KBC DAYS 2024

5-6 November

Programme - Research Infrastructures -
PhD student presentation abstracts - Participants

KBC
CHEMICAL BIOLOGICAL CENTRE

A collaboration between

UMEÅ UNIVERSITY

SLU

DAY 1, Tuesday 5 November

SESSION 1: OPENING AND KEYNOTE LECTURE I
Chairperson: Stefan Björklund

9.00 **Welcome**
Stefan Björklund
Scientific Coordinator of KBC

9.05 **Opening of the KBC DAYS 2024**
Alice Kempe
Kempestiftelserna

9.15 **Overview of the Research Support and Collaboration Office**
Åke Brännström
Research Support and Collaboration Office, Umeå University

9.30 **Research results and innovation**
Mats Falck
Project manager, Support Office for Life Science & Health (SOLH), Umeå University

9.45 **KEYNOTE LECTURE I: "The sun, the moon and the stars: measuring and modelling Arctic light fields over the full annual cycle"**
Dr. **David McKee**
Physics Department, University of Strathclyde, Glasgow, UK and Arctic and Marine Biology Department, UiT The Arctic University of Norway, Norway

10.30 *Coffee break*

SESSION 2: NEW FACULTY MEMBERS, AWARDS and GRANT RECIPIENTS from KBC
Chairperson: Heidi Burdett

10.45 **Coping with noise and making robust decisions - what can we learn from plants?**
Rishikesh Bhalerao
Department of Forest Genetics and Plant Physiology, Umeå Plant Science Centre, Swedish University of Agricultural Sciences

11.00 **Drought, tree-growth and the Wallenberg initiative in forest research**
Hjalmar Laudon
Department of Forest Ecology and Management, Swedish University of Agricultural Sciences

11.15 **Contrasting latitudinal diversity gradients with different interaction partners of honey bees**
Helena Wirta
Department of Ecology and Environmental Science, Umeå University

DAY 1, Tuesday 5 November

11.30 **Uncovering Ancient Mechanisms for Antigen Receptor Diversity**
Ryo Morimoto
Department of Molecular Biology, Molecular Infection Medicine Sweden (MIMS), Umeå University

11.45 **Plant cell wall dynamics: integrating growth, adaptation, and environmental sensing**
Laura Bacete Cano
Department of Plant Physiology, Umeå Plant Science Centre, Umeå University

12.00 *Lunch break*

Session 3: KEYNOTE LECTURE II and ELEVATED TALKS PRESENTATIONS by PhD STUDENTS
Chairperson: Rachel Feeney

13.00 **KEYNOTE LECTURE II: "Innovating biomaterials design for healthcare therapeutics and diagnostic applications"**
Prof. Dame **Molly Stevens**
University of Oxford, Imperial College London and Karolinska Institute

13.45 **Elevator talks presentations by PhD students** (2 min each)

1. Sensing Water on Mars: Clay-Salt Interactions under Simulated Martian Conditions
Trung Nguyen, *Department of Chemistry, UMU*

2. Inclusion stability: the unsung hero in *Chlamydia trachomatis*' evasion of host cell-autonomous immunity
Lana Hellga Jachmann, *Department of Molecular Biology, MIMS, UCMR, UMU*

3. MXene as a transparent and flexible electrode for all-solution-processed light-emitting electrochemical cells
Kumar Saumya, *Department of Physics, UMU*

4. Viewing the density of states through an electrochemical lens
Thushar Salkod Mahabaleshwa, *Department of Physics, UMU*

5. A SplitCas9 Based Conditional Knockout System to Characterize Essential Genes in Plasmodium berghei
Sophia Hernandez, *Molecular Biology, MIMS, UMU*

INTERACTION SESSION

14.00 **Poster presentations by PhD students**
and
coffee

DAY 1, Tuesday 5 November

SESSION 4: NEW FACULTY MEMBERS, AWARD AND GRANT RECIPIENTS FROM KBC

Chairperson: Anna Strandberg

15.00 **Sensing that a "cryptic" bacterial gene we discovered three decades ago finally might make sense**
Bernt Eric Uhlin
Department of Molecular Biology, Umeå University

15.15 **Groundwater changes in thawing Arctic landscapes**
Ylva Sjöberg
Department of Ecology and Environmental Science, Umeå University

15.30 **Semi-permeable capsules: emerging technology for single-cell multi-omics**
Linas Mazutis
Visiting professor at the Department of Molecular Biology, Umeå University

15.45 **The nature of bio-catalysis**
Johannes Messinger
Department of Plant Physiology, Umeå Plant Science Centre, Umeå University

16.00 **RNA Modifications: Key Regulators of Gene Expression and Cellular Function**
Francesca Aguilo
Department of Molecular Biology, Umeå University

16.15 **First results from a large-scale cloud reduction experiment in a tropical cloud forest**
Daniel Metcalfe
Department of Ecology and Environmental Science, Umeå University

16.30 *Poster viewing and mingle before the dinner starts*

18.00 *Dinner*

- Announcement of the PhD student presentation prize winners
- Announcement of the KBC Employee of the Year

DAY 2, Wednesday 6 November

SESSION 5: UMEÅ POSTDOC SOCIETY (UPS)

Chairperson and moderator: Najat Dzaki

8.30 **Opening**

8.40 **Postdoc Pitches** *(3 min each)*

1. microProteins in temperature sensitive flowering

Naveen Shankar, *Department of Plant Physiology, Umeå Plant Science Centre, UMU*

2. Immunology and the challenges of impaired T cell migration in autoimmunity

Fariba Mansourizadeh, *Department of Molecular Biology, UMU*

3. Tomorrow's light sources go organic

Anton Kirch, *Department of Physics, UMU*

4. Low-cost antibiotic detection in water and drinking beverages

Shatrudhan Palsaniya, *Department of Applied Physics and Electronics, UMU*

5. The Dynamic Shields: Investigating cell wall integrity and perception in Algae and Plants for a greener future

Demetrio Marcianò, *Department of Plant Physiology, Umeå Plant Science Centre, UMU*

6. Exploring the Unseen: Unravelling the Microbial Dark Matter

Jyoti Verma, *Department of Clinical Microbiology, UMU*

7. Natural chemical produced by microorganisms can prevent fungal growth *in vitro*

Tulio Teruo Yoshinaga, *Department of Clinical Microbiology, UMU*

8. Studying multidrug resistance from an evolutionary perspective

Ciaran Gilchrist, *Department of Molecular Biology, UMU*

9. MPK6 signaling in response to cold orchestrates the remodeling of the plasma membrane, serving as a key strategy for enhancing freezing tolerance

Ilian Giordano Ponce Pineda, *Department of Plant Physiology, Umeå Plant Science Centre, UMU*

10. Pancreatic endocrine organization in man and mice – Islet cellularity *vs.* function

Azam Mahmoudi Aznaveh, *Department of Medical and Translational Biology, UMU*

9.25 *Coffee break*

DAY 2, Wednesday 6 November

9.40 **Panel discussion: Progress/Moving Ahead**

Moderator: Najat Dzaki, *Umeå Postdoc Society*

Panel members:
Nora Lehotai*, a Science Manager at MIMS with expertise in communications and project coordination (non-postdoc)*
Sofia Mayans*, Director of Business Development Diamyd Medical AB, Interim CEO Vakona AB (non-postdoc)*
Anton Kirch*, an MCSF scholar at the Department of Physics*
Tulio Teruo Yoshinaga*, an EC scholar at Clinical Microbiology*
Fariba Mansourizadeh*, a staff scientist at Molecular Biology*
Dmitry Malyshev*, a staff scientist at the Department of Physics*

10.20 **Prize-giving ceremony and ending remarks**

10.25 *Break*

SESSION 6: KEYNOTE LECTURE III AND RESEARCH INFRASTRUCTURE PRESENTATIONS

Chairperson: Thomas Wågberg

10.30 **KEYNOTE LECTURE III: "Nanomechanical photothermal spectroscopy"**
Prof. **Silvan Schmid**
TU Wien, Institute of Sensor and Actuator Systems, Vienna, Austria

11.15 **Introduction to research infrastructures at KBC and SciLifeLab Umeå**
Linda Sandblad
Director of Umeå Centre for Electron Microscopy and SciLifeLab Site Umeå, Umeå University

11.25 **Simultaneous Submicron Infrared and Raman Microscopy**
Andras Gorzsas
Manager, Vibrational Spectroscopy Core Facility (ViSp), Umeå University

11.35 **C-trap: combined optical tweezers, confocal microscopy and advanced microfluidics for manipulation and visualization of single-molecule dynamics in real time**
Rubén Casanova-Sáez
Department of Plant Physiology, Umeå University

INTERACTION SESSION

11.45 **Posters by research infrastructures**

and standing lunch

DAY 2, Wednesday 6 November

SESSION 7: INFRASTRUCTURE PRESENTATIONS, RESEARCH SUPPORT AND AWARD RECIPIENT AT KBC

Chairperson: Linda Sandblad

13.00 **FIB-SEM for volume imaging at UCEM**
Sara Henriksson
Umeå Centre for Electron Microscopy (UCEM), Umeå University

13.10 **From Blurry to Brilliant: Super-Resolution Techniques in Modern Microscopy**
Sebastian Rönfeldt
Biochemical Imaging Centre Umeå (BICU), Umeå University

13.20 **Umeå Marine Sciences Centre**
Nicholas Kamenos
Director of Umeå Marine Sciences Centre (UMF), Umeå University

13.30 **Can the FAIR-data principles help you to document your scientific research expertise?**
Theresa Kieselbach
Umeå University Library, Department of Scholarly Communication, Umeå University

13.40 **New light on photoprotection**
Stefan Jansson
Department of Plant Physiology, Umeå Plant Science Centre, Umeå University

13.55 *Coffee break*
and time to talk to infrastructures' representatives by their posters

SESSION 8: NEW FACULTY MEMBERS, AWARD AND GRANT RECIPIENTS AT KBC

Chairperson: Lenny Haddad

14.15 **D-amino acids signal a stress-dependent run-away response in *Vibrio cholerae***
Felipe Cava
Department of Molecular Biology, Molecular Infection Medicine Sweden (MIMS), Umeå University

14.30 **From micro to macro: the role of microproteins in growth and development**
Stephan Wenkel
Department of Plant Physiology, Umeå Plant Science Centre, Umeå University

14.45 **Solitary chemosensory cells in the skin of fish: no longer orphans**
Suresh Jesuthasan
Department of Molecular Biology, Umeå University

DAY 2, Wednesday 6 November

15.00 **Assessing climate adaptation from natural forest trees**
Kelly Swarts
Department of Forest Genetics and Plant Physiology, Umeå Plant Science Centre, Swedish University of Agricultural Sciences

15.15 **Illuminating the Dark MicroProteome in Innate Immunity**
Iker Valle Aramburu
Department of Molecular Biology, Molecular Infection Medicine Sweden (MIMS), Umeå University

15.30 **Concluding remarks**
Stefan Björklund
Scientific coordinator of KBC

15.35 **Guided tours to infrastructures facilities**

Keynote Speakers

Prof. Dame Molly Stevens

University of Oxford, Imperial College London and Karolinska Institute

Professor Dame Molly Stevens FREng FRS is John Black Professor of Bionanoscience at the University of Oxford and part-time Professor at Imperial College London and the Karolinska Institute. Her multidisciplinary research balances the investigation of fundamental science with the development of technologies and designer biomaterials to address some of the major healthcare challenges across diagnostics, advanced therapeutics and regenerative medicine. Her research influences scientists around the world (>430 publications, h-index 109, >50k citations) and the impact of her work is recognised by numerous accolades, including the 2023 Novonordisk Prize. She is a serial entrepreneur and the founder of four spin-off companies.

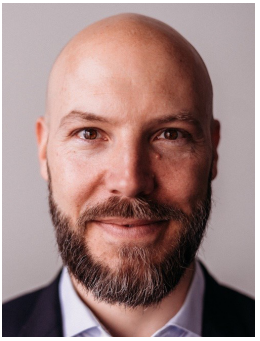
Keynote Speakers

Dr. David McKee

Physics Department, University of Strathclyde, Glasgow, UK and Arctic and Marine Biology Department, UiT The Arctic University of Norway, Norway

David McKee leads the Marine Optics and Remote Sensing Group at the Physics Department, University of Strathclyde and holds an adjunct position with the Arctic and Marine Biology Department at UiT The Arctic University of Norway. His research is focused on the development and use of optical technology and radiative transfer modelling to better understand marine ecosystems. Polar regions are characterised by extreme seasonality in light fields which are primary drivers of ecosystem function, with the darkness of polar night being beyond the range of standard sensors and models. This talk will present observations and simulations of the full annual light cycle at high latitudes using new approaches developed by the UoS/UiT team and co-workers. We will also discuss observations of animal responses to light pollution during the polar night and consider the role of light in a rapidly warming Arctic Ocean.

Keynote Speakers



Prof. Silvan Schmid

TU Wien, Institute of Sensor and Actuator Systems,
Vienna, Austria

Silvan Schmid, a professor at TU Wien, completed his doctorate in micro- and nanosystem technology at ETH Zurich in 2009. He then moved to the Technical University of Denmark, where he was appointed Assistant Professor in 2012. In 2016, he was promoted to Full Professor at TU Wien, where he currently heads the Micro and Nanosensors Group at the Institute of Sensor and Actuator Systems. Additionally, he received ERC grants in 2016 for nanoplasmomechanical systems research and in 2019 for a nanoelectromechanical infrared detector project. He is also a co-founder and scientific advisor of TU Wien spin-off Invisible-Light Labs GmbH, with which he received an EIC Transition grant. Since 2021, he additionally serves as the Dean of Academic Affairs for the Faculty of Electrical Engineering and Information Technology at TU Wien.

Information from Research Infrastructures

The Biogeochemical Analytical Facility - BAF

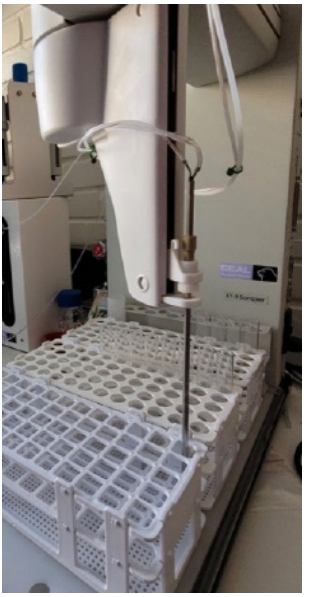
The infrastructure provides instruments for analysis of key chemical parameters in terrestrial and aquatic biogeochemical and ecological research and as such is of major interest for a large range of research groups.

BAF act as a core analytical facility for several major research projects run by researcher at EMG together with their collaborators and is also open for other users at Umeå and other universities.

INSTRUMENTS

The facility covers a scope of different instruments including:

- Gas chromatograph (set up for analyses of CO_2, CH_4, N_2O (FID, ECD))
  - Perkin Elmer, Clarus 500
- TOC/TN analyzer
  - Skalar, Formacs HTI
- Nutrient analyzer (NO_3+NO_2, NH_4, PO_4, TN, TP)
  - Seal Analytical, QuAAtro -39
- Elemental analyzer, for analyses of C/N/H/S on solids and glass fibers
  -Elementar, Unicube
- Fluorometer - Perkin Elmer, LS55
- Flow cytometer - BD Instrument, Facs,Verse
- Respicond facility (to measure respiration)
- Inverted microscope also with epifluorescence and cameras - Nikon, Eclipse TE 2000 and Eclipse T*i*



CONTACTS

For analyses contact: Anders Jonsson
Department of Ecology and Environmental Sciences
Mobile: 070-2778659
E-mail: anders.jonsson@umu.se

MORE INFORMATION

https://www.umu.se/en/research/infrastructure/baf/

Biopolymer Analytical Platform - BAP

The Biopolymer Analytical Platform (BAP) is dedicated to support research among KBC groups on cell walls of terrestrial and aquatic plants, and biopolymer materials. Our competence lies in applying a large range of standard methods for the analysis of lignocellulose, as well as in fine detection of soluble sugars and starch. The methods include carbohydrate and lignin composition analysis using conventional wet chemistry and state-of-the-art analytical devices. The instrumental backbone for many of those methods is gas chromatography/mass spectrometry (GC/MS). Pyrolysis-GC/MS is one of the most important analytical tools that quickly yields highly reproducible and comprehensive chemical fingerprinting of carbohydrate and lignin types in samples in the lower microgram range.

Postdocs, PhD students or project students with good lab work skills are required to do sample preparation in the BAP lab. We also provide an option to hire a professional staff hourly, in case your group has a lack of lab workers for sample preparation. It is possible to try a new method with us in the form of a project.

EXAMPLES FOR APPLICATIONS

- Pyrolysis-GC/MS for carbohydrate and lignin (G, S and H types) content estimation and for identification of organic compounds in soil/sediment
- TMS/Alditol acetate sugar-GC/MS for monosaccharide composition analysis
- Updegraff cellulose/anthrone assay for crystalline cellulose determination
- Klason and acetyl bromide lignin assay for lignin determination
- Enzymatic assays for soluble sugars and starch detection
- Size exclusion chromatography (SEC) for determination of MW, DP etc. of lignocellulose polymers
- Sample preparation and extraction using accelerated solvent extractor (ASE) 350

CONTACT

First contact for the customer: Laboratory manager, Junko Takahashi-Schmidt (Junko.TS@slu.se). We are in KBC G5

STEERING COMMITTEE

Totte Niittylä (Director), Dept. of Forest Genetics and Plant Physiology, SLU
Ewa Mellerowicz, Dept. of Forest Genetics and Plant Physiology, SLU
Hannele Tuominen, Professor, Dept. of Forest Genetics and Plant Physiology, SLU
Leif Jönsson, Dept. of Chemistry, UMU
Ola Sundman, Dept. of Chemistry, UMU
Stéphane Verger, Dept. of Plant Physiology, UMU
Junko Takahashi-Schmidt, Dept. of Forest Genetics and Plant Physiology, SLU

MORE INFORMATION

https://www.upsc.se/platforms/cell-wall-analysis/4845-biopolymer-analytical-platform.html

The Biochemical Imaging Centre Umeå - BICU

The Biochemical Imaging Centre Umeå (BICU) provides state-of-the-art imaging technology including advanced light microscopy and atomic force microscopy. BICU is an open-access imaging centre that offers cutting-edge technologies to researchers all over Sweden. Detailed information regarding our imaging centre organization and user fees can be found on our webpage.

We provide access and training to wide range of instruments including widefield, confocal and Tirf microscopy, FLIM, FLIM-FRET, FRAP, super-resolution (SIM and SMLM) and live cell imaging for an optimal spatial and temporal resolution. Furthermore, the centre provides access to Atomic Force Microscopy (AFM) to generate high resolution 3D topographical images and measure mechanical properties such as adhesion, stiffness and deformation of samples ranging from metal, glass, and surfaces coated with biomolecules to live cell under their physiological environment.

Apart from providing microscopy services we also actively take part in programs aimed at training young researchers in the use of the basic as well as advanced microscopy techniques and basic image analysis.

BICU is part of a National Microscopy Infrastructure (NMI): a Swedish infrastructure for the use and support of advanced microscopy in life science. The mission of NMI is to provide faster access to innovative technology and competence in microscopy for the life science research community. NMI also coordinates national and international knowledge exchange programs in microscopy. NMI in Umeå is the node specialized for advanced correlative imaging techniques. Hereby, BICU closely collaborates with Umeå Centre for Electron Microscopy (UCEM) to provide accessibility to various correlative light and electron microscopy (CLEM) techniques both in room temperature and cryo.

CONTACTS

Facility Director: Richard Lundmark, richard.lundmark@umu.se
Facility Manager: Irene Martinez Carrasco, irene.martinez@umu.se
Staff Scientist for CLEM: Sebastian Rönfeldt, sebastian.ronfeldt@umu.se
Staff Scientist for AFM: Fouzia Bano, fouzia.bano@umu.se

MORE INFORMATION

https://www.umu.se/en/research/infrastructure/biochemical-imaging-centre-umea-bicu/

BioMolecular Characterization Unit - BMCU

Research Infrastructure BMCU is an interdisciplinary facility that provides state-of-the-art technology to characterize biomolecules. The facility allows measurement of affinity using different technologies, together with molecular weight analysis, folding and overall structure.

At the facility we offer access, training and consultation for the following instruments;

Isothermal Titration Calorimetry (ITC), Surface Plasmon Resonance (Biacore3000/ ProteOn), Quartz Crystal Microbalance with Dissipation (QCM-D), Mass Photometer, NanoSight and CD spectrophotometer.

CONTACTS

For questions about access and training:

Johan Olofsson Edlund

johan.olofsson.edlund@umu.se

Department of Medical Biochemistry and Biophysics

For questions about organization:

Ronnie Berntsson & Marta Bally

Ronnie.berntsson@umu.se

marta.bally@umu.se

MORE INFORMATION

https://www.umu.se/en/research/infrastructure/biomolecular-characterization-umea-/

Computational Analytics Support Platform - CASP

The Computational Analytics Support Platform (CASP) is a data analytics service at Umeå University (UmU), launched during 2021, within the framework of the Computational Life Science Cluster. CASP is a local co-funded KBC infrastructure that primarily supports, but also trains life scientists in the analysis of experimental data using data-driven tools and strategies. We focus on the analysis of data from a wide range of technologies including, but not limited to, downstream omics (metabolomics/ proteomics), spectroscopy and imaging.

Our aim is to help bridge the existing gap in data-driven life science, allowing researchers to convert complex data into meaningful biological and chemical interpretations via the use of advanced data-driven tools and strategies. Combined, the group have strong expertise in data-driven life science, in addition to wide domain expert knowledge arising from active engagement with multiple projects in the 'omics' area and beyond. This allows a full understanding of the researcher's needs, not only in terms of the data analysis, but also in how the data was generated and equally important, the interpretation of the biology behind the project.

Support packages we provide

- Packaged and customer-specific data analytics projects
- One-to-one consultations for data analysis support - long term
- Personalised tutorials including theoretical knowledge and hands-on experience using data analysis and processing software
- Extended data analytics support for high-throughput experimental platforms including the Swedish Metabolomics Centre

Services we provide

- Statistical experimental design
- Multivariate data analysis
- Image analysis
- Deep learning and machine learning
- Pathway analysis and interpretation
- Publishing

CONTACTS

Please contact the Platform Manager Kate Bennett (katie.bennett@umu.se). We can help with the analysis of many different data types so please feel free to contact us and we will be happy to answer your questions.
We look forward to supporting you in your projects!

MORE INFORMATION

https://www.umu.se/en/research/infrastructure/computational-analytics-support-platform-casp/

Chemical Biology Consortium Sweden - CBCS

CBCS aims to help researchers identify and develop small molecules that affect their biological system of interest. Using small molecules to decipher and understand the function of biological pathways can give you powerful research tools and set the ground for generating new leads for drug discovery.

CBCS Umeå offers research facilities, equipment, user clubs and staff with expertise in assay development, small molecule screening, medicinal and computational chemistry, and profiling of compound quality. In addition, we have an updated compound collection for screening projects with over 350 000 small molecules and a research collaboration with AstraZeneca that provides access for academic researchers to their annotated small molecule library of 14,000 compounds, targeting over 1,700 human proteins. Additional services from CBCS include screening in BSL-3 labs, functional precision medicine, and cell painting.

Consultations and smaller service projects are offered on a first-come, first-served basis, while more extensive screening and chemistry projects are made available through a peer-review process. The instrument park at CBCS Umeå can be accessed through collaborative forms or user agreements.

CBCS has served researchers in Sweden for over ten years and currently has nodes at six universities and is part of SciLifeLab.

EQUIPMENT AT CBCS UMEÅ

- Plate readers; Biotek Synergy H4 and BMG ClarioStar
- High Content Screening Microscope – Molecular Devises ImageXpress
- High Throughput Flowcytometry - Sartorius iQUE3
- Liquid handling robotics; BC NxP, 96- and 384-well, Biomek i5 384-well, Assist Plus, Wellmate
- HPLC, Gilson & Shimadzu, fully equipped chemistry labs

SERVICES PROVIDED

- Development of biological assays (e.g., bacteria, yeast, cells, organelles, viruses) for high-throughput screening
- Biochemical (target based) and cell-based high-throughput screening
- High-throughput flow cytometry and imaging technology
- Organic chemistry and synthesis / Computational chemistry & modelling
- General expertise in preparative and analytical chemistry
- Course; Introduction to High Throughput Screening

CONTACTS

Department of Chemistry, KBC-building, Floor 4C
Erik Chorell: erik.chorell@umu.se

MORE INFORMATION

www.cbcs.se ; www.scilifelab.se/units/cbcs;
www.umu.se/en/research/infrastructure/cbcs

High Performance Computing Center North - HPC2N

Are your simulations saturating your PC?: HPC2N as an alternative

High Performance Computing Center North (HPC2N) is a national center for Scientific and Parallel Computing.

The High Performance Computing Center North (HPC2N) is a local/regional resource for researchers at HPC2N's partners (IRF, LTU, Mittuniversitetet, SLU and UmU). National Data Science Node in "Epidemiology and Biology of Infections" (DDLS). Our Director of HPC2N is Professor Paolo Bientinesi from the Computing Science Department.

We offer different types or hardware for computing and visualization including standard CPUs and Graphical Processing Units (GPU)s. Most common packages for Scientific Research are installed on our cluster for instance GROMACS, VASP, MATLAB, R/ Rstudio, among others.

To get started with our system, we offer different types of training courses including introductory courses, and more specialized courses in topics such as Molecular Dynamics, QM/MM, Git, R, Machine Learning, MPI, Julia, and OpenMP (recorded courses: : https://www.youtube.com/@HPC2N).

We provide a general support through a ticket system and a more advanced support for specific questions from researchers on-demand.

CONTACT
For general questions: info@hpc2n.umu.se
Specific questions: support@hpc2n.umu.se

Visiting address:
Umeå University
MIT-building
HPC2N
Campustorget 5, 4th
S-907 36 Umeå
Sweden

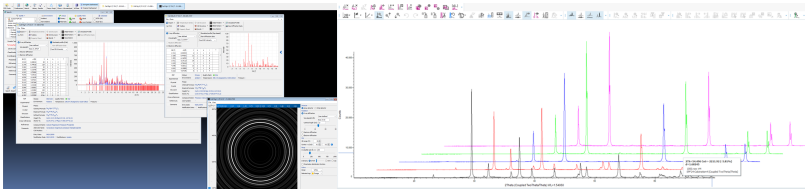
MORE INFORMATION
https://www.hpc2n.umu.se/

Multi-purpose Adaptive X-ray Scattering platform (MAXS)

Research infrastructure MAXS offers state-of-the-art X-ray diffraction, total X-ray scattering, and X-ray reflectometry with several sample environments for advanced material characterization to users from academy, industry, or public sectors. The platform also offers a comprehensive data evaluation environment with access to extensive reference databases for data collected at MAXS or elsewhere, including compatibility with data from synchrotron light sources.

The available instruments are two independent Bruker D8Advance systems with the possibility to choose from three X-ray wavelengths, X-ray profile, detector configuration with two detector types, and a broad selection of sample stages to match the needs of an experiment. The users can define what they need from an experiment and the instrument can be configured accordingly. An important feature is the automatic sample changer, increasing the sample throughput.

Data evaluation environment is provided locally at MAXS at two workstations, but also via network for internal users permitting local installation within Umeå University. Up to 20 users can simultaneously use the evaluation software with local installations of the crystallographic open database (COD) making it readily accessible for both research and education.

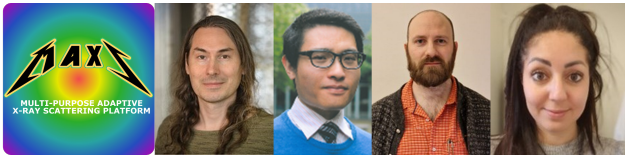


COURSES

MAXS hosts a user training course (1.5 ECTS) which includes a basic radiation safety traning module. We will open a longer course in powder X-ray diffraction (7.5 ECTS) which goes into details about diffraction and different strategies for data analysis.

CONTACT

The managing team consists of Nils Skoglund (manager), Charlie Ma, Markus Carlborg, and Marjan Bozaghian Bäckman. Please contact us at maxs@o365.umu.se if you are interested. We are located in room B6-39-07.



MORE INFORMATION

https://www.umu.se/en/research/infrastructure/multi-purpose-adaptive-x-ray-scattering-platform-maxs/

µNordic Single Cell Hub

µNiSCH (µNordic Single Cell Hub) is a cutting-edge infrastructure dedicated to advancing single cell biology at Umeå University. Our facility focuses on consolidating and expanding research in this dynamic field. We are also at the forefront of developing innovative molecular tools for single cell transcriptomics and genomics, with a special emphasis on microbial studies. The facility is located within the Department of Molecular Biology.

Both the advanced equipment and specialized expertise are open to all research groups interested in single cell biology applications on eukaryotic and prokaryotic cells, including:

- Single cell transcriptomics
- Single cell genomics
- Cell-based phenotypic screening assays
- Multi-step biological workflows in single cells
- Spatial distribution of gene expression
- Characterization of tissue microenvironment

Currently, we can offer expertise and access to the following equipment:

Onyx Microfluidics Platform, a microfluidic platform designed to generate and manipulate water-in-oil droplets or semi-permeable capsules for high-throughput single-cell and single-molecule analysis.

Chromium Single Cell Gene Expression system, a cutting-edge platform designed to analyze gene expression at the single-cell level.

The OT-2 multi-well pipetting robot, an automated liquid-handling system designed to streamline and enhance laboratory workflows.

The Pannoramic Midi II, an automatic digital slide scanner for high-throughput microscopy imaging, offering precision and efficiency in pathology and research applications.

LabSat Multiplex immunostaining system, an advanced automated platform designed for rapid and precise immunohistochemistry and immunofluorescence staining, particularly in research and clinical settings.

Celsee Genesis system, enable the capture of cells from liquid biopsies and other sample types. After capture, the enriched cells can be recovered for downstream analysis such as single-cell genomics, digital PCR, or culture.

Mantis Rapid Dispenser System, liquid handling platform designed to streamline and enhance precision in laboratory workflows.

CONTACTS

For requests or questions, please contact:

Staff Scientist Dr. Tugrul Doruk (tugrul.doruk@umu.se)

Director of Facility Dr. Kemal Avican (kemal.avican@umu.se)

MORE INFORMATION

Webpage is under construction

NanoLab

NanoLab is an open-access infrastructure located at the Department of Physics. It is a classified Class 100 cleanroom which comprises a variety of advanced fabrication and characterization setups, including, **thin-film deposition system (PVD75 thermal evaporator), nanoimprinter (Obducat NIL 2.5), mask aligner (Karl Süss Mask Aligner MJB3, X-ray diffractometer (PANalytical Xpert3 Powder), optical tensiometer (Attension Theta), low-pressure plasma system (diener electronics ATTO)**, **Four-Point Probe system, High Vacumm AFM,** as well as number of standard pieces of equipment, such as spin coaters, optical microscopes, vacuum ovens, hotplates, UV- curing boxes, analytical scales, etc. , visit NanoLabs website for more technical details, specific parameters and requirements for each individual equipment.

Original manuals and short user manuals for all equipment are to be found in KBC website and in the NanoLab.

The equipment in NanoLab is made available to all scientists at Umeå University, as well as external institutions. '

Besides the equipment available in the Nanolab, the Nanolab offers space for user´s own experiment inside the cleanroom. Users have access to fume hoods and central gases (N_2, Ar, H_2, O_2, liquid CO_2, compressed air) and vacuum in each working station and inside the fume hoods.

Trainings are offered annually for using the cleanroom and for the most of the equipment. Check KBC or Nanolab homepage for recent course announcements or contact Dr. Roushdey Salh (the coordinator of the NanoLab).

The infrastructure is supported by KBC and supervised by experts from department of Physics, Microbiology, and Applied physics and electronics. The NanoLab is used for both research and to educate student in advanced levels.

The NanoLab has special environment, with this unique opportunity comes many responsibilities and restrictions. All users are kindly asked follow the general rules of a cleanroom and to keep an active eye on the overall facilities and taking part in improving the cleanroom. Therefore, every user must take part in the cleanroom training seminar before having the license to use the NanoLab and the facilities independently.

CONTACT

Roushdey Salh, roushdey.salh@physics.umu.se

MORE INFORMATION

https://www.umu.se/en/research/infrastructure/nanolab/

National Bioinformatics Infrastructure Sweden - NBIS

NBIS, National Bioinformatics Infrastructure Sweden, is a distributed national research infrastructure. We are the SciLifeLab bioinformatics platform and the Swedish node in Elixir, a European intergovernmental organisation bringing together life science resources from across Europe. With over a hundred staff members, we work with bioinformatics support, infrastructure and training.

NBIS has staff at six sites: Umeå, Uppsala, Stockholm, Linköping and Lund. We provide expertise in most areas of bioinformatics, including omics analysis, genome assembly/annotation, image analysis and biostatistics. We also offer support in systems development, such as interactive websites and data processing pipelines.

NBIS is mainly funded by the Swedish Research Council, SciLifeLab, the Knut and Alice Wallenberg Foundation, and Swedish universities.

We provide:

- Weekly online drop-in sessions, Tuesdays at 14:00; http://meet.nbis.se/dropin. Join to discuss study design, data analysis or other bioinformatics-related questions.
- Free consultation meetings to discuss study design.
- Hands-on project support, ranging from assistance with smaller tasks to long-term engagement.
- Free, extensive hands-on support to a limited set of projects selected in a peer review process (enabled by a grant from Knut and Alice Wallenberg Foundation).
- Tools, data management, systems development and guidelines for the life science community.
- Introductory and advanced training events, such as workshops in RNAseq data analysis, epigenomics data analysis, tools for reproducible research, python programming, and many other bioinformatics related topics.
- The Swedish Bioinformatics Advisory program - A mentorship program for PhD students interested in guidance from a bioinformatics expert.

CONTACT

For general questions: info@nbis.se
Local contact in Umeå: Jeanette Tångrot, jeanette.tangrot@umu.se

MORE INFORMATION

https://www.nbis.se

Nuclear Magnetic Resonance - NMR

The KBC NMR Core facility provides access to state-of-the-art NMR equipment and expertise for all researchers in the KBC and Campus environment. This facility is part of the national infrastructures SwedNMR funded by VR RFI and SciLifeLab and it is operated by the Swedish NMR Centre at the University of Gothenburg and Umeå University. As a national service infrastructure, we grant access to academic and industrial researchers across Sweden.

The NMR facility offers access to powerful liquid and solid-state NMR infrastructure with spectrometers ranging from 400 to 850 MHz. Our ultrafast magic angle spinning probe and cryo-MAS probe are unique for the Nordic countries, enabling high-resolution spectra of proteins and studies and complex biological samples in the solid-state. High-field instruments are equipped with cryo-probes for optimal sensitivity for biomolecular solution NMR and environmental NMR. Robotic sample preparation and sample changers are available for high-throughput applications such as metabolomics and fragment- based screening (FBS).

SERVICE PROVIDED BY THE INFRASTRUCTURE

The NMR core facility offers nation-wide NMR access in four areas: Liquid- and solid-state structure analysis, materials science, metabolite studies and chemical biology. In addition, our personnel provide expertise according to the users need in all areas, from experimental design and sample preparation to data analysis.

Three-dimensional structures can be determined for soluble proteins, solid and membrane-bound proteins, nucleic acids and biomolecular complexes.

Metabolomics can be carried out on liquid and solid samples, including temperature-sensitive biological specimen. Advanced support of the entire process is provided, including bioinformatics data analysis support. Through collaboration with the Swedish Metabolomics Centre, we offer combined NMR- and MS-based metabolomics.

Our solid-state NMR equipment allows structural studies of insoluble protein aggregates such as amyloid fibrils and membrane proteins in their functional lipid environment.

FBS is performed using substance libraries from - and in interaction with - Chemical Biology Consortium Sweden (CBCS).

PERSONNEL

Gerhard Gröbner, prof., Platform Director, Dept of Chemistry
Jürgen Schleucher, prof., Platform Director, Dept of Med Biochemistry and Biophysics
Mattias Hedenström, Staff Scientist, Dept of Chemistry
Tobias Sparrman, Staff Scientist, Dept of Chemistry
Ilona Dudka, Staff Scientist, Dept of Chemistry
João Figueira, Staff Scientist, Dept of Chemistry

MORE INFORMATION

https://www.umu.se/en/research/infrastructure/nmr/
https://www.scilifelab.se/units/swedish-nmr-centre/
https://www.swednmr.se

Protein Expertise Platform - PEP

The Protein Expertise Platform (PEP) is a core facility at the Chemical Biological Center (KBC) and a node of the national infrastructure Protein Production Sweden (PPS). PEP provides researchers with needed services and expert advice in questions of bioinformatics, cloning, growth optimization, expression and protein purification.

MATERIAL

PEP keeps a set of cloning vectors, with a variety of fusion partners and purification tags, designed to improve protein solubility and to facilitate protein purification. In addition, PEP also have different strains of competent *E.coli* bacteria ready for transformation, as well as various antibiotics and proteases that are commonly used in protein expression and purification. Competent cells for transformation to *Agrobacterium tumefaciens* are also available.

CLONING

We offer cloning services, e.g. PCR (standard cloning), subcloning, and mutagenesis.

PROTEIN EXPRESSION SYSTEMS

E. coli
Plant suspension cells

PROTEIN EXPRESSION SCREEN (SMALL SCALE)

We can run a small-scale expression test to see if your protein of interest is expressed and soluble. If you experience problems due to low solubility or low expression, we can run a small-scale experiment to test a number of different setups.

PROTEIN EXPRESSION AND PURIFICATION (SCALE UP)

We also offer scaled-up protein expression and purification using affinity tags, IEX and SEC.

EDUCATIONAL ACTIVITIES

Graduate courses such as the fast "Cloning, Protein Expression and Purification" (CPEP), "Protein Crystallization" and "Basic Bioinformatics" courses address many topics of high interest for young researchers. Taking our courses enables them to independently solve general problems ranging from sequence analysis, primer design, molecular cloning to protein construct design and purification.

CONTACT (For Project request or questions regarding our services)

Uwe Sauer uwe.sauer@umu.se
Phone: 090-786 5930

MORE INFORMATION
https://www.umu.se/en/research/infrastructure/pep/

Swedish Metabolomics Centre - SMC

Swedish Metabolomics Centre (SMC; www.swedishmetabolomicscentre.se) was launched in 2013 via an infrastructure grant from Knut & Alice Wallenberg Foundation and co-funding from Umeå University, Swedish University of Agricultural Sciences and Chalmers Technical University. Since 2016 SMC is a part of SciLifeLab. The centre aims to support the researchers at Swedish Universities with mass spectrometry based small molecule, lipid and metabolomics analysis in biological tissues and fluids, and furthermore, to become a leading knowledge centre in metabolomics and related areas.

SERVICES

All service request starts with a meeting between the SMC and the customer, either in person or over the phone or Skype, to better understand the customer's research question and together decide the analysis of choice. SMC also offers an Open lab access service (OAP-service), where researchers after training by SMC personnel can rent an instrument and perform analysis themselves.

- Untargeted metabolite profiling (metabolomics)
- Targeted metabolite profiling, e.g. amino acids, sugars, fatty acids, TMAO (for details, contact Head of Facility).
- Lipid profiling (for details, contact Head of Facility).
- Study design
- Method development
- Basic statistics
- Open lab access services

EQUIPMENT

Mass spectrometers

- Leco Pegasus BT, GCTOFMS
- Leco Pegasus HT, GCTOFMS
- Agilent 7000C, GCQqQMSMS
- Thermo Scientific LTQ-Orbitrap XL
- Agilent UHPLC-QqQMSMS 6495A
- Agilent UHPLC-QqQMSMS, 6495D (2)
- Agilent 6546 Accurate-Mass UHPLC-QTOFMSMS (2)
- Agilent 6560 Ion Mobility UHPLC-QTOFMSMS

CONTACTS

For service requests or questions please contact: info@swedishmetabolomicscentre.se

Head of Facility: Dr. Annika Johansson (annika.johansson01@umu.se), +46722445254

Facility Directors: Prof. Johan Trygg, Prof Stefan Jansson

MORE INFORMATION

https://www.umu.se/en/research/infrastructure/metabolomics/;
https://www.swedishmetabolomicscentre.se/

Trace Analysis Platform and Gas Isotope Ratio Mass Spectrometry - TAP and IRMS

A Technical Platform at the Department of Chemistry

This platform aims to provide state-of-the-art equipment, user training and support for trace analysis of small molecules and metals in complex matrices, such as environmental and biological samples. The platform supports the detection of minute quantities of analytes such as metals, organic compounds, organometallic compounds with both qualitative and quantitative methods, and gases with their isotopologues. For metals both total concentrations and speciation analysis are supported.

APPLICATION EXAMPLES

The equipment that forms the foundation of the platform is or has been supporting work in the following areas:

- Trace element analysis (metals, phosphorus, sulphur, chlorine and bromine)
- Speciation analysis (Hg, Sn and As compounds)
- Protein-metal complexes and interactions
- Trace analysis of persistent organic pollutants (POPs)
- Multi-residue analysis of pharmaceuticals
- Indoor air pollutant and metabolomics studies
- Non-target screening/characterization and identification of unknowns
- Online detection of gaseous analytes and their isotopologues

INSTRUMENTATION

The platform has mass spectrometry based equipment, most often coupled to initial chromatographic separation, encompassing the following fields:

- Organic GC-MS
- Organic LC-MS
- Organo-Metal ICP-MS
- Gas isotope-ratio MS with direct liquid or gaseous online sampling

SERVICES

The platform primarily provides access to instrumentation, but can also provide analytical services and operator training. The services may include: design of experiments, sample preparation, instrumental analysis and interpretation of data. Service is provided at three different levels: 1) Seed projects (a few samples),

2) Small projects (10s of samples) and 3) Projects and long-term service (100s of samples) Contact the relevant co-ordinator for questions on availability, prices and level of support.

CONTACTS

The facility is mainly located on the 6:th floor in the KBC building.

Main Contact:	Peter Haglund, Director, 090-786 6667
Co-ordinators:	Erik Björn, ICP-MS, 090-786 5198
	Peter Haglund, Non-Target MS Analysis, 090-786 6667
Per Liljelind	GC-MS, 090-786 9321
Richard Lindberg	LC-MS, 090-786 5464
Dmitry Shevela	Isotope-ratio MS (3:rd floor), 090-786 5293

MORE INFORMATION

https://www.umu.se/en/research/infrastructure/tap/
http://tap.chem.umu.se/
http://irms.chem.umu.se/

Umeå Center for Electron Microscopy - UCEM

UCEM provides instruments and methods in Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM). The Center operates as an interdisciplinary University core facility for imaging and advanced Electron Microscopy (EM), and as a national and international research infrastructure for Cryo-EM, electron tomography, EM volume imaging and correlative micrscopy methods. UCEM houses seven EM instruments, diverse sample preparation equipment as well as computer infrastructure and software for image processing. The facility staff provides service and training to users in the facility labs, where students and scientists can perform advanced sample preparation, imaging and image analyzes.

SEM instruments, Merlin and Evo, offer high-resolution surface imaging, with multiple detector systems operating under cryo, room temperature or heated conditions. The Scios DualBeam is an instrument combining SEM with a Focused Ion Beam (FIB) volume imaging, during 2024 we also upgrade Scios for electron beam lithography. Aquilos 2 is a new FIB-SEM instrument for thin cryo-lamella preparation, cryo-lift-out, and cryo-SEM imaging, with possibilites to combine lamella preparation with subsequent TEM or cryo electron tomography analyses. Correlative Light and Electron Microscopy (CLEM) solutions for finding the precise location of a target proteins or structure of interest simplifying localization and high-resolution imaging of the same sample. TEM instruments Talos L120 offer ideal TEM solutions for entry level and sample screening, negatie staining, studies of cell and tissue morphology, electron tomography and CLEM. Service at UCEM also includes cell and tissue fixation, resin embedding, ultra-microtome sectioning, Tokuyasu sectioning, immunolabeling and staining techniques. Cryo-EM is the method of choice for visualization of hydrated proteins, viruses, cells and small organisms. Samples are plunge frozen in liquid ethane, preserved in amorphous ice and imaged under cryo condition. With Glacios 200 kV and Titan Krios 300 kV, equipped with autoloader for cryo samples. The cryo-EM instruments are equiped with a direct electron detectors, Falcon 4i, including a Selectris energy filter for contrast enhancement at Titan Krios. The method “cryo-EM single particle 3D reconstruction and analysis, SPA” is used for structure biology studies and cryo-electron tomography is used to study e.g. molecular complexes, subcellular volumes or microorganisms in 3D. With the same cryo-EM instruments we can colled electron diffrction data for 3D reconstraction of proteines, small molecules and chemical copmpunds. “MicroED” provides best structural information of samples in very smal, “sub-micro-meter” crystals.

Together with BICU, UCEM provides CLEM imaging support as part of the National Microscopy Infrastructure (NMI) and offer micro-patterning on grids and cryo stagen fluorescence microscopy with a Leica Thunder system. UCEM is also part of the Nordic network; CryoNET. UCEM supports sample preparation for MAX IV microscopy beamline and other synchrotron users. The establishment of an advanced EM facility in Umeå was made possible through external funding by the Swedish Research Council, Knut and Alice Wallenberg Foundation and the Kempe Foundations.

CONTACT

For general enquiries: Linda Sandblad, Facility Director
Visiting address: Electron Microscopy Building, KB-D, Umeå University
Mobile: +46 (0)70 932 49 36, E-mail: linda.sandblad@umu.se

MORE INFORMATION

https://www.umu.se/en/research/infrastructure/umea-centre-for-electron-microscopy-ucem/

Umeå Marine Sciences Centre - UMF

Umeå Marine Sciences Center is a complete research facility with all the platforms required to conduct world-leading research. We have several research vessels, smaller boats, a hovercraft, snowmobiles, mesocosms, a diverse array of field and lab-based analytical instrumentation, a research dive team and an engineering workshop, all underpinning world-class research and innovation.

Our indoor mesocosm facility is one of the most advanced in Europe. It enables us to conduct large-scale deep-water experiments with high precision and accuracy over environmental conditions, including control of temperature, salinity, stratification, convective stirring, haloclines, ice cover, carbonate chemistry and light fields.

Mesocosm highlights:

- 12 replicated 6m deep mesocosms
- Full sailinity range (2-34)
- 3 adjustable temperature depths enabling stratification and convective stirring from polar to tropical temperatures (2-30ºC accuracy +/- 0.5º C)
- Carbonate chemistry control for example in multiple stressor experiments
- Advanced adjustable light sources emulating daylight spectra for any biome globally
- Control of over-chamber atmospheric air temperature down to -200 C
- Ice cover where freezing or thawing rate can be adjusted
- Intact bottom sediments can be transferred to the mesocosms

At Sea: Umeå Marine Sciences Center also has 12 transportable free-floating mesocosms, designed for experiments in extreme and icy conditions which can be used in situ, or transported to other locations.

In the Laboratory: Our facility contains two experimental halls with smaller mesocosms and aquaria including licencing for fish-based investigations. Our advanced water treatment allows experiments with environmentally hazardous chemicals and pharmaceuticals or biological agents.

A full list of our facilities is available here: https://www.umu.se/en/umea-marine-sciences-centre/marine-research/transnational-access-umf-eng/

CONTACT
Dr Regina Kolzenburg: regina.kolzenburg@umu.se

MORE INFORMATION
https://www.umu.se/en/umea-marine-sciences-centre/

The UPSC Microscopy Facility

The Umeå Plant Science Centre (UPSC) Microscopy Facility offers hands-on introductions, user consultation, and open-access usage following mandatory introduction based on a flat rate fee per hour for usage of equipment.

UPSC Microscopy Facility has the main focus to work with plant images and hence our confocal and multiphoton systems are tailormade for work with thick samples, have spectral detectors to adapt to autofluorescence, very sensitive HyD or GaAsP PMT detectors and long working distance objectives as well as high resolution objectives. We have sectioning equipment, motorized stages for tiling and stitching at our imaging microscopes and often both highly sensitive monochromatic cameras and color cameras. Our latest addition is a Thunder flexisystem stereo/macroscope to remove out of focus blur and thus clarify fluorescence imaging using computational clearing and adaptive deconvolution.

EQUIPMENT

- Sectioning: Cryostat – CryoStar NX70 equipped with CryoJane tape system, Vibratome VT1000S, Microtome Zeiss HM 350, Ultramicrotome – Power Tom XL
- Light microscopes: Leica DMi8 inverted fluorescence microscope, Leica 205FA epifluorescence microscope, Leica Thunder Imager Model Organism etc.
- Fluorescence Activated Cell Sorter (FACS) BD FACS Aria III Flow Cytometer
- Immunorobot: Intavis InsituPro VSI
- Atomic Force Microscope NanoWizard® 4 XP BioScience with Leica LSI HSC macroconfocal is placed on top.
- Confocal microscopes: Zeiss LSM780 CLSM with inverted stand; Zeiss LSM880 CLSM with airyscan, airyfast, PicoQuant FLIM, FLIM-FRET, FCS, FCCS and inverted stand; Zeiss LSM800 CLSM with airyscan and upright stand; Leica Stellaris 8 DIVE multiphoton with White light laser, powerful Mai-Tai multiphoton laser, Tau, Lightning and inverted stand; Nikon CrEST Cicero. Spinning Disks for fast imaging and an upright stand Nikon LV100ND microscope; Zeiss LSM 980 CLSM, with black box around the system can either be operated at room temperature or with a temperature-controlled stage insert (10-40°C).

CONTACT

Facility Director: Stéphane Verger stephane.verger@umu.se

Facility managers:

Marta Derba-Maceluch marta.derba-maceluch@slu.se (light microscopes, sectioning and AFM)

Anna Gustavsson anna.gustavsson@umu.se (confocals and multiphoton)

MORE INFORMATION

https://www.upsc.se/platforms/microscopy-facility.html

Vibrational Spectroscopy Core Facility - ViSp

ViSp provides FT-IR and Raman spectroscopy and microspectroscopy services, ranging from design of experiments to measurements and data analysis. ViSp has state-of-the-art instrumentation, including two vacuum bench FTIR spectrometers, two confocal Raman microscopes with 5 laser lines (from 405 to 785 nm), a portable Raman spectrometer and a cutting-edge combined optical photothermal infrared (OPTIR) and Raman microscope. The techniques are suitable to detect and localise (at submicron resolution) chemical changes in a wide range of samples, at high speed and low cost, non-destructively and free of external agents (dyes, markers, labels). ViSp can provide both hardware and software development to adapt the techniques to the needs of the users / projects.

EXAMPLE APPLICATIONS/RESEARCH PROJECTS

Due to the exceptional versatility of the techniques, example projects cover a wide range of scientific disciplines and applications. Among the most prominent are materials sciences (nanotechnology, semiconductors), plant sciences (high-throughput chemotyping/screening, investigating the effects of gene manipulations or environmental factors), environmental sciences and biofuel applications (from microplastics, to biochars, and algae), bio/geo/chemistry (absorption on mineral surfaces, real-time, in situ monitoring of reactions, protein conformational changes) and medicine (assessing tissue compositional changes under various pathological conditions, diagnosing and monitoring disease onset and progression, drug targeting and molecular mechanistic studies, in vivo chemical compositional analysis of tissues). ViSp is primarily research driven and actively participates in projects where new methods need to be developed as well as applying existing methodologies in new areas.

TEACHING ACTIVITIES / COURSES

A User Licence Course is run twice a year, giving a basic introduction to vibrational spectroscopy in general and training users in running their own experiments at ViSp. ViSp is also involved in several courses at Umeå University and SLU.

LOCATION

Chemistry Department, Building C, floors 1 and 6.

CONTACT

András Gorzsás, manager

E-mail: andras.gorzsas@umu.se

MORE INFORMATION

https://www.umu.se/en/research/infrastructure/visp/

X-Ray Photoelectron Spectroscopy Platform - XPS

The X-ray photoelectron spectroscopy (XPS) platform is an open infrastructure at Umeå University enabling users both within UmU and outside to obtain analyses of the chemical composition of their sample surface. Knowledge of the elemental composition, oxidation state and spatial distribution of atoms at surfaces, near-surfaces, and interfaces is crucial to our understanding of key reactions in nature and technology. Surfaces are, after all, the interface through which materials - as small as nanoparticles and bacteria, to as big as nuclear fuel reactors and spaceships - interact with their environments. XPS, also known as Electron Spectroscopy for Chemical Analysis (ESCA), is now one of the most widely used tools in countless fields of science and engineering where advanced analyses of surfaces and interfaces is needed. The platform provides surface analysis by XPS, UPS, and LEIPS techniques. Full range of conventional XPS experiments is available including monochromatic Al Kα excitation, angle- resolved XPS, XPS imaging, and cryogenic measurements.

EQUIPMENT

AXIS Ultra DLD is an electron spectrometer manufactured by Kratos Analytical, Ltd. (UK). The instrument was installed at the Dept of Chemistry in 1999 and upgraded twice in 2004 and 2009.

The new XPS spectrometer **AXIS SUPRA+** is installed and put in operation November 2023.

SERVICES

In the outermost 10 nm of a surface (10 atomic layers), XPS provides:

- Identification of all elements (exc. H and He) present in concentrations >0.1 atomic %
- Semi quantitative determination of the elemental surface composition
- Information about the molecular environment (oxidation state, bonding atoms, etc.)
- Non-destructive elemental depth profile 10 nm into the sample and surface heterogeneity assessment
- Lateral variations in surface chemical composition (XPS imaging with spatial resolution of 1-5 μm)
- Studies on wet/hydrated (frozen) samples
- Experimental determination of band gap, work function, electron affinity and ionization energy in materials with UPS (HOMO) and LEIPS (LUMO)

The XPS platform is **the only facility for XPS analyses in Northern Sweden** (north of Uppsala). The platform supports a unique field of research, developed at the Department of Chemistry involving investigations of fast-frozen samples including mineral-aqueous solution interfaces, interfaces of biomaterials with biologically relevant media, and surface chemistry of microorganisms. The platform also supports a large range of research areas by providing state-of-the-art surface analysis in areas including ecology, chemistry, physics, archeology, molecular biology and engineering. .

STEERING BOARD

Andrey Shchukarev (Assoc. Prof., Dept of Chemistry), Knut Irgum (Prof., Dept of Chemistry), Jean-François Boily (Prof., Dept of Chemistry), Ludmilla Morozova-Roche (Prof., Dept of Medical Biochemistry and Biophysics)

CONTACT

Andrey Shchukarev, Dept of Chemistry, KB.C6, B6-35-07 (XPS lab) & B6-33-07 (office), tel. 090-786 5361. andrey.shchukarev@umu.se

MORE INFORMATION

https://www.umu.se/en/research/infrastructure/xps/

X-Ray Diffraction Facility - XRDF

The X-Ray Diffraction Facility (XRDF) provides crystallographic expertise and access to state of the art equipment for crystal set-ups and for single crystal X-Ray Diffraction, which provides 3D structural information at atomic resolution of small molecules as well as macro-molecules such as proteins, DNA, RNA, and their complexes. X-Ray Diffraction is ideally suited for drug target screening ("High Throughput Screening") and "Fragment Based Drug Discovery" by determining the structure of proteins with bound drug candidates. In addition, the X-ray equipment can be used for powder and fibre diffraction.

EQUIPMENT

- Nano-drop crystallization robot (mosquito®) for screening of crystallization conditions
- A Formulatrix "RockImager" for temperature controlled crystal storage and imaging and
- A "Rockmaker" liquid handling robot for screen optimization and custom screens
- A high brilliant X-Ray Diffraction system (X8 PROTEUM) with a fine focus, monochromatic X-Ray beam at $\lambda = 1.54$ Å
- A CryoStream 700 cooling system maintains the crystals at 100K during data collection
- High-end computing equipment and sophisticated software for data collection and analysis

SERVICE

- Screening for crystallization conditions
- Monitoring, evaluation and scoring of crystallization screens
- Optimization of initial screens
- Diffractions tests and iterative crystal optimization
- Full diffraction data collection incl. data processing and data analysis
- X-Ray crystal structure determination, refinement and validation
- Deposition of coordinates with the appropriate data bank, (PDB or CSD)
- Compound screens: co-crystallization with fragments and compounds (in collaboration with CBCS)
- Cryogenic preservation (vitrification) of crystals and storage in LN2

CONTACT

Uwe Sauer (coordinator):
Phone: 090-786 5930
e-mail: uwe.sauer@umu.se

MORE INFORMATION

https://www.umu.se/en/research/infrastructure/x_ray_diffraction_facility/

Overview Infrastructure Presentations

Research Infrastructure	Contact persons	Poster	Tour
Biogeochemical Analytical Facility (BAF)	anders.jonsson@umu.se		
Biopolimer Analytical Platform (BAP)	junko.TS@slu.se	**I-1**	Yes (6/11)
Biochemical Imaging Centre Umeå (BICU)	richard.lundmark@umu.se irene.martinez@umu.se sebastian.ronfeldt@umu.se fouzia.bano@umu.se	**I-2** **I-3**	Yes (after conference)
BioMolecule Characterization Unit (BMCU)	ronnie.berntsson@umu.se marta.bally@umu.se johan.olofsson.edlund@umu.se	**I-4**	Yes (after conference)
Computantional Analytics Support Platform (CASP)	katie.bennett@umu.se johan.trygg@umu.se	**I-5**	
Chemical Biology Consortium Sweden (CBCS)	erik.chorell@umu.se	**I-6**	
Genomic Medicine Center North (GMC)	camilla.holmlund@umu.se	**I-7** **I-8**	
High Performance Computing Center North (HPC2N)	info@hpc2n.umu.se pedro.ojeda-may@umu.se	**I-9**	Yes (6/11)
Multi-purpose Adaptive X-ray Scattering platform (MAXS)	maxs@o365.umu.se nils.skoglund@umu.se	**I-10** **I-11** **I-12**	Yes (6/11)
µNiSCH µNordic Single Cell Hub (µNiSCH)	kemal.avican@umu.se tugrul.doruk@umu.se	**I-13**	
NanoLab	roushdey.salh@umu.se		
National Bioinformatics Infrastructure Sweden (NBIS)	jeanette.tangrod@umu.se	**Roll-up**	Drop-ins
Nuclear Magnetic Resonance Core Facility (NMR)	mattias.hedenstrom@umu.se tobias.sparrman@umu.se jurgen.schleucher@umu.se gerhard.grobner@umu.se ilona.dudka@umu.se joao.figueira@umu.se	**I-14**	Yes (6/11 and after conference)
Protein Expertise Platform (PEP)	uwe.sauer@umu.se	**I-15**	
SciLifeLab Training Hub	nina.norgren@scilifelab.se	**I-16**	
Swedish Metabolomics Centre (SMC)	annika.johansson01@umu.se hans.stenlund01@umu.se swedishmetabolomicscentre@umu.se	**I-17**	Yes (6/11)
Trace Analysis Platform (TAP) and Gas Isotope Ratio Mass Spectrometry (IRMS)	peter.haglund@umu.se dmitry.shevela@umu.se	**I-18**	

Overview Infrastructure Presentations

Research Infrastructure	Contact persons	Poster	Tour
Umeå Core Facility for Electron Microscopy (UCEM)	linda.sandbland@umu.se sara.henriksson@umu.se sara.sandin@umu.se nils.hauff@umu.se agnieszka.ziolkowska@umu.se	**I-19** **I-20** **I-21** **I-22**	Yes (6/11)
Umeå Marine Sciences Centre (UMF)	regina.kolzenburg@umu.se nick.kamenos@umu.se	**stand**	
The UPSC Microscopy Facility	stephanie.robert@slu.se anna.gustavsson@umu.se marta.derba-maceluch@slu.se	**I-23**	
Vibrational Spectroscopy Core Facility (ViSp)	andras.gorzsas@umu.se	**roll-ups**	Yes (6/11 and after conference)
X-Ray Photoelectron Spectroscopy (XPS)	andrey.shchukarev@umu.se	**I-24**	
X-Ray Diffraction Facility (XRDF)	uwe.sauer@umu.se	**I-25**	

MORE INFORMATION ABOUT RESEARCH INFRASTRUCTURE AT KBC

https://www.umu.se/en/chemical-biological-centre/kbc-scientific-infrastructures/

Can the FAIR-data principles help you to document your scientific research expertise?

Theresa Kieselbach, Carolin Rebernig, Johanna Österåker, Olivia Ekman, Kristoffer Lindell

Umeå University Library, Department of Scholarly Communication, 90187 Umeå, Sweden

The FAIR-data principles (Wilkinson et al., 2016) are part of national and international policies on Open Science (Kungliga biblioteket, 2024) (UNESCO, 2021) and they are included in the policies for research data management of Umeå University (Umeå University, 2021) and the Swedish University of Agricultural Science (Swedish University of Agricultural Sciences, 2022). A principal idea behind making research data FAIR is that all data that resulted from public funding is an investment of society into future research and development. To make this possible, such research data shall be findable, accessible, interoperable and re-usable. One way to put the FAIR-data principles into practice is making research data accessible in a trusted repository such as, for instance, the EBI databases, the SciLifeLab Data Centre or Zenodo. A common question is, if it is worth the time and effort to describe research data according to the recommendations of the FAIR-data principles and to submit them to a trusted repository? Traditionally, scientific publication in high-ranking journals and success in winning external grants have been decisive criteria to advance in a scientific career in academia. However, these criteria are changing. The assessment criteria for research expertise for the appointment of teachers at Umeå University (Umeå University, 2024) give room for merits in Open Science. In addition, Umeå University signed the CoARA Declaration (CoARA, 2023) that aims to change the assessment practices for research and researchers and give credits to affords that were put into making science more open. From this perspective, the FAIR-data principles provide a perspective to complement the documentation of scientific research expertise with merits that are relevant for appointment in academia. The research data team at Umeå University library can give advice on how one can give access to research data in a trusted repository and put the FAIR-data principles into practice.

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PhD student presentation abstracts

Elevator talk #1✓ **Poster #1**

Sensing Water on Mars: Clay-Salt Interactions under Simulated Martian Conditions

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Liquid water is essential for habitability and life "*as we know it*". However, under the extreme environmental conditions on Mars (average -50 ^{0}C, 6 mbar CO_2), water is not stable in liquid form, existing mainly as ice and small amount as vapour. The discoveries of secondary minerals on Mars, including nontronite clay mineral and chloride salts, have constrained its complex geochemical and aqueous history, as their formation has a close relationship with liquid water [1]. These minerals also serve as valuable indicators for potential water sources due to their excellent water-loving characteristics. Nontronite is a swellable clay that can adsorb and preserve water and organics in its interlayer structure thanks to its high surface area and negatively charged structure [2]. Chloride salts can (i) melt ice/frost, (ii) form brines *via* deliquescence by adsorbing water vapor, and (iii) reduce water evaporation rate. During warmer seasons on Mars, hygroscopic salts (*e.g.*, chlorides, perchlorates) could form transient brines through these processes [3, 4]. A study revealed that the interactions of deliquescent brines with Martian regolith in the near surface may play a role in the geological formation of Recurring Slope Lineae that appears as seasonal, collapsing dark streak during early springs and summers [5]. However, there are very few studies focused on the nontronite-brine interactions under Mars-like conditions. To fill this gap, we investigated the water sorption and retention of nontronite-chloride mixtures using microgravimetric (Dynamic Vapour Sorption) and spectroscopy (Raman, X-ray Diffraction) techniques. Our findings suggest that the presence of $CaCl_2$ and $MgCl_2$ enhanced the water sorption of nontronite significantly, even at low humidities (~ 5 – 20 % RH). Additionally, nontronite retained the $CaCl_2$ brine better than other chloride brines under low temperatures. Hence, the interactions of nontronite and chlorides with water vapour on Mars near surface could potentially lead to the formation and retention of liquid water following the Martian diurnal cycles. Our findings furthermore provide essential insights into the aqueous geochemical history of Mars and suggest the potential preservation of water in Martian regolith even today. This extends the relevance of our research to the search for water and life on Mars and support ongoing and future Mars missions.

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Elevator talk #2✓ **Poster #2**

Inclusion stability: the unsung hero in C*hlamydia trachomatis*' evasion of host cell-autonomous immunity

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Within the EU, Scandinavian countries have the highest rates of *Chlamydia* STIs (sexually transmitted infections). In women, *Chlamydia* STIs can cause serious complications like pelvic inflammatory disease, infertility, and ectopic pregnancy, while in men, they can lead to inflammation and infertility. Currently, there is no vaccine, and treatment relies on broad-spectrum antibiotics, which can disrupt the normal microbiota and contribute to the promotion of antibiotic resistance. A *Chlamydia*-specific treatment not causing such collateral damage would be highly beneficial.

Chlamydia trachomatis, the causative agent, is an intracellular bacterium that invades the cells of its host and grows inside them within a vacuole termed inclusion. The bacterium modifies this inclusion by inserting inclusion membrane proteins (Incs). The Inc CpoS is especially crucial for *C. trachomatis'* pathogenicity, as it blocks the induction of host cell-autonomous defenses. In detail, the lack of CpoS has been shown to activate immune signalling and early death of the host cells, which effectively disrupted bacterial replication. To reveal CpoS' mode of action, we used a combination of genome-wide genetic screening and mechanistic investigations involving among others innovative microscopic reporters. Thereby, we revealed a role for CpoS in stabilizing the inclusion. Its absence caused subtle membrane damage, which preceded the induction of host cell death. Moreover, we identified a striking reliance of inclusion maintenance on two distinct sphingolipid supply routes and showed that blocking both routes simultaneously destabilizes inclusions early on, clearing the infection without harming the host cells. These findings could inspire the development of narrow spectrum approaches to treat *C. trachomatis* or other intracellular pathogens by destabilizing their vacuoles.

PhD student presentation abstract

Elevator talk #3✓ **Poster #3**

MXene as a transparent and flexible electrode for all-solution-processed light-emitting electrochemical cells

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Light-emitting electrochemical cells (LECs) are electroluminescent devices that commonly comprise a single emissive layer sandwiched between a reflective and a transparent electrode. It is notable that the emissive layer and both electrodes can be air-stabile, which renders the LEC technology a good fit for fabrication by cost- and energy-efficient ambient-air printing and coating. However, the demonstrated solution-processable materials for the transparent electrode in LECs is so far limited to PEDOT:PSS, Ag nanowires and graphene. 2-dimensional MXenes are an interesting option for this task, not the least since they have demonstrated function as the transparent electrode in organic light-emitting diodes.[1] Here, we report that a Ti_3C_2Tx MXene indeed can function as the solution-processable transparent electrode in LEC devices, which deliver bright and uniform light emission (fig1). We show that a key criterion in order for a MXene electrode to be functional in LEC devices is that it is electrochemically inert at the relevant electrode potential.[2]

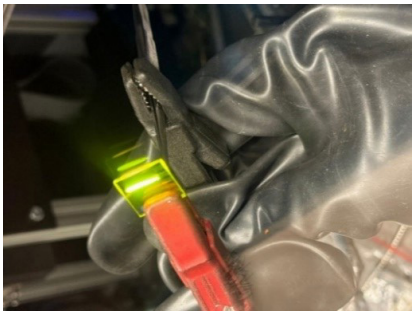

fig1. Photograph of light from MXene-LEC

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PhD student presentation abstract

Elevator talk #4✓ **Poster #4**

Viewing the density of states through an electrochemical lens

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Light-emitting electrochemical cells (LECs) operate by in situ electrochemical doping of an electroluminescent organic semiconductor (OSC) through the action of mobile ions1. Current drift-diffusion models applied to understand LECs assume that the energy of the electronic charge carriers injected into the active material is equal. However, in disordered systems, such as amorphous OSCs, the charge carriers exhibit an energy distribution termed density of states (DOS). Moreover, the electrochemical doping of the OSC can induce further broadening of the DOS through coulombic interactions between the ions and the electronic charge carriers. Here we measure the DOS of the HOMO and LUMO of an amorphous OSC termed "Super yellow" during electrochemical doping through differential pulse voltammetry (DPV). The DPV technique practically eliminates non-faradaic contributions, thus enabling direct access to the DOS. We find that both the HOMO and LUMO of Super Yellow features a broad, two-peak DOS. We anticipate that our results can aid in improving the accuracy of modeling of LECs.

Acknowledgment: This work was supported by the Wallenberg Initiative Materials Science for Sustainability (WISE) funded by the Knut and Alice Wallenberg Foundation.

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PhD student presentation abstract

Elevator talk #5✓ **Poster #5**

A SplitCas9 Based Conditional Knockout System to Characterize Essential Genes in *Plasmodium berghei*

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Plasmodium requires nearly half of its genome to proliferate during the clinically relevant blood stages. The high degree of essentiality in the genome underlines interesting biology and provides targets for treatments and interventions. Interrogating the function of these essential genes at scale has been hampered by the lack of gene knockdown tools or scalable conditional knockout systems in the parasite. To address this, we are developing a scalable system to inducibly knockout genes in the blood stage of *P. berghei* using a rapamycin inducible SplitCas9 line coupled with an artificial chromosome (PbAC). The *Pb*AC allows stable maintenance of the guide RNA and gene knockout repair template until desired time of gene knockout. We have generated a *Pb*AC that contains a ZeoR/PheS selection cassette flanked by AttP sites that allows gene specific CRISPR guide RNA and gene knockout repair templates (adapted from the *Pb*HiT system) to be cloned using a BP gateway reaction. Development of this system will allow us to perform a screen where we can classify essential genes into which specific stage of intraerythrocytic development they are important for.

Poster #6

Occupant-Centered Human-Building Interactions for Demand Response

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Background: The integration of renewable energy resources in residential buildings significantly reduces CO2 emissions, as buildings consume approximately 70% of global electricity, with residential structures accounting for 55% of this consumption. To manage the intermittency of renewable energy, demand response (DR) programs are utilized, aiming to enhance self-consumption of on-site renewable energy and minimize reliance on grid electricity.

Knowledge Gap: Current DR programs often overlook the thermal comfort, especially preferences of occupants, prioritizing energy savings at the expense of user satisfaction. This disregard results in a negative user experience, causing participants to abandon the DR programs.

Aim: The project proposes the development of occupant-centric DR systems that prioritize individual thermal comfort alongside energy management.

Methods: By leveraging immersive virtual environments in the Intelligence Human-Buildings Interactions (IHBI) lab, users can try out interactions with buildings in various characteristics, exploring how their behaviours influence both energy consumption and comfort. This approach enables users to find strategies that balance their comfort with energy efficiency, while also benefiting from economic incentives.

Contributions: By categorizing human-building interaction patterns, energy consumption, building characteristics, thermal preferences, etc., the project will offer:

1) *Thermal Comfort Evaluation Metrics*: Development of a DR-based thermal comfort model that considers occupant behavior in the context of demand response.

2) *Personal Practice Guidance:* Provision of personalized interaction strategies tailored for different user groups, ensuring the guarantee of thermal preference and energy savings during DR participation.

3) *Long-term Engagement Insights:* Providing insights that will encourage sustained participation in DR program over long term according to the evidence collected in a number of experiments.

Poster #7

3D Printed Biofilm Incubator with Temperature and Motion Control

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Biofilm contamination threatens both our healthcare and food industry, and more effective disinfection methods are needed. However, disinfection assays require repeatability and control over the biofilm's properties, and biofilm growth is very dependent on the environmental conditions. Conventional laboratory rockers are versatile tools for mixing, staining and washing of biological samples. But when the operations require precise control of the motion and temperature, then commercial alternatives are sparse and often come with a hefty price tag, limiting their use. In this work, we show how to build a temperature-controlled rocker platform using a 3D printer, CNC milling machine and off-the-shelf components. We evaluate and compare its performance to commercial systems, as well as in a cell cultures assay. The results show that our system perform similar to systems costing as much as $6600, while being quick to build and costing less than $350. As a proof of concept, we show how to use this system to grow biofilms of different bacterial strains. These biofilms will aid in developing methods to treat and guard against biofilm growth on various materials and environments.

Poster #8

Ultra-Sensitive Detection of Bacterial Spores via SERS

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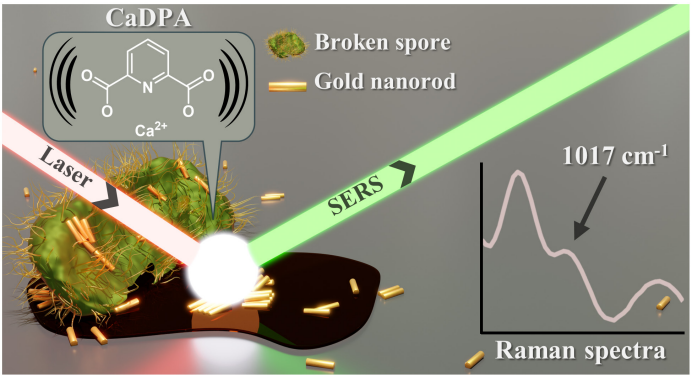
Bacterial spores are highly resilient and capable of surviving extreme conditions, making them a persistent concern in contexts such as disease transmission, food safety, and bioterrorism. Their ability to withstand standard sterilization methods necessitates rapid and accurate detection techniques to effectively mitigate the risks they present. In this study, we introduce a surface-enhanced Raman spectroscopy (SERS) approach for detecting *Bacillus thuringiensis* spores by targeting calcium dipicolinate (CaDPA), a biomarker uniquely associated with bacterial spores. Our method uses probe sonication to disrupt spores, releasing their CaDPA, which is then detected by SERS on drop dried supernatant mixed with gold nanorods. This simple approach enables the selective detection of CaDPA, distinguishing it from other spore components and background noise.

We demonstrate a limit of detection of biogenic CaDPA from concentrations as low as 10^3 spores/mL, with a sensitivity that reaches beyond single-spore levels of CaDPA. Furthermore, we demonstrate the technique's effectiveness in real-world applications by detecting CaDPA from a complex matrix of unprocessed milk spiked with spores. These findings highlight the potential of SERS as a sensitive and specific technique for bacterial spore detection, with implications for fields requiring rapid and reliable spore identification.



Poster #9

Optical-optical double-resonance polarization spectroscopy using a cavity-enhanced frequency comb probe

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Molecular line lists for gases at high temperatures are crucial in fields such as combustion, astrophysics and atmospheric science. However, due to the lack of accurate laboratory data, these lists are incomplete or inaccurate, and the theoretical models that generate them lack validation. Indeed, absorption bands for gases at high temperatures present an extreme density of lines that cannot be resolved in the spectrum of a heated sample: as temperature rises, multiple excited states are populated, and the Doppler width increases, so the transitions starting from these states overlap. This is especially true for methane, where the fundamental stretching and bending modes and their overtones are close in energy.

Optical-optical double-resonance (OODR) spectroscopy overcomes this challenge by pumping room-temperature molecules to a single excited state with a high-power, monochromatic, continuous wave laser. Then, a laser probe excites transitions from this single state to the final upper states. In our case, the probe is a frequency comb, which allows detection of multiple transitions simultaneously and with high resolution [1]. The probe transitions are Doppler-free, because only a narrow velocity group of molecules is excited by the pump. Moreover, we increase the sensitivity via a cavity resonant with the comb probe [2].

At the OODR transitions, the sample is birefringent. The ratio between probe transition intensities with parallel and perpendicular pump-probe polarizations depends on the rotational quantum numbers (i.e., the J numbers) of the final states. So, the final states can be assigned via two measurements with parallel and perpendicular pump polarization [3]. Instead, in OODR *polarization* spectroscopy, it is the shape of the lines corresponding to the transitions in the P, Q and R branches that depends on this ratio, so the J numbers of the final states can be assigned from a single measurement. In our experiment, the polarizations of the pump and probe in front of the sample are linear and set at 45 degrees with respect to each other. After the cavity, a polarization analyzer, set crossed to the probe polarization, lets through only the light whose polarization is affected by the OODR transitions, suppressing the background. We detect methane transitions in the $3\nu_3 \leftarrow \nu_3$ spectral range with signal-to-noise ratio more than three times higher than in conventional OODR spectroscopy [2, 4].

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Poster #10

Surface Enhanced Raman Spectroscopy (SERS) for Selective Trace Detection of Chemical Warfare Agents

Rasmus Öberg[1,2], Nora Molander[1], Damir Asoli[3], Magnus Andersson[2,4], Tomas Rindzevicius[5], Andreas Larsson[1], and Per Ola Andersson[1]

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The abstract is not included in the online conference booklet

Poster #11

A history of repeated antibiotic usage leads to microbiota-dependent mucus defects

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Recent evidence indicates that repeated antibiotic usage lowers microbial diversity and lastingly changes the gut microbiota community. However, the physiological effects of repeated – but not recent – antibiotic usage on microbiota-mediated mucosal barrier function are largely unknown.

By selecting human individuals from the deeply-phenotyped Estonian Microbiome Cohort (EstMB) we here utilized human-to-mouse faecal microbiota transplantation to explore long-term impacts of repeated antibiotic use on intestinal mucus function. While a healthy mucus layer protects the intestinal epithelium against infection and inflammation, using *ex-vivo* mucus function analyses of viable colonic tissue explants, we show that microbiota from humans with a history of repeated antibiotic use cause reduced mucus growth rate and increased mucus penetrability compared to healthy controls in the transplanted mice. Moreover, shotgun metagenomic sequencing identified a significantly altered microbiota composition in the antibiotic-shaped microbial community, with known mucus-utilizing bacteria, including *Akkermansia muciniphila* and *Bacteroides fragilis*, dominating in the gut. The altered microbiota composition was further characterized by a distinct metabolite profile, that may be caused by differential mucus degradation capacity.

Consequently, our findings suggest that long-term antibiotic use in humans results in an altered microbial community that has reduced capacity to maintain proper mucus function in the gut.

Poster #12

Scarcity of purine dNTPs impacts mtDNA quality and quantity

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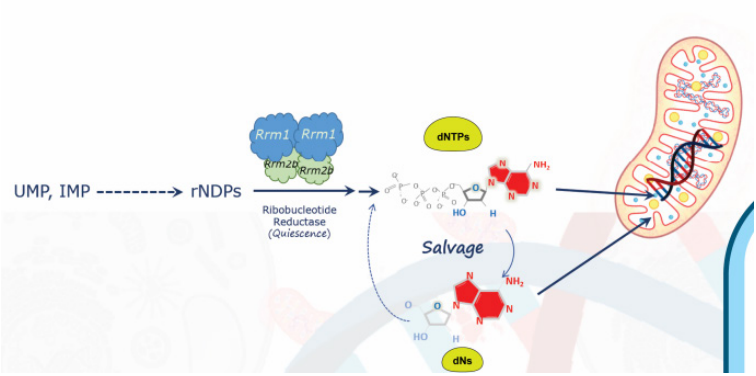
Ribonucleotide Reductase (RNR) is a key enzyme that catalyses the committed step in *de novo* synthesis of deoxyribonucleoside triphosphates (dNTPs). Where RNR is defective, DNA synthesis and maintenance are impaired.

The cells in the majority of mammalian tissues become quiescent after birth, ceasing to undergo cell division. However, mitochondrial DNA (mtDNA) continues to replicate. Therefore RNR dysfunction in quiescence mainly impacts mtDNA maintenance. This results in a systemic energy crisis that can be fatal in extreme cases, whereas less severe cases present mild symptoms at later onset. Despite the broad range of mitochondrial diseases that can result from defective dNTP production, no cure is available today.

To find possible treatment alternatives, we have investigated the mechanism of disease progression in a murine model lacking the small subunit of RNR in quiescent cells, called *Rrm2b*. Our *Rrm2b*-null mice accurately model the most extreme scenario in patients lacking the functional protein. This has allowed us to discover that the primary casualty in RNR defeciency are the purine dNTPs. Further, some preliminary results indicate that the symptoms which accompany the disease phenotype may be mediated by the Adenosine Monophosphate-activated protein kinase (AMPK), a key regulator in cellular energy homeostasis.

Put together, we believe that our findings would be useful in developing treatments that address the underlying disease, as well as palliatives for the secondary symptoms.



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