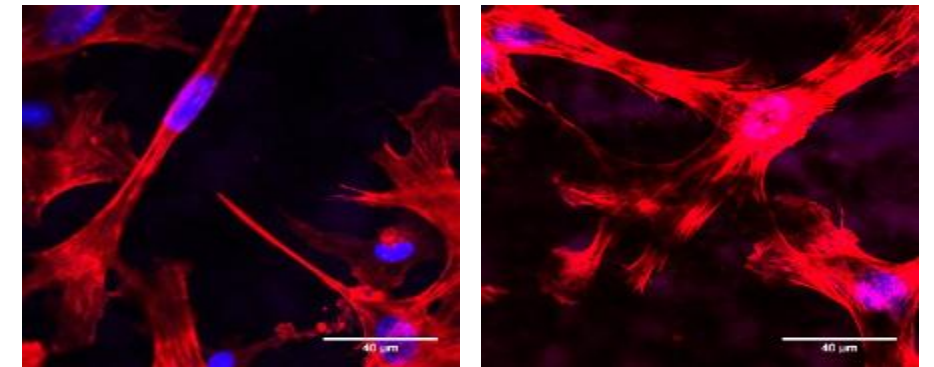
A cantilever under cardiomyocytes records their beating, which changes with isoproterenol, metoprolol and caffeine.

## AFM of one cell: height and stiffness



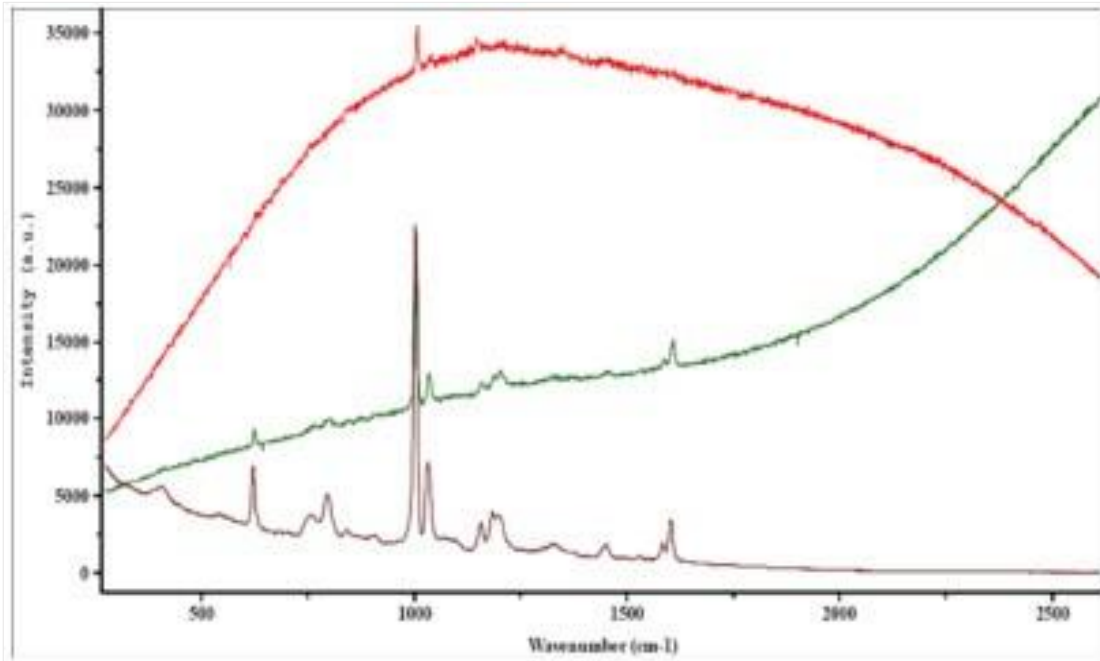
Same cell: topography (left), Young's modulus (right)

## Confocal: actin (red) and nuclei (blue)

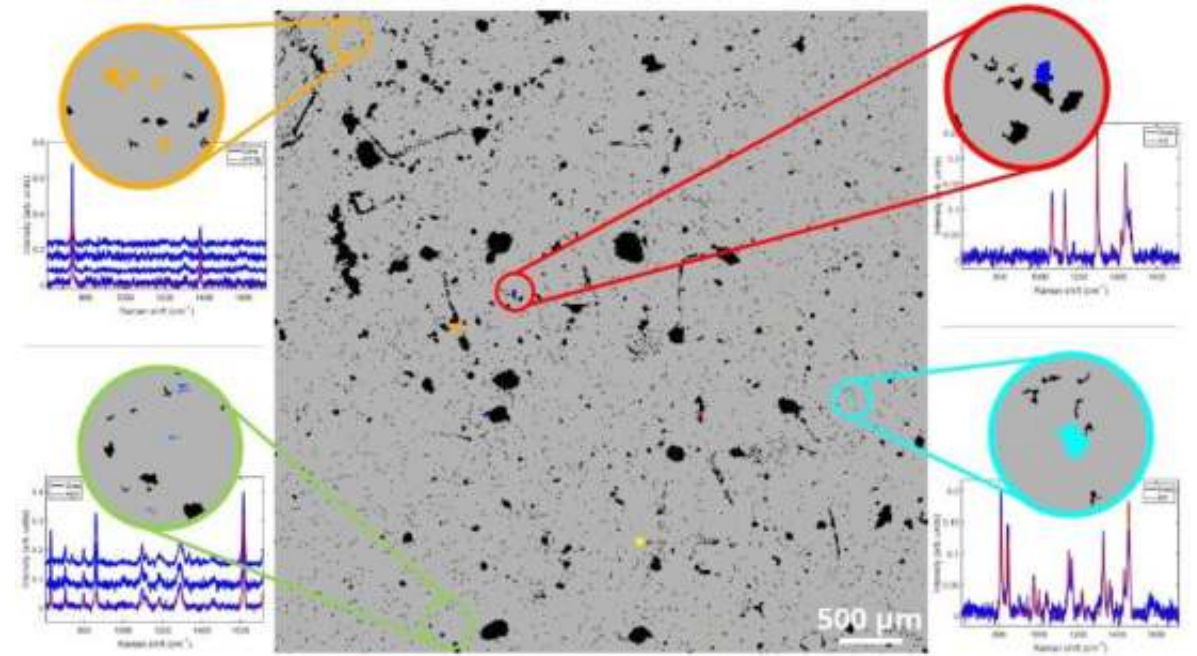


# Raman adds a chemical fingerprint to the AFM map

## Raman spectra identify compounds



## Chemical map: one spectrum per particle



- Two lasers (633 and 785 nm); the new laser lowers the fluorescence background
- Each spectrum is a fingerprint of a chemical compound
- Chemical maps can be combined with AFM topography of the same spot

# The surface is chosen to match the sample

| Surface       | Properties                                                     | Best for                                                      |
|---------------|----------------------------------------------------------------|---------------------------------------------------------------|
| Mica          | Atomically flat, hydrophilic, negatively charged at neutral pH | Proteins, DNA, nanoparticles, lipid bilayers                  |
| HOPG graphite | Atomically flat, hydrophobic, conductive                       | Proteins, by spontaneous adsorption                           |
| Gold          | Hydrophobic, binds thiols (-SH)                                | Thiol-tagged molecules, electrodes and biosensors             |
| Glass         | Amorphous and rough, hydrophilic                               | Whole cells and bacteria with optical microscopy              |
| Polystyrene   | Hydrophobic, no groups for covalent binding                    | Adherent cell culture, usually with an adhesive protein layer |

**Charge decides binding.** Proteins stick to mica when the buffer pH lies between the pKa of mica (~3) and the protein's isoelectric point. Silanization or poly-L-lysine adds functional groups or positive charge where that is not enough.

# Typical samples & example applications

## Samples we work with

- Cell & tissue cultures, organoids, tissue sections
- Hydrogels and biomaterials
- Nanoparticles and liposomes
- Proteins, DNA & molecular complexes
- Cell membranes

## What we help you answer

- Mechanical-property & stiffness mapping
- 3D surface topography and cell adhesion
- Chemical mapping of tissue sections (e.g. bone, neurodegeneration)
- Microplastics analysis, forensic sample analysis
- Cardiomyocyte / arrhythmia-relevant function (MEA)

**Not sure your sample fits?** Most projects start with a short feasibility conversation — see “How to start working with us”.

# Fresh investment, 2024–2026

**DONE 2024****Renishaw inVia Raman upgrade — €176,418**

New laser tuned for biological samples, fully integrated with AFM — chemical mapping now correlates directly with topography and mechanics from the same region of interest.

**IN PROGRESS****Video-rate (high-speed) bioAFM — Bruker MultiMode 8-HR**

Enables dynamic imaging of biomolecular assembly and membrane remodeling — processes, not just static snapshots.

**IN PROGRESS****Enhanced fluorescence module — NanoWizard 4XP + Leica DMI8**

Confocal/super-resolution-like optical co-registration, while keeping full AFM integration.

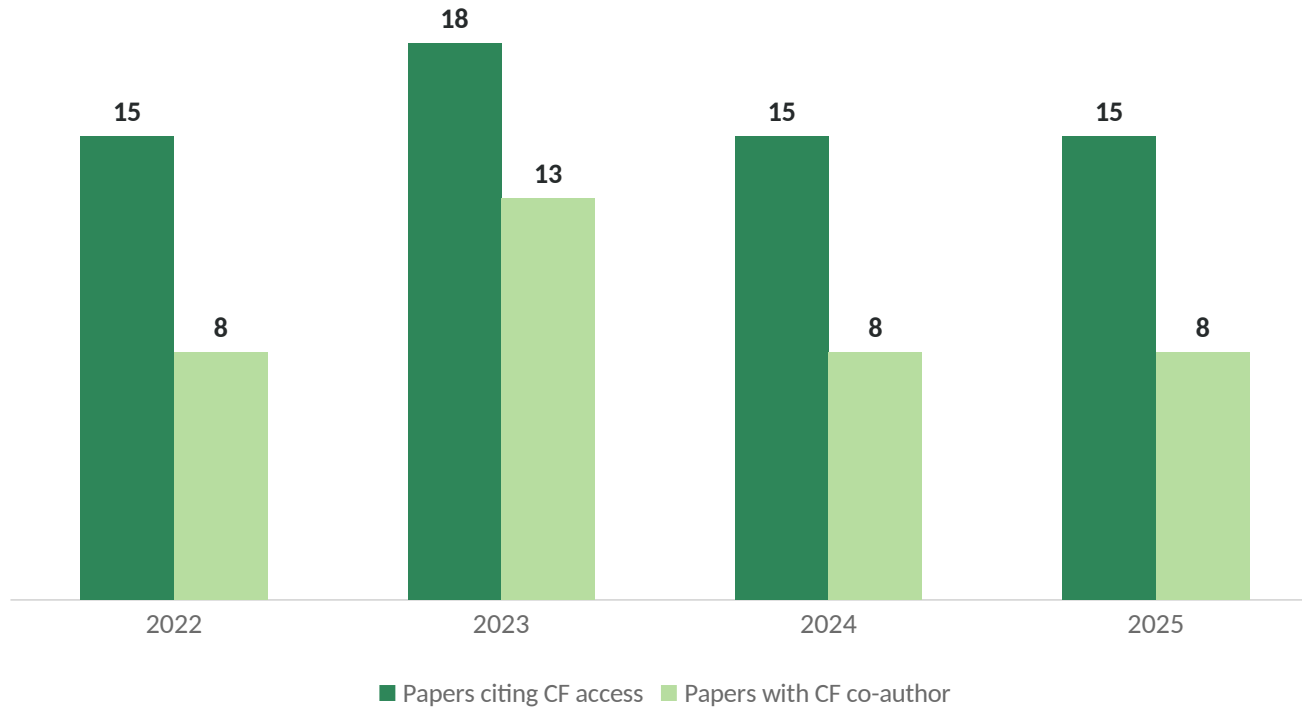
**PLANNED****Dimension FastScan Bio — control-electronics refresh**

Cost-effective life-extension for a high-value platform, at a fraction of replacement cost.

# A track record you can build on

Publications, growth and industry trust — the numbers behind the microscope

# Publication impact, 2022–2025



**63** papers acknowledged CF access; **37** included a CF staff co-author.

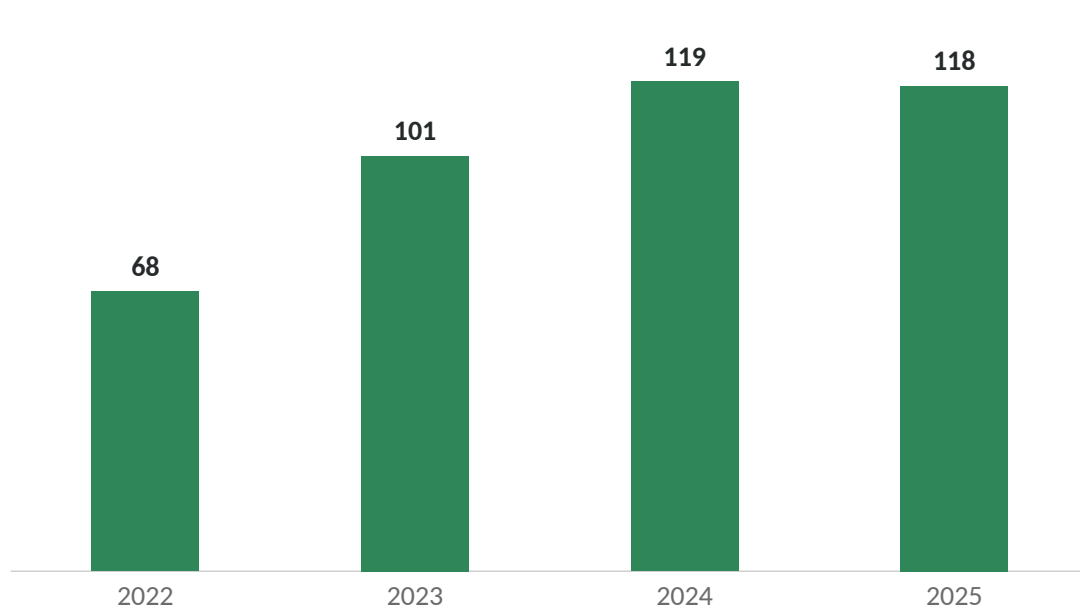
## Highlight

### 2023 • Bioactive Materials (IF 18.9)

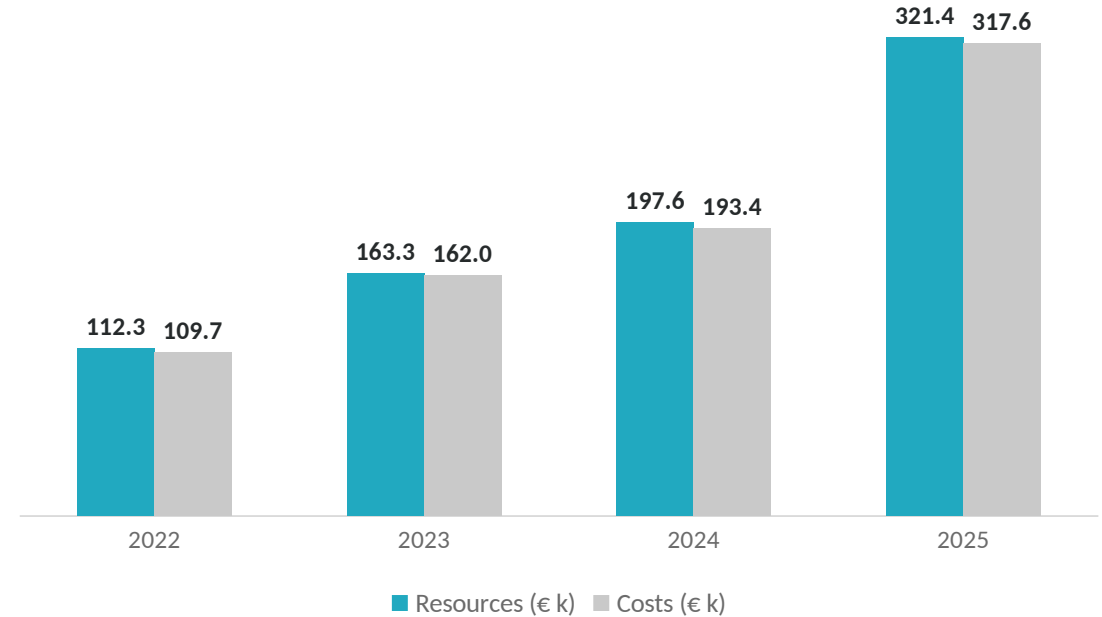
Nanotoxicological profiling of selenium nanomaterials, enabled by CF Nanobio's imaging and nanomechanics.

*Also: Analytical Chemistry, ACS Catalysis — biosensing, enzymology, cardiomyocyte function and biomaterials.*

# Growing — and financially sound



Number of users — +74% since 2022



Resources vs. costs (EUR) — balanced every year

Every year closed positive — €1,321 to €4,276 in reserve, not excess profit: a prudent buffer for unplanned service interventions.

# Industry & applied partners

Fee-for-service AFM, Raman and correlative measurements, sample characterization and method consultation — under the same data-quality and acknowledgement rules as academic projects.

**Bruker s.r.o.**

**Delong Instruments a.s.**

**Měřicí technika  
Morava s.r.o.**

**ORLEN Unipetrol  
RPA s.r.o.**

**ÚJV Řež, a.s.**

**€3,586 → €9,624** external fee income, 2022 → 2025

2025 marked the facility's first material commercial contribution alongside academic use. Expanding structured industry collaboration is a 2026–2030 development priority.

# Applied projects: wearables and infection diagnostics

Intra-CF activities and technologies in the field of applied research

## Wearables for monitoring of physical activity

- Technology development
- **Getting investment-ready**

## Collaborations

- MUNI FIT, ESF, FSpS
- EGMedical
- Garage Angels
- BUT
- BiosensorPlus
- Řehoř Diagnostics

## Detection of sexually transmitted infections

- **Spin-off**  **ACTOSENS**
- JIC supported

## Collaborations

- National Institute of Public Health
- MUNI ESF
- BUT
- VELZA

# How to start working with us

1

## Contact us

Email [jan.pribyl@ceitec.muni.cz](mailto:jan.pribyl@ceitec.muni.cz) or [core.facility@ceitec.muni.cz](mailto:core.facility@ceitec.muni.cz) with your sample and scientific question.

2

## Feasibility discussion

We advise on method choice and sample prep, and where useful, run a short pilot measurement.

3

## Get access

Competency-based training for independent self-service, or a full-service project delivered by CF staff.

4

## Acknowledge us

Cite CF Nanobio in resulting publications; co-authorship where staff contribution is substantial.



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CEITEC



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Central European  
Institute of Technology

# Thank you for your attention! Questions?

Jan Příbyl · [jan.pribyl@ceitec.muni.cz](mailto:jan.pribyl@ceitec.muni.cz)

[core.facility@ceitec.muni.cz](mailto:core.facility@ceitec.muni.cz) · [ceitec.eu/core-facilities/](https://ceitec.eu/core-facilities/)



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# Visit our labs Lab tour at 14:00, meet in the atrium

See the AFM, Raman and electrophysiology instruments at the end of the lunch break  
CF Nanobiotechnology · CEITEC MU



MUNI  
SCI



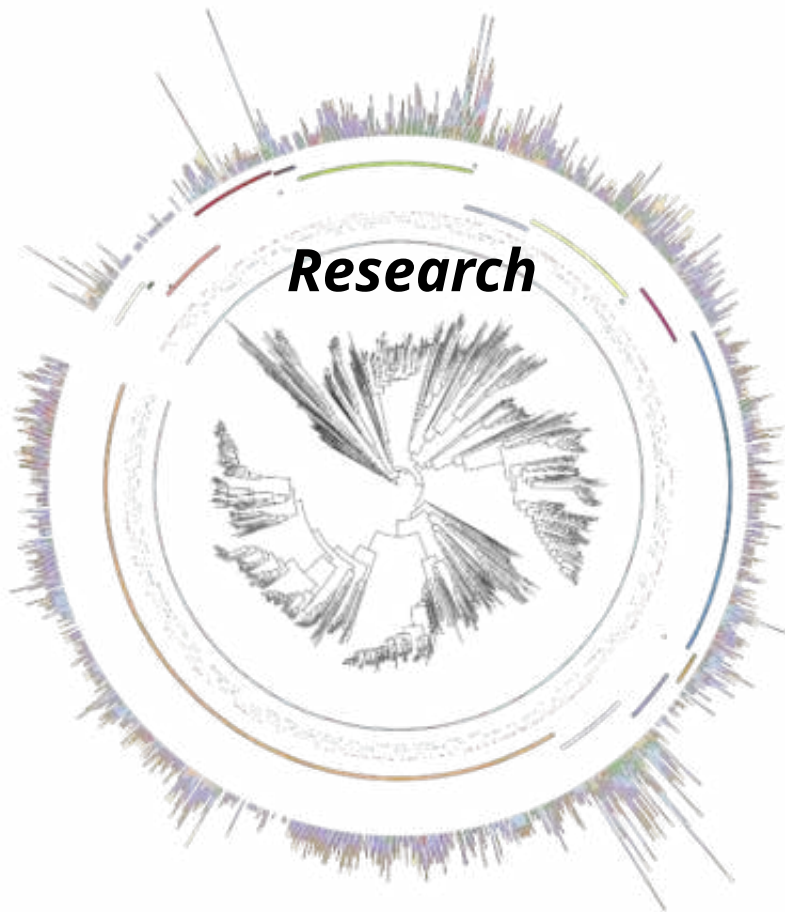
# **CCM: Interface for translational research**

**Luděk Sehnal**

***Industry***



***Research***



***Infrastructure***





## 1. Isolation



## 2. Deposition



## 3. Distribution



## 4. Long-term maintenance

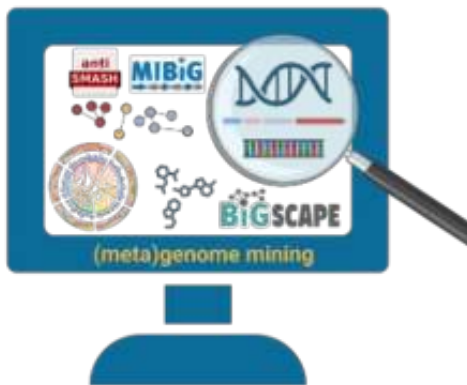


## 5. Characterization

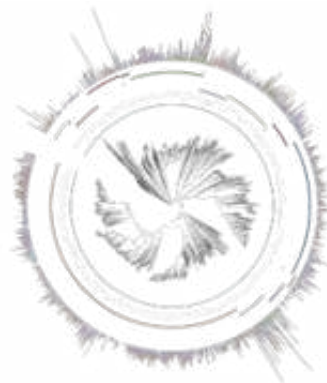


# COLLECTIONS CONCEPT

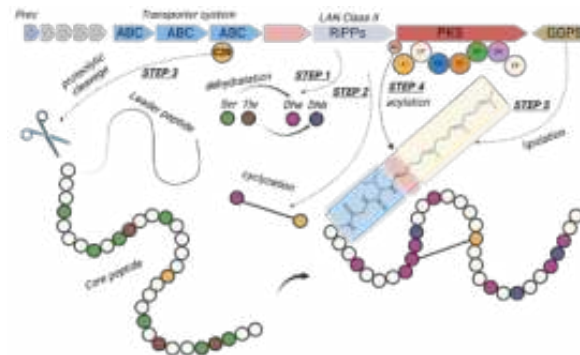
### Services



### Research



### *Natural Product Research*



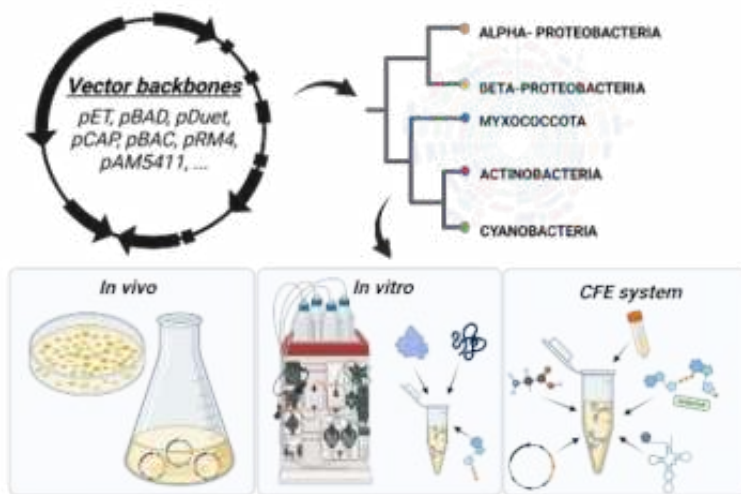
### *Microbial taxonomy*

# CCM SynBio & Microbiome infrastructure

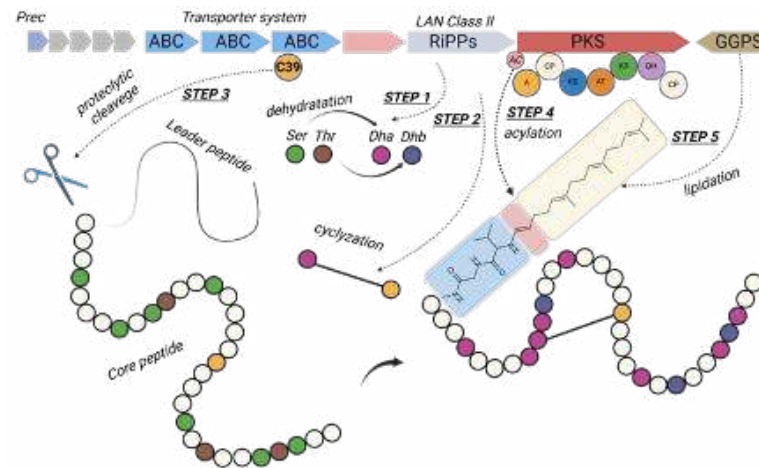
*Bioinformatics*  
(2027)



*Synthetic biology*  
(2027)



*NPs chemistry*  
(2029)



Science



Clinical diagnostic



Food industry



Over 200 customer companies  
worldwide

ZENTIVA



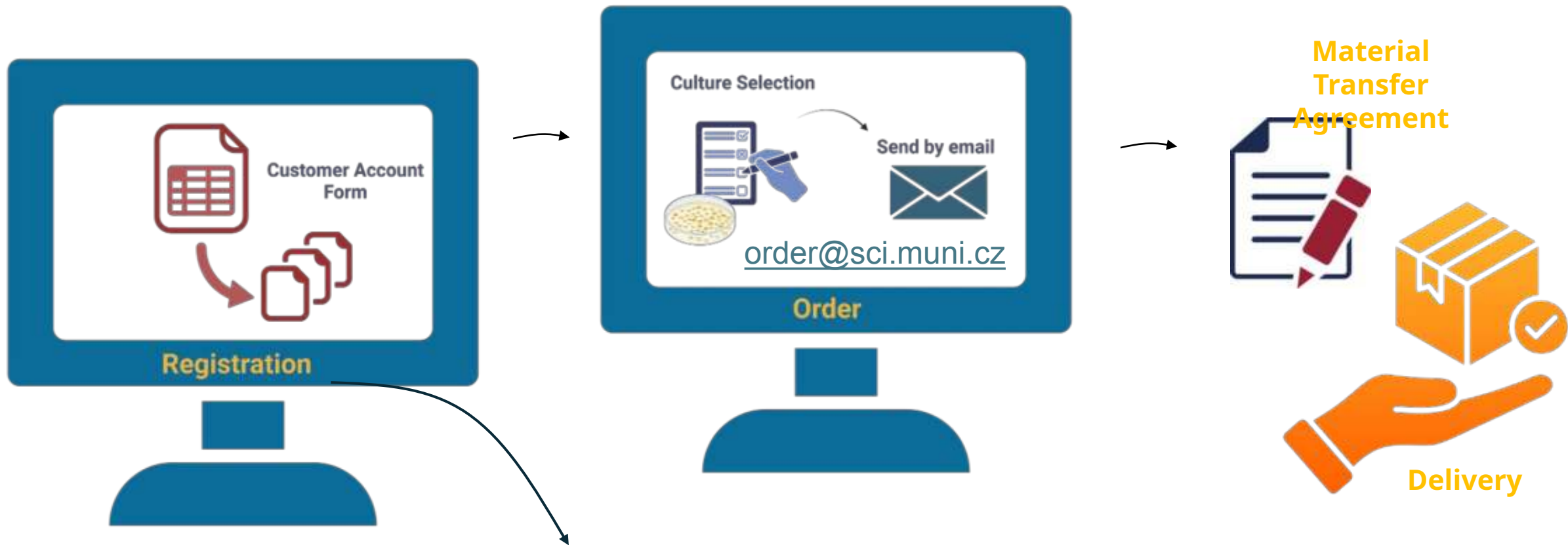
ČEVAK

Pharma/Biotech

Water quality



Agriculture



[Catalogue of cultures](#) | [Czech Collection of Microorganisms](#) | [MUNI SCI](#)



5K+ bacterial/fungal strains in public catalogue

# Data at CCM

Additional 16K+ bacterial/fungal strains in private catalogue



(12K+ from Antarctica)

TAXONOMI

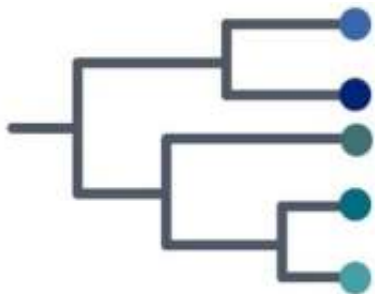
C

GENOMIC

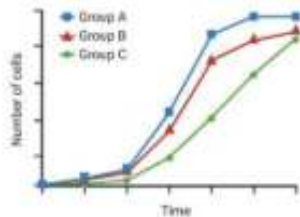
PHENOTYP

E

BIOGEO SOURCES



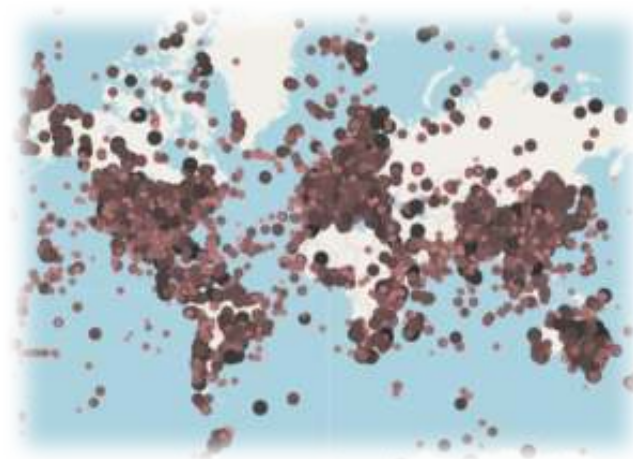
CULTIVATION

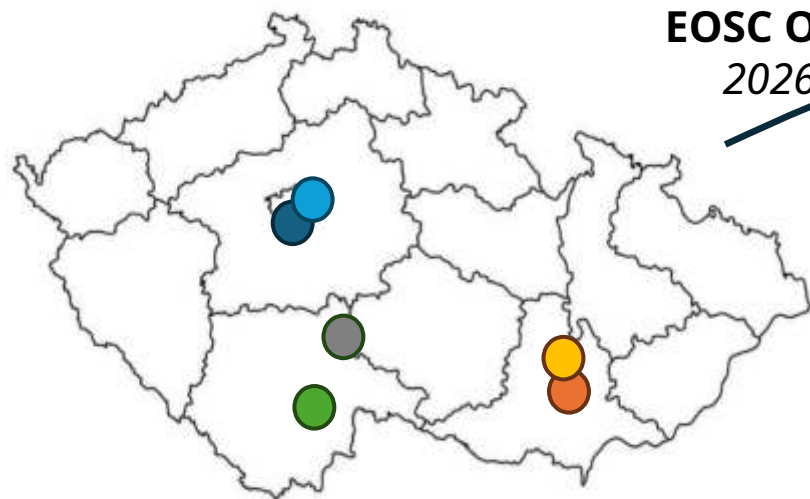


METABOLISM



MORFOLOGY





*Czech partners for building MIRRI CZ*

**EOSC OSII**  
2026

**CzechMi Data Hub**  
2029

**Application to join LRI**  
2030



**Joining MIRRI as full member**  
2032



**LARGE RESEARCH  
INFRASTRUCTURES**



**CCALA**  
Culture Collection  
of Autotrophic Organisms



**VUVeL** VÝVOJNÍ PRÁCE  
VÝSTAVISKOVÝ  
LABORÁTORIUM



**MILCOM**



**MIRRI** MICROBIAL RESOURCE  
RESEARCH  
INFRASTRUCTURE  
EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM

# FAIR dataset of microbiological data

*CzechMi DataHub - dataset*



Algae and  
Cyanobacteria



Fungi



Viruses



Bacteria



Archaea



Over 15,000 fully characterized strains!

TAXONOMY

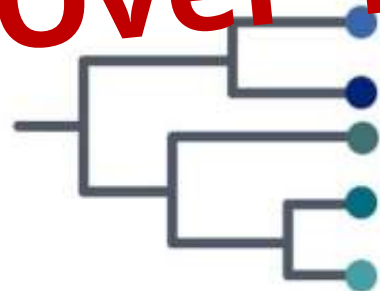
GENOMICS

METABOLISM

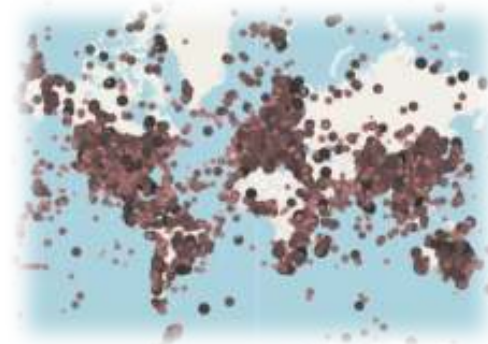
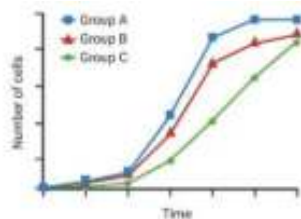
PHENOTYPE

MORPHOLOGY

BIOGEO SOURCES

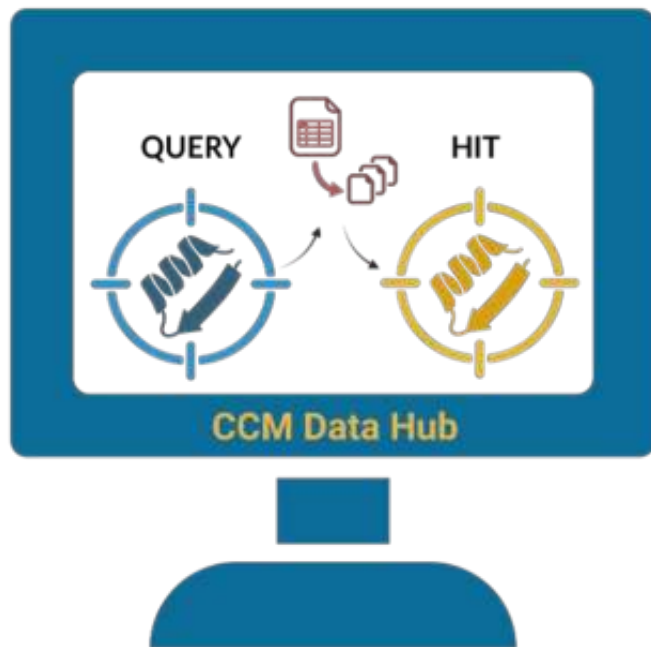


CULTIVATION

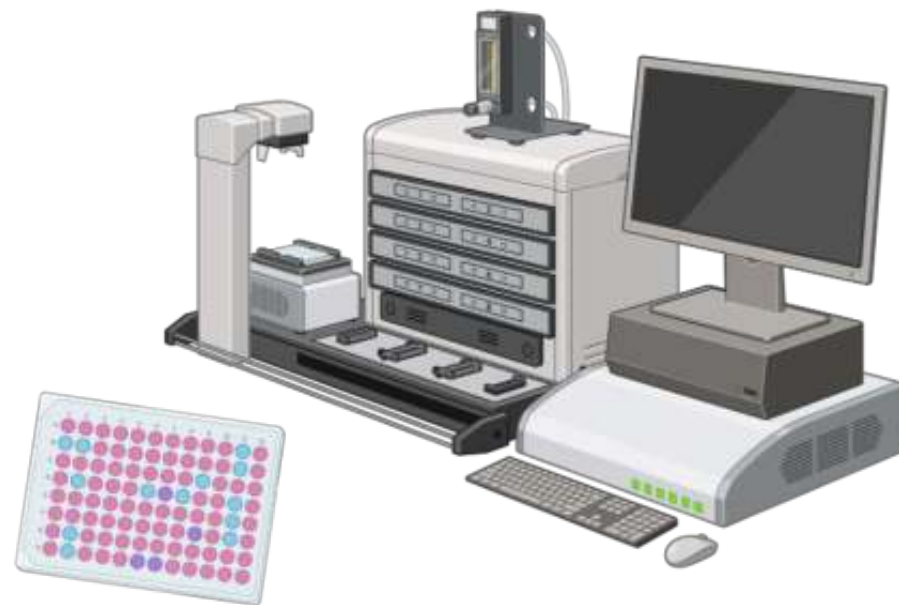


# CCM Biodiscovery platform

*In silico screening platform*



*Experimental validation*



# Translational genome mining for natural products



**RNDr. Stanislava Bezdíček  
Králová, Ph.D.**

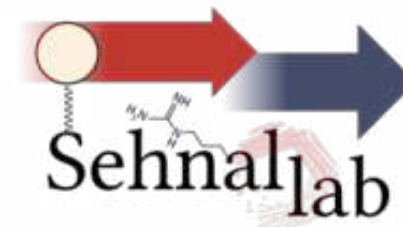
Bkralová lab  
Faculty of Pharmacy, MU



**RNDr. Luděk Sehnal, Ph.D.**

Natural Product Chemical Biology  
lab

UEB, Faculty of Science, MU



**Thank you for your attention**





# CEITEC MUNI Core Facility Proteomics

Zbyněk Zdráhal, CF Day Life Sciences, 7 October 2026

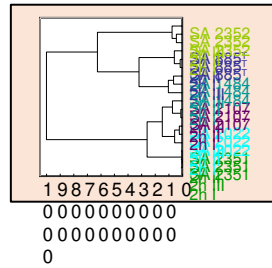


# Welcome in Proteomics

## Content

- Services
- Access rules
- News
- Acknowledgment

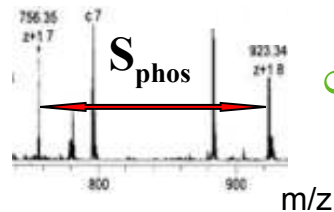
# Services



- **Intact mass measurement**  
(MW, MALDI-MS profiling)

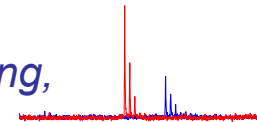
- **protein identification**  
(de novo sequencing)

- **protein complexes analysis**  
(-protein, -RNA, -DNA)



- **characterization of protein modifications**  
(phosphorylation, acetylation, methylation etc.)

- **quantification of complex protein mixtures**  
(relative and absolute quantitation, isotopic labeling, label-free)



Overview of our services is available at  
<https://www.ceitec.eu/proteomics-core-facility/cf95>

## Access rules

### Full service mode



Register • Order • Bring sample • Pick-up report

<https://www.ceitec.cz/centralni-laborator-proteomika/cf95>

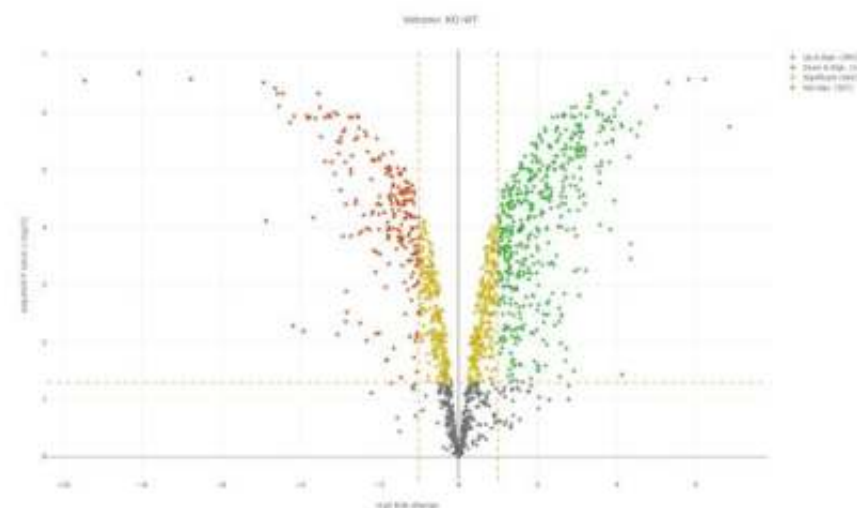
**please talk to us:**

**prior you start a proteomic experiment in your lab**

Personal discussion is highly recommended.

Selection of optimal design of the whole experiment (**also on your side**) enables to maximize obtained information, **saves a lot of your** (and our) **time and work**.

- **application for reporting results of LC-MS/MS analyses**  
*stand-alone, portable, offline*



- **in full use**



## timsTOF Ultra 2

- Spatial proteomics
- **Single cell/subcellular proteomics**

- Ultimate sensitivity
- Scan rate - 300 Hz

Sample preparation protocols should be established

# News



- Automation of sample prep protocols
  - SP3
  - in-solution digestion
  - phosphopeptide enrichment
  - ...
- Higher throughput
- Better reproducibility (*especially for low-input samples*)

## New booking system

!!! Transfer from October 15 !!!



Oct 15



- Fully functional for processing **orders that have already been opened**, just as you're used to
- **All new requests !!!**
- Both booking systems will operate in parallel until all currently open orders in the old system have been processed.
- Then, info from our old system will be available upon request.

# Acknowledgements

- Acknowledgements are vital for our operation and investment in MS equipment and for providing our services in reduced prices.
- All users are required to acknowledge the projects that support our Core Facility (*mainly CIISB infrastructure projects*), preferably to Funding section.
- Any co-authorship by CF members is entirely at the user's discretion, unless otherwise agreed in advance.
- Current version of acknowledgements text is at:  
<https://www.ceitec.eu/proteomics-core-facility/cf95/tab?tabId=132>
- The acknowledgements text will be changed in 2027

# Acknowledgements



*The current version:*

## **Preferred version:**

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## **Short version:**

*We acknowledge CEITEC Proteomics Core Facility of CIISB, Instruct-CZ Centre, supported by MEYS CR (LM2023042).*





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Central European  
Institute of Technology

# Thank you for your attention!

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<https://www.ceitec.eu/proteomics-core-facility/cf95>