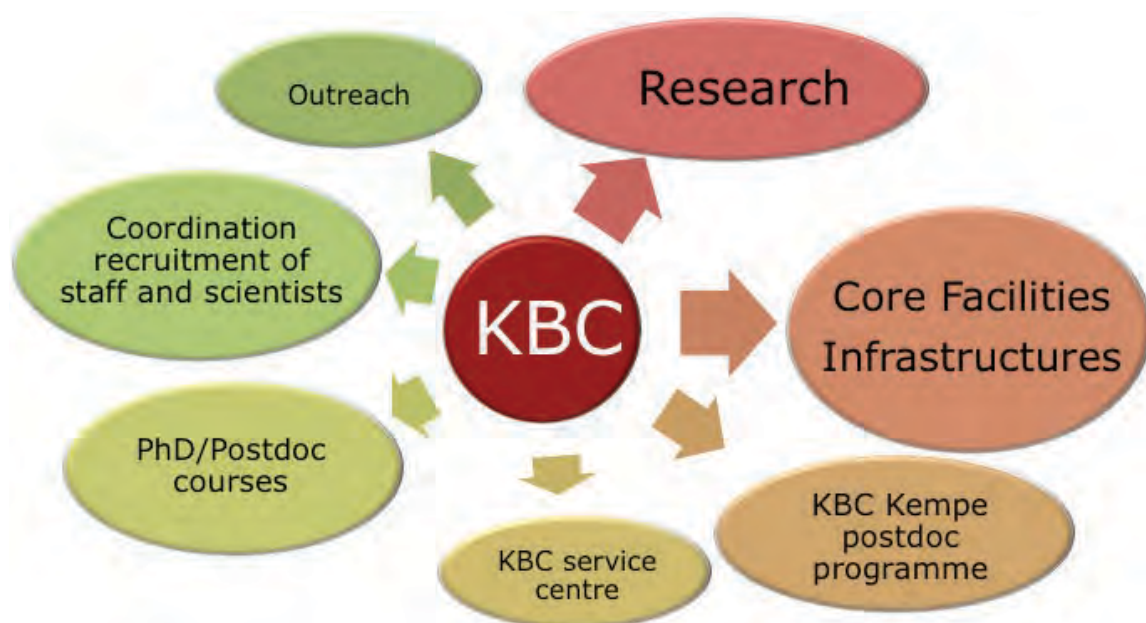


# KBC Report

The **Chemical Biological Centre** (*in Swedish: Kemiskt Biologiskt Centrum KBC*) is an interdisciplinary centre in life science and medicine at Umeå University and Swedish University for Agricultural Science.

The centre is unique in its collaboration and open, interdisciplinary atmosphere. Since it's funding in 2007, the scientific coordinator for KBC and the KBC group works for the enhancement of the interdisciplinary collaboration on all levels of research and education:

- Coordination and organisation of scientific infrastructures
- Organizing conferences, meetings and workshops
- KBC Postdoctoral Programme
- KBC Research School
- Joint recruitment of personnel
- Information, outreach and service centre
- Social activities (Swedish course, choir, *skidstafetten*)



## Contact

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# Background - Introduction

The KBC initiative started 2007 after a decision of the Vice-Chancellor, which was connected to the reorganization of the Department of Chemistry (see report “Molekylärt samspel”). A KBC group was appointed with Hans Wolf-Watz, professor at the Department of Molecular Biology as scientific leader. The main goal of the initiative was to strengthen the scientific competitiveness of the KBC environment.

Initially the focus was on the recruitment of seven new professors, five at the Department of Chemistry (Johannes Messinger, Leif Jönsson, Pernilla Wittung-Stafshede, Jyri-Pekka Mikkola, Jean Francois Boily), one at the Department of Medical Biochemistry and Biophysics (Erik Johansson) and one at the Department of Plant Physiology (Catherine Bellini). The recruitments were completed in summer 2009.

The KBC group also received a KBC postdoctoral programme from the Kempe Foundations to support the recruited professors as well as stimulate collaboration projects within the environment. The support from the Kempe foundations has been renewed three times for two-year port docs on collaboration projects within the environment.

With support from Swedish Research Council (VR), KBC started in 2008 a graduate school with Marianne Sommarin as director. In parallel, also the Umeå Centre for Microbial Research UCMR received support for another research school and the two initiatives were to a large extent coordinated and could thereby offer high quality courses to PhD students and postdocs in Umeå up to 2014. Together, the research school and the postdoc programme were very important for the deepening of interdisciplinary collaboration within the KBC departments.

In 2008 the responsibility for the KBC initiative was moved from the central administration to the Faculty of Science and Technology and Per Gardeström, was appointed by the Vice-Chancellor as scientific coordinator for KBC. In connection to this the KBC group was extended with a representative from the Department of Forest Genetics and Plant Physiology at SLU (part of UPSC), and in 2010 also research units from the Department of Applied Physics and Electronics, the Department of Biomass Technology and Chemistry (BTC – now: Forest Biomaterials and Technology at SLU) joined the KBC environment in 2010. Since 2011 also the department of Physics participates in the collaboration. Together with the earlier participants from the Chemistry Department, the Department of Ecology and Environmental Science, the Department of Medical Biochemistry and Biophysics, UPSC Department of Plant Physiology the KBC collaboration includes 8 department or units from three faculties and two universities. In addition a representative from MIMS/UCMR is part of the KBC group and a very important partner in all KBC activities.

In 2009 Eva-Maria Diehl was recruited as information officer to support the KBC group with both information and administrative activities including webmaster for the KBC homepage, information of activities and help with courses workshops and local conferences. Eva-Maria is also since 2009 the information officer for MIMS.

The question of how to organize research infrastructure has from the start of the KBC collaboration been an important part of the activities by the KBC group and contact persons to the first “technical platforms” were identified 2007/2008. These activities were intensified during the second KBC period and research infrastructures were divided into **Core Facilities**, **Technical platforms** and **User Groups** depending on availability, management, participation in teaching and economy (see appendix 1). Now, in 2016, the KBC environment is coordinating seven Scientific Core Facilities of which several have the now also the status of national facilities.

At the end of the first period 2007-2011 an external evaluation of the KBC activities was made. The outcome was very positive and for the following 5-year period 2012-2016 an increased budget was granted.

## **The KBC Environment**

The KBC Environment encompasses today departments in the KBC building and affiliated departments research centres, research units and centres of excellence at Umeå University and the Swedish University of Agricultural Sciences (SLU). Three faculties and two universities are represented in the Chemical Biological Centre.

### ***From the Faculty of Science and Technology (UmU)***

- Department of Chemistry
- Department of Plant Physiology - part of the Umeå Plant Science Centre – UPSC
- Department of Ecology and Environmental Science
- Department of Physics
- The Thermochemical Energy Conversion Laboratory at KBC (TEC/KBC) and part of Applied Physics and Electronics

### ***From the Faculty of Medicine (UmU)***

- Department of Medical Biochemistry and Biophysics
- The Umeå Centre for Microbial Research (UCMR - VR funded Linnaeus Centre)
- The Laboratory for Molecular Infection Medicine Sweden (MIMS), the Swedish node in the Nordic EMBL Partnership for Molecular Medicine. Both UCMR and MIMS are managed at Department of Molecular Biology.













### ***From the Faculty of Forest Sciences (SLU)***

- Department of Forest Genetics and Plant Physiology - part of the Umeå Plant Science Centre – UPSC
- Department of Forest Biomaterials and Technology and the Biofuel Technology Centre (SLU)
- Berzelii Centre for Forest Biotechnology – part of UPSC

All participating departments and research units as well as affiliated members are represented in the KBC Group, the board who is coordinating the research and infrastructure activities at KBC.

## The KBC Group 2016

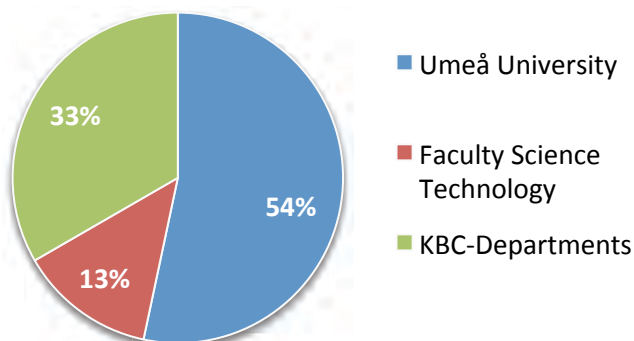
The group meets one time per month and is chaired by Per Gardeström. The KBC communication officer, Eva-Maria Diehl, acts secretary for the group

|  |   |  |   |
|--|---|--|---|
| <b>Per Gardeström</b><br>Professor, Plant Physiology/UPSC<br>Scientific Coordinator  |    | <b>Marianne Sommarin</b><br>Professor, Plant Physiology/<br>UPSC, Deputy Vice-Chancellor<br>responsible for research, Umeå<br>University |    |
| <b>Fredrik Almqvist</b><br>Professor, Chemistry<br>Co-Director The Laboratories for<br>Chemical Biology Umeå/ CBCS<br><i>Deputy: Lars Lövgren, head of dept.</i>   |    | <b>Richard Bindler</b><br>Professor, Ecology and<br>Environmental Science<br><i>Deputy: Sebastian Diehl</i>                              |    |
| <b>Andrei Chabes</b><br>Professor, Departmental Chair<br>Medical Biochemistry and Biophysics<br><i>Deputy: Erik Johansson, head of dept</i>  |   | <b>Linda Pommer</b><br>Lecturer, Applied Physics and<br>Electronics/KBC<br><i>Deputy: Christoffer Boman</i>                              |   |
| <b>Torbjörn Lestander</b><br>Lecturer, Forest Biomaterials and<br>Technology and the Biofuel<br>Technology Centre  |  | <b>From 1 March 2016</b><br><b>Stefan Jansson</b><br>Professor, Plant<br>Physiology/UPSC   |  |
| <b>Bernt Eric Uhlin</b><br>Professor, Molecular Biology<br>Director, The Laboratory for Molecular<br>Infection Medicine Sweden (MIMS)<br>Scientific Coordinator Umeå Centre for<br>Microbial Research (UCMR) |  | <b>Until 1 March 2016</b><br><b>Göran Samuelsson</b><br>Professor, Plant<br>Physiology/UPSC  |  |
| <b>Thomas Wågberg</b><br>Lecturer, Physics<br><i>Deputy: Kjell Rönnmark, head of<br/> department</i>   |  | <b>Gunnar Wingsle</b><br>Professor, Forest Genetics and<br>Plant Physiology/UPSC   |  |

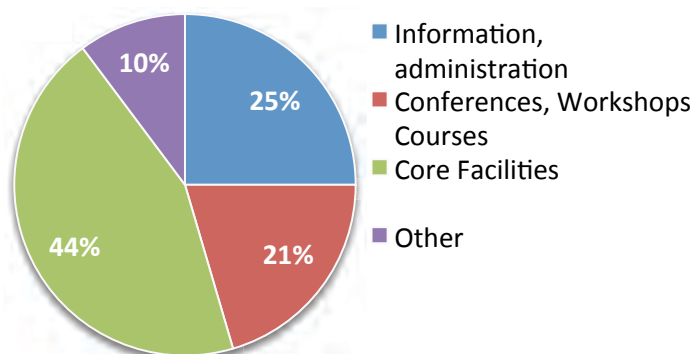
## Budget KBC (2012-2016)

After the evaluation 2011, the yearly budget for the following five years (2012-2016) was in total 3 500 kkr per year. Umeå University centrally contributed with 2000 kkr, the Faculty of Science and Technology with 500 kkr, the KBC departments 150 kkr each and the smaller KBC units with 50 kkr each.

**Income year 2016  
(total 3.500 kSEK per year)**

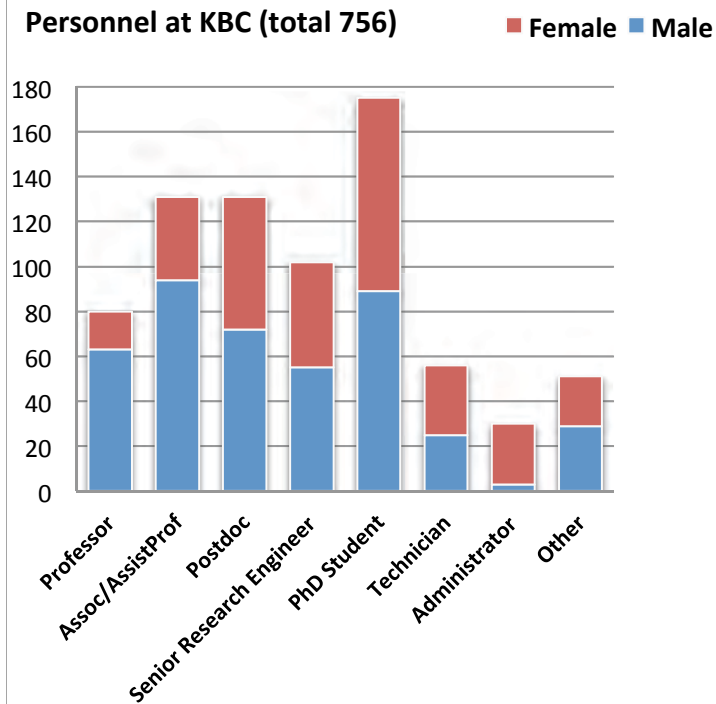


**Expenses year 2016**

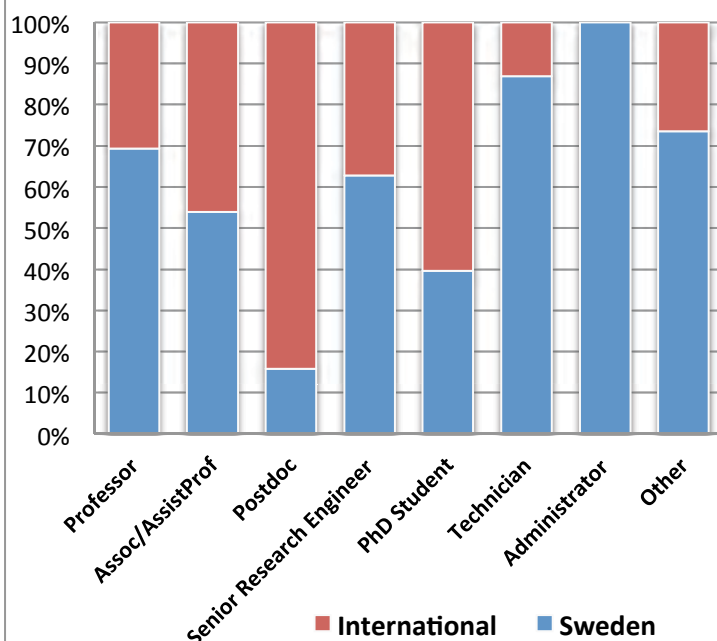


## Personnel at KBC (January 2016)

**Personnel at KBC (total 756)**



**Employees with international background**



### Employees at the KBC departments

Assoc/Assistant Professors: *lektor, biträdande lektor, forskare*

Other: *Universitetsadjunkt, studievägledare, projektassistent, projektsamordnare, guest professor*

Technician: *Forskningsingenjör, datatekniker, forskningsassistent*; PhD student: *Doktorand, inkl stipendiater*; Postdoc: *Postdoktorand, inkl stipendiater*; Not included: *Emeritus prof, Exchange students, visiting guests, Master and BSc students*

KBC is an international environment. Within the Departments of Physics, Plant Physiology, Forest Genetics and Plant Physiology and Ecology and Environmental Science 50 nationalities are represented. The Department of Chemistry and the Department of Medical Biochemistry and Biophysics have no information about the international background of their members. After Sweden (48,6%) the majority of scientists come from Germany

(6,9%), China (6,0%), France (4,2%), India (2,5%), Poland (2,5%) (see list of all KBC personell in appendix 2).

## Coordination and Organization of the KBC Core Facilities and Infrastructures

During 2012 representatives from KBC group and KBC infrastructures started an overviewing process of the organisation of the scientific infrastructures at KBC. The group presented a proposal for re-organisation and new definitions for the infrastructures, which was later in fall 2012 approved by KBC group.

The definitions for **Core Facilities**, **Technical Platform**, **User Group** are still valid and are based on the infrastructure's availability, management and internal organisation, participation in teaching, service and booking system, economy, and follow-up and are in the following described in the appendix 1.

### Core Facilities at KBC:

- Biochemical Imaging Centre Umeå - BICU
- Computational Life Science Cluster – CliC, Proteomics Core
- Laboratories for Chemical Biology Umeå - LCBU
- NMR Core Facility, NMR for Life
- Proteomics Core Facility
- Swedish Metabolomics Centre – SMC
- Umeå Core Facility for Electron Microscopy – UCEM
- Vibrational Spectroscopy Core Facility ViSP

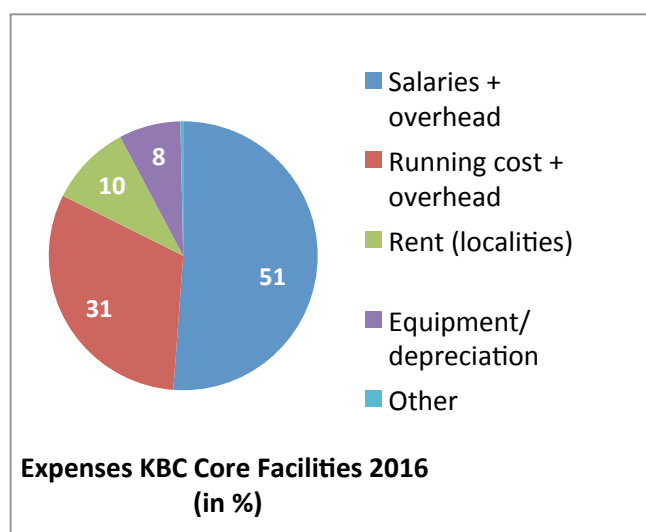
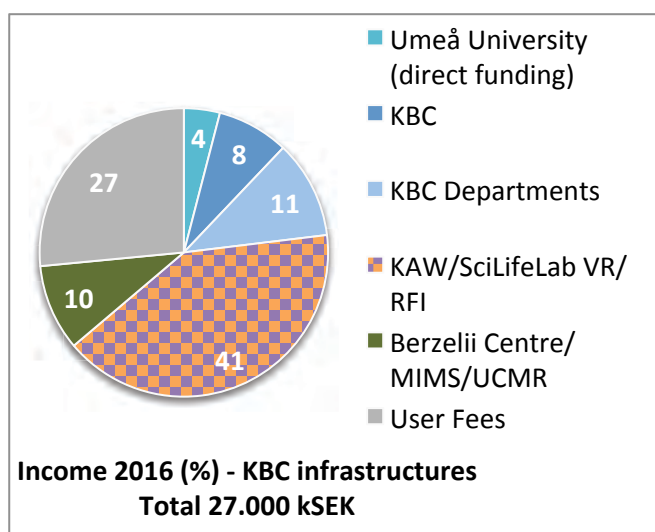
### Technical Platforms at KBC:

- Protein Expertise Platform - PEP
- X-ray Crystallography
- NIRX

Each Core Facility is in this report presented by:

- Short Summary of the Facility – Activity – Provided Service and Equipment - Personal
- Budget – Total budget for 2016 planned income and expenses
- Users - Numbers and affiliations
- Teaching activities
- Future Development
- 10 key publications (publication list in the appendix 6)

### Summary economy of service organised by KBC Core Facilities





## KBC – Postdoctoral Programme

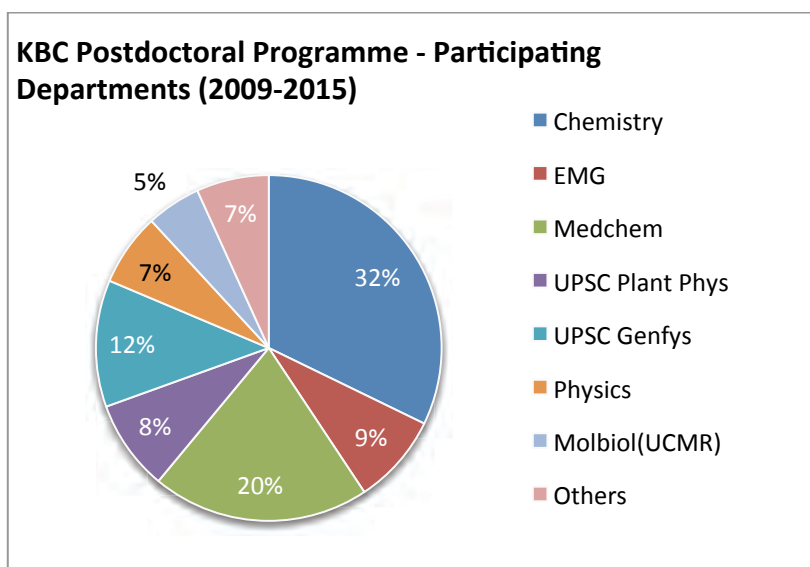
With the generous support from the Kempe Foundations the KBC group was able to set up a KBC postdoctoral programme. The goal of the programme was to support research and scientific integration and interaction between the research groups and departments within the KBC environment.

The KBC group set up criteria for the programme: Two or more research teams could apply for a joint grant of one 2-year post-doctoral resource. At least two of the research teams must be directly associated with different departments within the KBC environment. The project should, in addition, be innovative and focused. In order to support rejuvenation at least 60% of the fellowships will go to projects led by young group leaders (“young” referring to applicants with a PhD received no earlier than 10 years prior to the application deadline).

External evaluation of the applications was the basis of the final decision by the KBC group. The KBC information officer supported the research groups with their announcement of the postdoctoral fellowships in international web portals and by mailings.

In total 25 postdocs have been recruited since 2007 for interdisciplinary / interdepartmental KBC postdoc stipends, funded by the Kempe Foundation. Some of the postdoctoral projects involved not only KBC departments but also other departments within the Faculty of Medicine (Medical Biosciences, Pharmacology, Neurosurgery, and Molecular Biology), Faculty of Science and Technology (Mathematics) or even industrial partners in Örnsköldsvik.

### *Overview over the affiliation of the research groups who participated in the KBC interdepartmental postdoctoral programme*



An overview over all KBC interdepartmental Kempe postdoctoral fellows and their project as well as their publications is shown in appendix 3.

The KBC environment with its exceptional spirit of interdisciplinary interaction and collaboration was in 2010 awarded by the votes from the international postdocs as “best place to work for postdocs”.

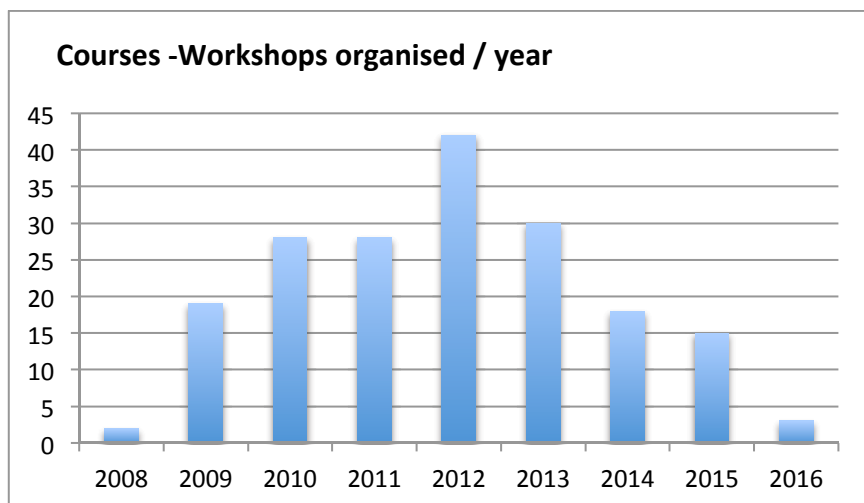


In February 2010 the postdoc poll organised by The Scientist ranked the “Life Science Departments” at Umeå University as number 4 outside of the USA and on first place in Sweden.



## KBC Research School 2009-2013/2014

With support from the Swedish Research Council a KBC research school was organised at KBC and coordinated in collaboration with Research School at Umeå Centre for Microbial Research (UCMR), which received funding from the VR for the same period. The KBC Research School was directed by Marianne Sommarin, professor at UPSC - Department of Plant Physiology, and Deputy- Vice Chancellor for Research at Umeå University. The UCMR Research School was directed by Debra Milton and Åke Forsberg, both assoc professors at Department of Molecular Biology. From 2009 until 2014 around 200 courses have been organised together with the UCMR Research School several courses were a workshop under one week with both a theoretical part and a practical training. Many courses were set up for the first time at Umeå University and can now be organised on a routine basis by the scientists and core facilities at KBC. For the personal and career development (e.g. Basic and Advanced English Writing, Presentation Technique, Creativity Effective Writing and Publishing), external experts were contracted for the courses. Several demonstrations, and technique-based trainings were organised with external lecturers and also in collaboration with companies.



In total, more than 2000 PhD students and Post-docs participated at the courses which were open also for PhD students from other departments at the Faculty of Science and Technology and at the Faculty of Medicine.

A detailed list over all courses and workshops is found in the appendix 4.

## Conferences organized by KBC / or with support from KBC

Course and workshops for PhD students and postdoc stimulated the interaction and collaboration between the KBC research groups with a bottom up perspective. The KBC scientists organised with support from KBC several conferences with an interdisciplinary focus. One of them is the Umeå Renewable Energy Meeting UREM, which is in 2016 organised for the eighth time. Renewable Energy and biofuels are strong research areas with several research projects funded by e.g. VR, Umeå University, FORMAS and Berzelii. From the start of the KBC environment. The KBC communication officer and the KBC service centre support the scientists in the organisation of conferences.

There are different types of conferences/symposia organised at KBC:

- Broad interdisciplinary conference with focus on a strong research environment (e.g. UREM)
- Conference organised in close collaboration with a scientific research infrastructure (e.g. Metabolomics Chemometrics) – often organised as a national symposium
- Meeting hosted by KBC to enhance the interaction with external scientific infrastructures and research centres (e.g. MAX IV Roadshow, The SciLifeLab Outreach Day, SMC Educational Day)
- Smaller interdisciplinary workshops (e.g. "Återintroduktion av skogsvildren till Sverige, 2015")
- Conferences and meetings to support the exchange and interaction within the KBC environment as the KBC DAYS which are organised since 2009

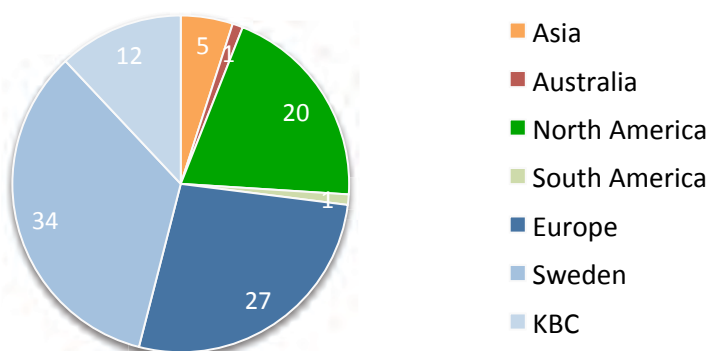
Since 2009 more than 100 conferences, workshops and symposia have been organised (detailed list in the appendix 5). The planned **Interactive focus environment at KBC** will hopefully enable the KBC departments and infrastructures in the future to organise more workshops and conferences as live stream or webinar available also for people outside of Umeå.

## Seminars at KBC

All seminars are announced in a newsletter and on the information screens in the KBC environment and at the Department of Molecular Biology. Between 130 and 150 seminars per year are organised by departments at KBC.

For 2015 half of the guest speakers had an international affiliation from outside Sweden.

It illustrates how international the network of the KBC scientists is. And it illustrates also that people from all over the world find Umeå and KBC so attractive to come for a visit and to give a seminar talk. All four Nobel laureates who visited Umeå University (2010-2014) had a relation to KBC scientists, who were hosts for the Nobel visit. The KBC also invited the most motivated high school students to special events with the Nobel laureates additional to the Nobel lectures organised by the University's communication department.



### Seminars 2015 - Continent affiliation of the speakers (%)

## Outreach Activities

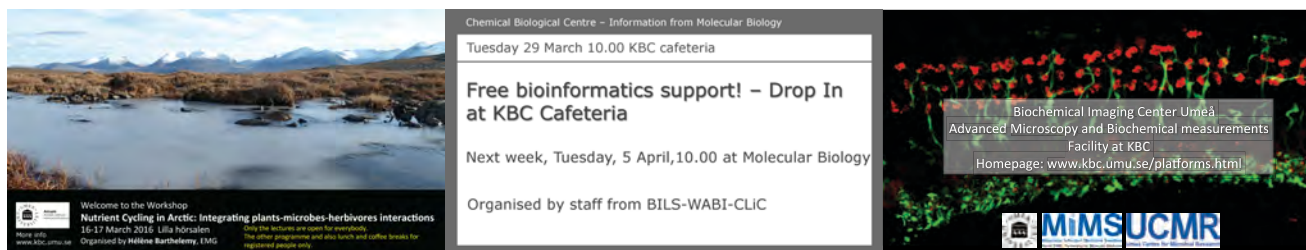
The KBC departments set up special programmes for schools. Since several years KBC also invited High-school students to meet Nobel laureates who are invited by KBC researchers.

Several open days have been organised: Two Fascination of Plants Days and a Researchers Night during the year of chemistry in 2011. Scientist from KBC usually also participate at public lecture series organised by the university.

A new activity "school students – meet scientists" was organised in connection with the Umeå Renewable Energy Meeting 2016 at Sliperiet. Scientists who were involved in the conference gave popular science talks and participated in a mingle, where they met the school students in a very informal way, showing examples from their research and answered questions. The information officer at KBC is usually organising visitors' programmes for groups invited by the management of the university. Some examples: *Riksdagens Jordbruksutskott*, The director of the Stockholm office of the Japanese Society for the Advancement of Sciences, The Kempe Foundations, *Senioruniversitetet*.



School students meet the scientist at the Mingle in connection with Umeå Renewable Energy Meeting 2016 Sliperiet, 23 February.



## Information screens

In 2015 the KBC environment invested in more than 20 screens, which were set up within the KBC building. The screens connect the departments and make joint announcements of seminars, conferences and other events/news possible. The KBC information officer developed a new layout and information strategy for the screen publications.

Seven screens are administrated by the KBC communication officer and set up in the central area of KBC, all other screens are administrated by the KBC departments. Some connect also the Climate Impact Research Centre (CIRC) in Abisko and the EMG research groups at Uminova with the KBC environment.

Together with the responsible persons in the department, the KBC communication officer set up guidelines and a communication plan. Print och Media's graphics person made a layout following the university's rules.

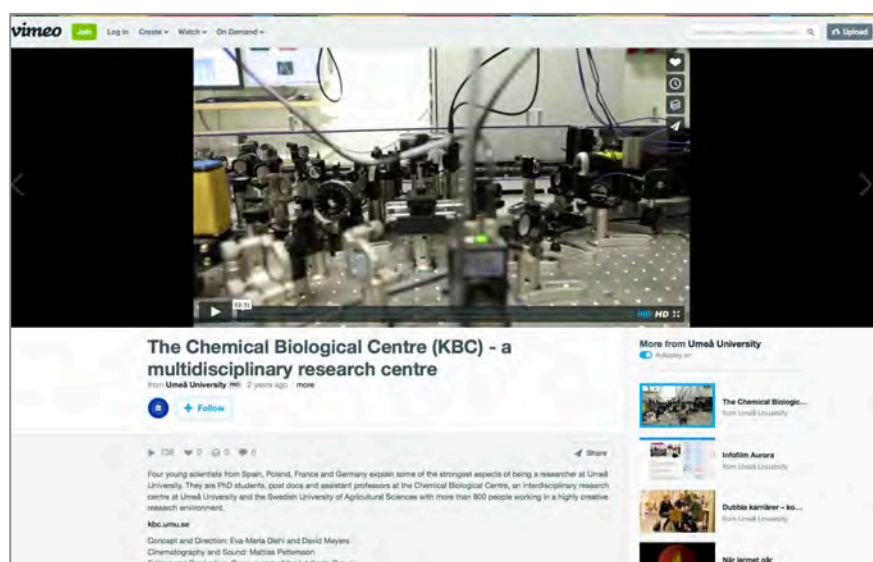
A colour scheme makes the information easier. All departmental seminars, courses, conferences and other events of interest on campus, also at NUS (e.g. Regional cancer research centre) are now announced in the central KBC building and the announcements are available for all departments in a joint pool of screen pictures.

In addition, the plan is to show information about the research infrastructure. In 2015 Biochemical Imaging Center Umeå was the first KBC Core Facility, which was presented different techniques available at the facility.

## Movie about KBC

The KBC communication officer produced in 2014 a movie about KBC. Four international scientists, a group leader, a lecturer, a PhD student and a Postdoc had the opportunity to talk about their experience with KBC and why they chose Umeå for their career. The movie is published on the UmU movie website on Vimeo:

<https://vimeo.com/88655847>.



# Description of the KBC Core Facilities

## Biochemical Imaging Centre Umeå - BICU

### Short Summary of the Facility

The national centre for advanced fluorescence imaging, *The Biochemical Imaging Centre Umeå*, was founded by support from VR-RFI in order to establish a node of excellence within fluorescence super-resolution and live cell imaging.

#### Equipment

The centre includes equipment for combined use of different advanced imaging techniques to visualize the same sample in multiple ways. The instrumentation includes a spinning disk microscope, for **extreme high-speed live cell imaging** and a confocal microscope with resonant scanner. Both systems are fully equipped for photo-bleaching (FRAP) and photo-quenching (FRET) experiments and TIRF (total internal reflection fluorescence) microscopy.

The confocal equipment includes a STORM-unit capable of super-resolution imaging down to **20nm to visualise previously unresolved structures**. It is also equipped with micromanipulators to facilitate direct administration of molecules in individual cells. The centre also includes an Apotome widefield microscope equipped with the shuttle-and-find system, which allows correlative imaging of the same sample in the scanning electron microscope.

The facility is also equipped with an **Atomic Force Microscope (AFM)** that provides high resolution and force measurements to test specific interactions between the biological molecules in their natural environment. We can get the insight into the geometry, elasticity and dynamic behavior at the level of single molecules or single cells.

Complementary to the imaging instruments, the centre provides equipment for precise affinity measurements on surfaces or in solution using Surface Plasmon Resonance, Ligand-tracer and Isothermal Titration Calorimetry.

#### Personnel

##### Richard Lundmark, Associate Professor

BICU Director, MIMS group leader

Department of Medical Biochemistry and Biophysics and Department of Integrative Medical Biology

##### Irene Martinez, PhD

BICU Manager, Light Microscopy specialist.

Department of Medical Biochemistry and Biophysics

#### Steering committee

|                            |  |
|----------------------------|--|
| Richard Lundmark           | Associate Professor, Medical Biochemistry and Biophysics and Integrative Medical Biology |
| Thomas Borén               | Professor, Medical Biochemistry and Biophysics   |
| Pernilla Wittung Stafshede | Professor, Chalmers Technical University, Gothenburg                                     |
| Markus Grebe               | Professor, University of Potsdam, Germany and Umeå Plant Science Centre                  |
| Karl-Erik Magnusson        | Professor, Linköping University  |

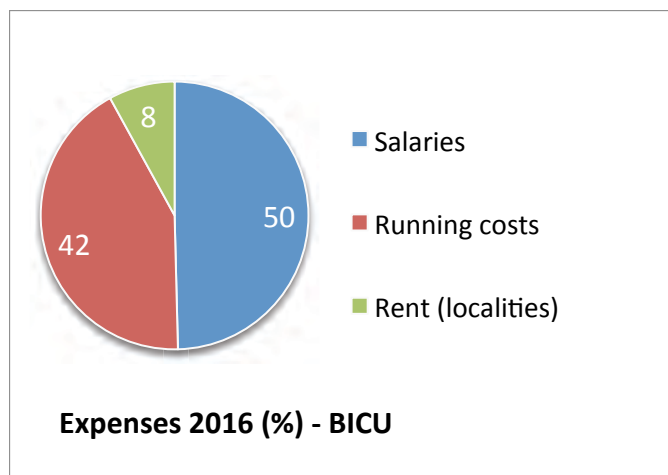
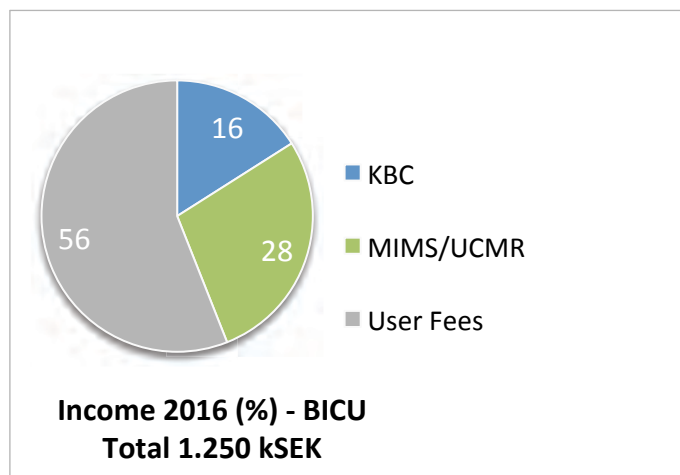
#### Contact information

Chemical Biological Centre KBC - Department of Medical Biochemistry and Biophysics, Umeå University, 901 87 Umeå  
Visiting Address

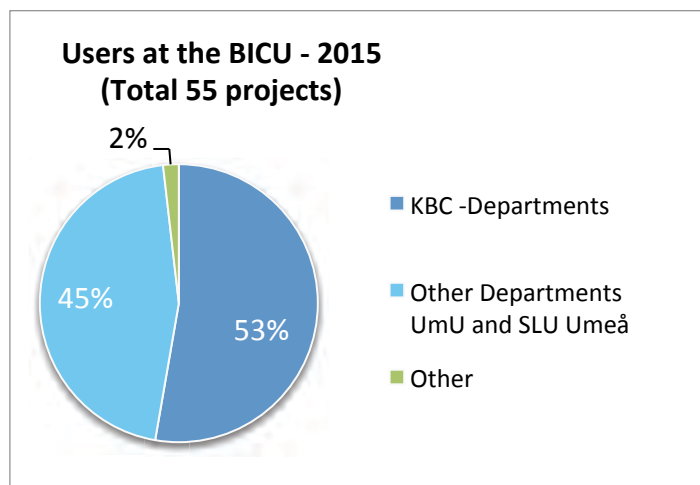
KBC building, Linnaeusväg 6, Umeå University, floor 6,

<http://www.kbc.umu.se/platforms/bicu.html>

## Budget - BICU



## Users of the Biochemical Imaging Core Facility



## Teaching activities (2015)

- Workshop in Micrography and Image Processing for Science. Doctoral Programme in Infection and Antibiotics.
- BICU Zeiss Workshop: Spinning Disk presentation. Umeå
- Novel Fluorescence-based Methods in Immunology. National symposium, Stockholm
- Summer research camp. Umeå

## Future Development

Together with the Umeå Core Facility of Electron Microscopy (UCEM), another KBC Core Facility, BICU provides correlated light and electron microscopy (CLEM) imaging on a national basis.

## Key Publications

*Se appendix 6.*

# Computational Life Science Cluster – Proteomics Core

*Since 1 April 2016 part of NBIS (National Bioinformatics Infrastructure Sweden, <https://bils.se/nbis/>)*

The emergence of proteomics, the large-scale analysis of proteins, has been inspired by the realization that the final product of a gene is inherently more complex and closer to function than the gene itself. With correlation between gene expression levels and protein abundance reported to be poor, quantitative proteomics is necessary in order to determine protein abundances. Over the last decade mass spectrometry-based proteomics has advanced from qualitative analyses, to addressing more biologically relevant issues requiring measurement of the abundance of identified proteins and hence quantitative mass spectrometry.

We have formed a Proteomics core under the CLiC umbrella together with the KBC Proteomics Facility that offer service and support for Swedish researchers, in collaboration with and partially financed by BILS, a national research infrastructure.

Support functions of the Proteomics core are:

- Experimental design
- Advice on sample preparation protocols
- Method development
- Data processing
- Statistical analysis

The contact person is the first point of contact for researchers that require assistance with proteomics projects.

A core facility steering committee has been setup for prioritizing projects, for determining the extent and nature of support tasks, and deciding on which projects should be conducted as collaborations.

The proteomics platform has also played an important role in the set-up of the KBC server and the current bioinformatics infrastructure includes:

- on-line booking of instruments using the KBC resource booking tool
- a local Mascot server providing access to many important sequence databases
- facilities for data transfer
- integrated facilities for data storage and post processing work with mass spectrometry data

## **Contact person**

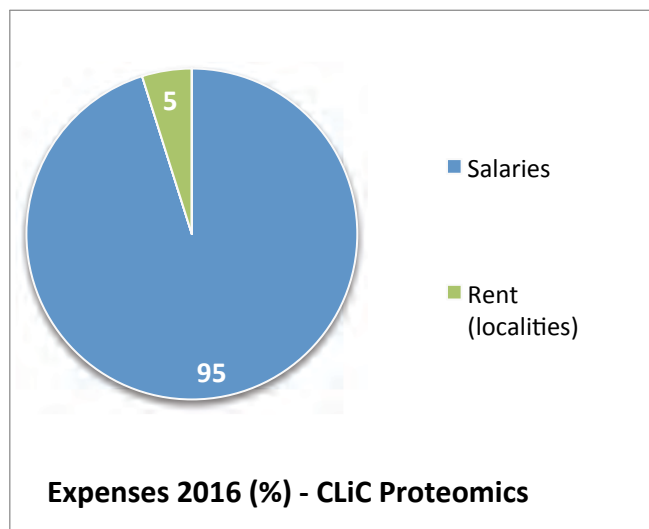
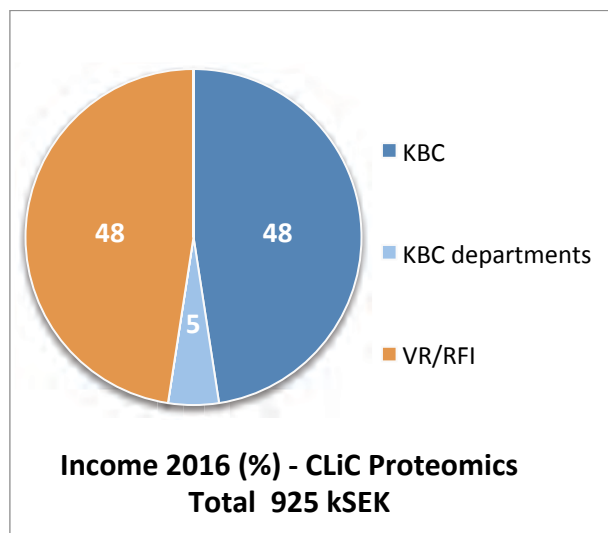
Joakim Bygdell, PhD, Senior Research Engineer  
KBC building, floor 4 Linnaeusväg 10, 90736 Umeå

## **Steering committee**

|                   |  |
|-------------------|--|
| Per Gardeström    | professor, KBC Scientific Coordinator, KBC, Department of Plant Physiology |
| Thomas Kieselbach | PhD, Department of Chemistry   |
| Uwe Sauer         | Assoc.Professor, Dept of Chemistry   |
| Johan Trygg       | professor, Department of Chemistry   |
| Gunnar Wingsle    | professor, Department of Forest Genetics and Plant Physiology              |

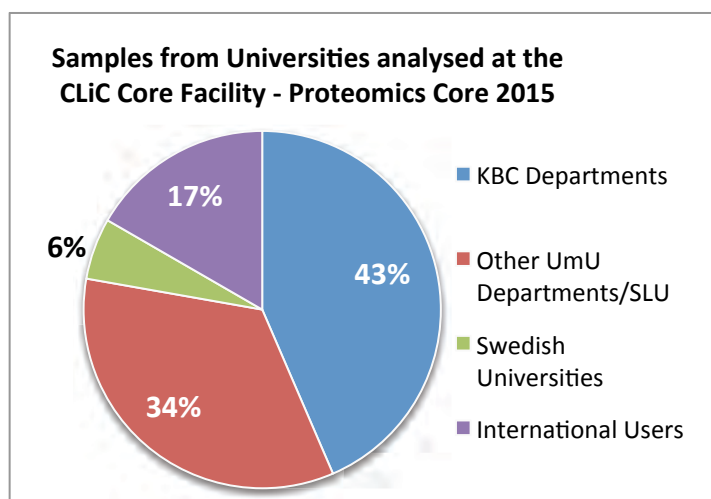


## Budget



## User

The CLiC – Proteomics Core is part of the national pool of bioinformatics experts within the National Bioinformatics Infrastructure Sweden, NBIS. The core facility manager, Joakim Bygdell, was responsible for two biostatistics projects at SLU Uppsala and Uppsala University. The facility manager performed 21 bioinformatic projects related to proteomics projects at KBC Proteomics Core Facility.



## Teaching activities

The Manager of the CLiC Core Facility is regularly involved in teaching a master course “Functional Genomics”.

## Future Development

Joakim Bygdell will also in the future collaborate with the other representatives in NBIS at Umeå University and also continue with the recently started Drop-in Bioinformatics service, which is weekly offered for free for everybody who is interested in bioinformatics analyses.

## Key Publications

*Se appendix 6.*



# Laboratories for Chemical Biology Umeå - LCBU

## Summary of the facility

LCBU is part of the national network CBCS “Chemical Biology Consortium Sweden”. The objective of CBCS is to provide Swedish researchers open access to world-class capabilities within assay development, screening, medicinal and computational chemistry, profiling of compound quality, as well as state-of-the-art compound collections to enable development of chemical tool compounds that are used in basic and applied research to generate groundbreaking insights into complex biological processes – Chemical Biology. Since 2015 LCBU is also a SciLifeLab Satellite.

## Equipment

- HPLC, Gilson
- HPLC, Shimadzu
- Beckman Coulter NxP,
- Synergy H4 with Biostacker, Biotek
- ArrayScan VTI, ThermoScientific
- Beckman Coulter NxP

## Service provided

The focus of LCBU is to provide access to cutting edge expertise and an infrastructure in chemical biology within the following areas:

- Assay development
- Computational chemistry & modelling
- Biochemical, cell-based and phenotypic high-throughput screening
- High-throughput imaging technology
- Hit optimization
- Medicinal chemistry expertise
- General expertise in preparative and analytical chemistry
- Assay development and screening with bacteria, viruses and fungi
- Screening at biosafety level 2

The services offered by LCBU are available through a project prioritization system that all CBCS facilities share. The initial contact for the user is either through the CBCS web page or by direct contact to a CBCS and leads to a “first PI meeting” where CBCS describe the working model and the PI presents the project proposal.

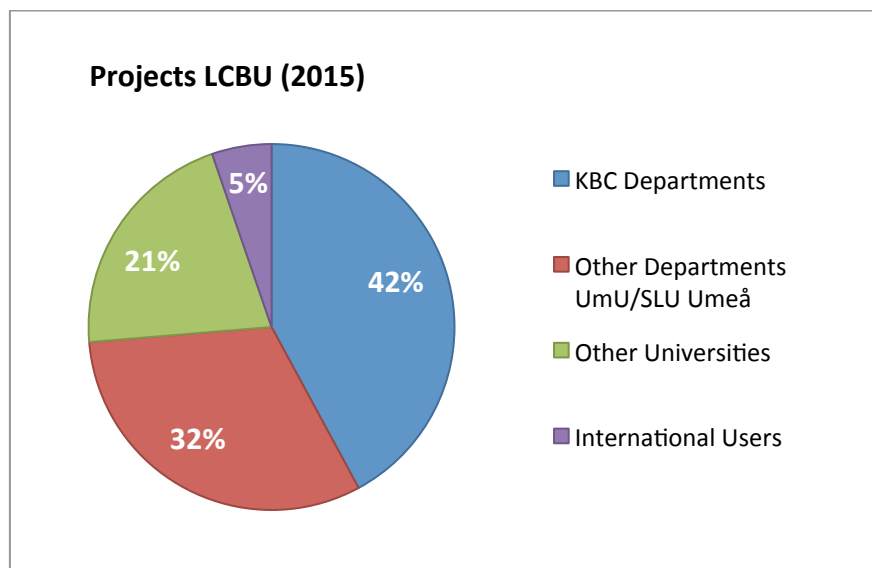
## Contact person

Per-Anders Enquist, Facility Manager  
[pa.enquist@umu.se](mailto:pa.enquist@umu.se)

Mikael Elofsson, professor, Department of Chemistry  
Director of LCBU  
[mikael.elofsson@umu.se](mailto:mikael.elofsson@umu.se)

## Users

LCBU plays an important role in Umeå Centre for Microbial Research and Molecular Infection Medicine Sweden (MIMS, Nordic EMBL partnership). To strengthen plant capacities we collaborate with Umeå Plant Science Center and fragment-based screening is pursued by the national infrastructure NMR for Life.



Budget: The Laboratories for Chemical Biology have not received any funding from KBC. In 2015 it was funded by VR, NordForsk, User Fees, Umeå University, SciLifeLab.

## Teaching

Two courses are currently offered: “Introduction to high throughput screening” (2ECTS), a web-based theoretical course and “Assay development in high throughput screening” (2ECTS), a practical course that gives the basis for experimental work.

## Future development

A new development within LCBU is to develop, in collaboration with UPSC, chemical biology and screening in plants. Also several users have expressed a need for screening capacity at biosafety level 3. The plan is to incorporate a screening unit in the facility, which is planned at Umeå University.

# KBC Core Facility NMR - Nuclear Magnetic Resonance

## Short Summary of the Facility – Activity - Equipment

The KBC Core facility NMR provides access to state-of-the-art NMR equipment and expertise for all researchers in the KBC and Campus environment. This infrastructure is part of the national infrastructure “**NMR for Life**” ([www.nmrforlife](http://www.nmrforlife.se)), funded by KAW (2013-2020) and ScilifeLab (2016, 2017- under review); and operated by the Swedish NMR centre at the University of Gothenburg and at Umeå University. As part of “NMR for Life” the infrastructure grants access to academic and industrial researchers across Sweden.

The KBC Core Facility offers access to the most powerful liquid and solid-state NMR infrastructure in the country with instruments at 850, 600, 500 and 400 MHz, respectively. High-field instruments are equipped for biomolecular solution NMR, robotic sample preparation and high-throughput metabolomics of biofluids. This facility offers nationwide unique solid-state NMR at 850 and 500 MHz for studies of membrane proteins & amyloid fibrils, metabolomics on intact tissues, environmental NMR and fragment-based screening as national support for CBCS.

## Service provided by the infrastructure

The KBC Core Facility operates all NMR instruments available on campus, and serves a large user group from UmU, SLU and companies, see publications. Local users span a remarkably wide range of fields, from materials science, chemical biology and -synthesis, structural biology, plant- and environmental sciences, biogeochemistry to medical metabolomics. Local researchers profit strongly from the facility’s status as national infrastructure, for the following applications:

“NMR for Life” offers nation-wide NMR access in three areas: Liquid- and solid-state structure analysis, metabolite studies and chemical biology. In addition, NMR for Life offers expert assistance throughout a project also for users less proficient in NMR. Three-dimensional structures can be determined for soluble proteins, solid and membrane-bound proteins, nucleic acids and biomolecular complexes.

Metabolite studies, especially 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 NBIS). Through close collaboration with the Swedish Metabolomics Centre, we offer combined NMR- and MS-based metabolomics.

In Gothenburg, a routine workflow for cell-free protein expression and labelling has been established, and specialized procedures are available for obtaining structural data for intrinsically disordered proteins, believed to constitute 1/3 of the human proteome. In Umeå, dedicated solid state NMR equipment allows structural studies of insoluble protein aggregates, such as amyloid fibrils and membrane proteins in their functional lipid environment. In Gothenburg and Umeå, dedicated equipment has been installed for smallest sample sizes and for dynamics studies, respectively.

For chemical biology “NMR for Life” has set up robotic sample preparation combined with dedicated NMR probes for chemical biology. In Umeå, fragment-based screening is routinely performed using substance libraries from - and in interaction with - CBCS (Chemical Biology Consortium Sweden) and LCBU (Umeå).

## Personnel

|                                |   |
|--------------------------------|---|
| <b>Gerhard Gröbner,</b>        | Platform Director, professor, Department of Chemistry                           |
| <b>Jürgen Schleucher,</b>      | Platform Director, professor, Department of Medical Biochemistry and Biophysics |
| <b>Mattias Hedenström, PhD</b> | Service, Department of Chemistry  |
| <b>Tobias Sparrman, PhD</b>    | Maintenance, Department of Chemistry  |

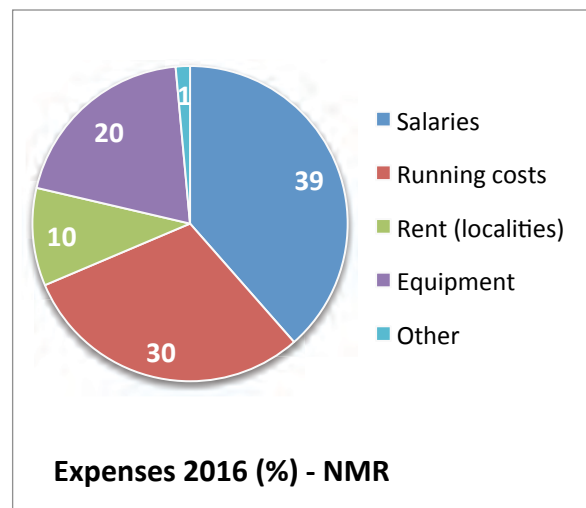
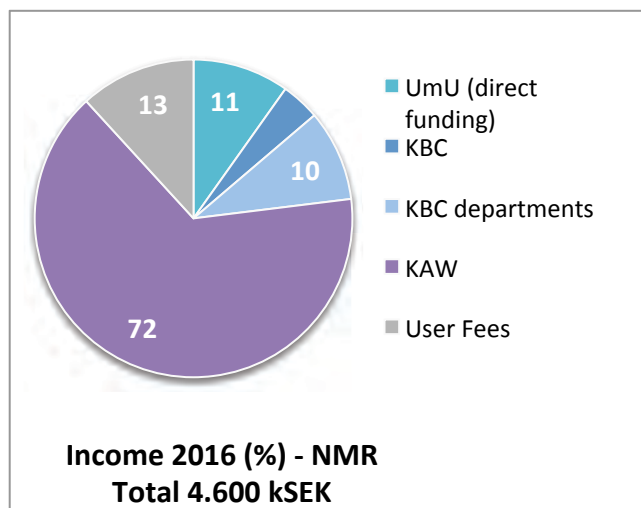
## Steering committee

|   |   |
|---|---|
| <b>Bernt Eric Uhlin,</b>                  | professor Dept Molecular Biology, Director MIMS and Scientific Coordinator UCMR |
| <b>Fredrik Almqvist</b>                   | professor Department of Chemistry   |
| <b>Pernilla Wikström</b>                  | Researcher, Department of Medical Biosciences                                   |
| <b>Per Gardeström</b>                     | professor, KBC Scientific Coordinator, KBC, Department of Plant Physiology      |
| <b>Jürgen Schleucher, Gerhard Gröbner</b> |   |

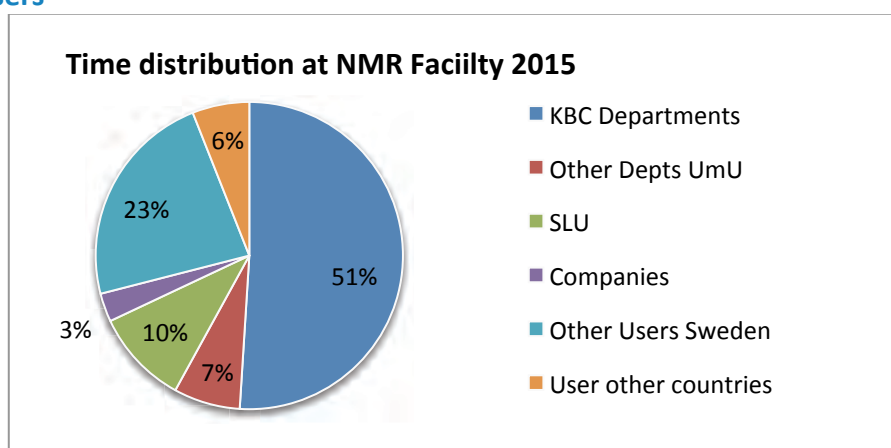
## Contact information

Nuclear Magnetic Resonance (NMR), Chemistry building - 1st floor  
[www.kbc.umu.se/platforms/nuclear-magnetic-resonance.html](http://www.kbc.umu.se/platforms/nuclear-magnetic-resonance.html), [www.nmrforlife.se](http://www.nmrforlife.se)

## Budget



## Users



## Teaching

The infrastructure offers comprehensive training on NMR experiments, metabolomics and data handling, fragment-based drug screening, structure determination. In addition, dedicated symposia and the Swedish NMR Conference are organized. Methods development includes operating procedures for metabolomics, isotopomer-based metabolic regulation, time-optimized data collection, cell-free protein expression, and in general development of novel solution- and solid-state NMR methods and their demonstration in new research fields. NMR module I (license for independent routine use) for was offered within KBC during 2014 and within the Masterprogramme course HT 2015. Advanced NMR tools and applications have been taught in various KBC undergraduate and graduate courses.

Various tours to the NMR lab have been given. A nation-wide NMR metabolomics course will be offered in spring 2016

## Outreach

Swedish NMR Centre (GU and UME) organized Swedish NMR conference in Gothenburg 2014, planned in Umeå 2016. Participating in EU NMR networks and COST MPNS Action TD1103 "European Network for Hyperpolarization Physics and Methodology in NMR and MRI" (G. Gröbner Swedish representative). All Umeå-based NMR groups present the facility and research at national and international conferences, e.g. J. Schleucher invited speaker at photosynthesis GRC conference and European Geosciences General Assembly.

## Future Development

1. The outside funding of the NMR facility is unchanged compared to 2014, because the new KAW funding exclusively covers an extension for 2018-2020. 2. The funding for the SciLifeLab satellite (currently 2016 funded) will be used to cover service to national users, while KAW funding will be used to develop new application fields.

# KBC Core Facility for Proteomics

## Short Summary of the Facility – Activity – Provided Service / Equipment

The KBC Proteomics Core Facility provides infrastructure for research in protein science and proteomics and is located at Department of Chemistry (Umeå University) and at the Department of Forestry Genetics and Plant Physiology (UPSC, SLU). It was initiated in 2003, and it became a core facility of the KBC in 2012. The work of the facility has from the beginning included the entire range of research in life science at Umeå University, the Norrland University Hospital, and SLU. As a result, the services of the facility are requested by 20 to 25 research groups per year from many different departments.

Since 2010, the facility contributed to the projects of more than 150 students, PhD students and researchers at eleven departments of Umeå University and at the Department of Forestry Genetics and Plant Physiology of SLU. This work is documented in 28 publications and acknowledged in seven PhD thesis. Since 2003, the work of the KBC Proteomics Core Facility contributed to 50 publications. A list of these publications is available at the presentation of the facility on the KBC homepage. The staff of the facility analyse during a year between 800 and 1200 samples, which cover a relatively broad range of different levels of complexity.

To keep pace with the development of technology in proteomics, the staff of the facility have regularly applied for external grants for new instrumentation. Since 2004, external grants for more than eight million Swedish crowns came from the Swedish Research Council, the Kempe Foundation, and the Troedsson Foundation. This made it possible to establish very good technology for both qualitative protein analysis and quantitative proteomics including the bioinformatics tools needed for quantitative proteomics on a larger scale. An overview of the current instrumentation is given in table 1. Currently, the staff of the facility is working on developing targeted proteomics applications, which is going to be important for future research.

An important line in the work of the facility was the development of bioinformatics. A milestone in the bioinformatics work at the facility was the installation of the KBC server and the KBC data storage facilities, which were set-up in 2008. In 2012, the facility succeeded in winning funding for a senior research engineer in bioinformatics, who is 50% financed by NBIS and plays an important role for integrating Umeå University into the national network of bioinformatics infrastructures.

## Equipment

### Instruments at the KBC Proteomics Core Facility

- **Synapt G2 si mass spectrometer** from Waters is a high end instrument for qualitative and quantitative analysis of samples with high complexity, and for analysis of post-translational modifications. In addition, some MRM assays for absolute quantitation of individual peptides are possible. This instrument is used together with an ACQUITY-M nano UPLC System (Waters) for ESI LC-MS/MS applications.
- **HCT Ultra ETD II ion trap mass spectrometer** (Bruker) is mainly used for qualitative analyses of samples with lower complexity. Like the Synapt G2si mass spectrometer, it is coupled to an ACQUITY-M nano UPLC System (Waters) for LC-MS/MS applications.
- **Typhoon scanner from GE Healthcare**: a laser fluorescence scanner that is used for a wide range of imaging applications.

## Personnel

**Gunnar Wingsle, professor**  
**Joakim Bygdell, PhD**  
**Thomas Kieselbach, PhD**

Platform manager/director, Forest Genetics and Plant Physiology, UPSC (SLU)  
Senior research engineer, BILS Expert, Department of Chemistry  
Senior research engineer, Department of Chemistry

## Steering committee:

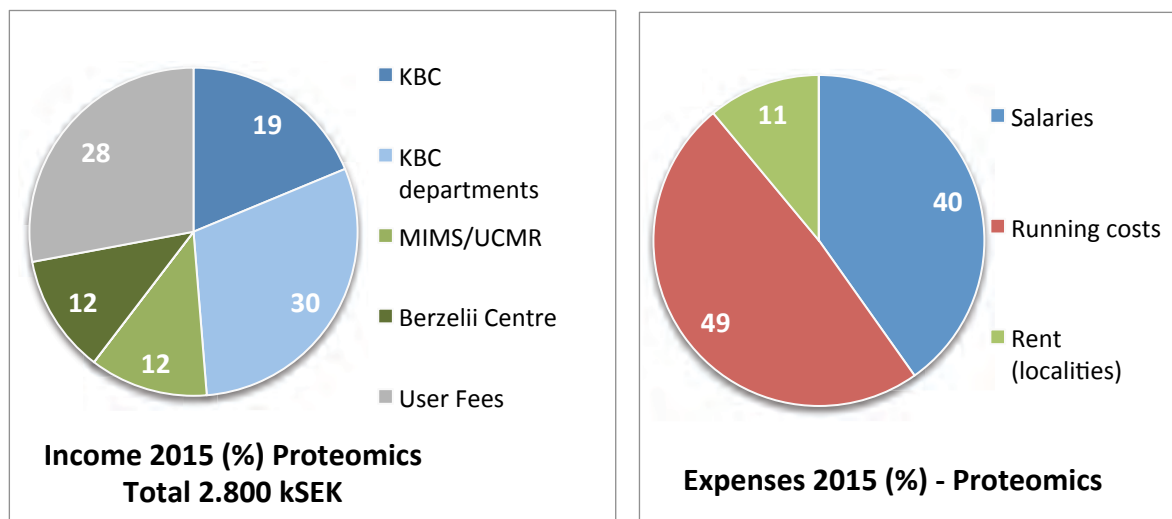
**Per Gardeström**  
**Wolfgang Schröder**  
**Anders Byström**  
**Pernilla Wikström**  
**Sven Carlsson**

professor, KBC Scientific Coordinator; Department of Plant Physiology  
professor, Department of Chemistry  
professor, Department of Molecular Biology  
Researcher, Department of Medical Biosciences  
professor, Department of Medical Biochemistry and Biophysics

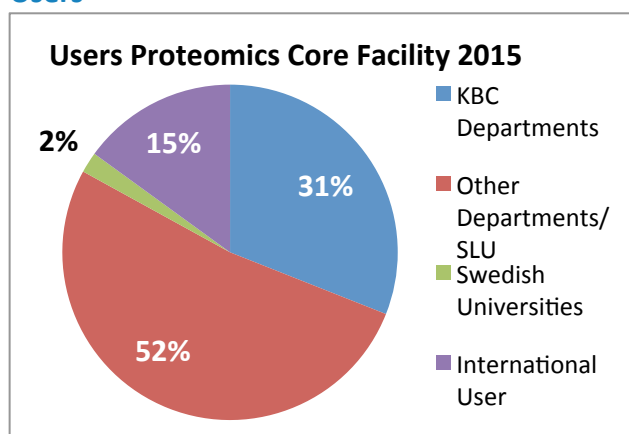
## Contact information:

<http://www.kbc.umu.se/platforms/proteomics.html>

## Budget (2015)



## Users



## Teaching activities

The staff of the facility have organized and taught courses for the graduate schools at the KBC and UCMR and contributed to other courses including: Applied Mass Spectrometry (Dep. of Chemistry), Protein Separation Methods and Analytical Techniques (Dep. of Chemistry), Biophysical-Chemical Concepts (Dep. of Chemistry), Functional Genomics Course (UPSC) and more. Other educational activities include the KBC Mass Spectrometry Day (2011), the Scandinavian Plant Proteomics Day (2012) and bioinformatics workshops in collaboration with SciLifeLab at the BMC Uppsala.

## Future Development

The facility has the goal to improve their instruments and bioinformatics resources to provide research groups in the fields of life sciences at Umeå University and SLU Umeå easy access to advanced analytical techniques at high standard. The facility is also going to focus on developing methods for targeted proteomics that allow for the relative and absolute quantification of selected individual proteins in biological samples due to the fact these assays are becoming increasingly important in many disciplines of life sciences. In addition, the facility is going to collaborate more closely with the core facilities at other Swedish universities to be able to give researchers in Umeå easy access to analytical techniques that are not available in Umeå such as imaging applications.

## Key Publications

*Se appendix 6.*

# Swedish Metabolomics Centre - SMC

The Swedish Metabolomics Centre (SMC; [www.swedishmetabolomicscentre.se](http://www.swedishmetabolomicscentre.se)) is a collaboration between SLU and Umeå University, and was formed 2013 via an infrastructure grant from KAW and co-funding from the two collaborative universities. Since 2016 SMC will also be part of SciLifeLab. The center has two parts, a service component and a research and development component named "Metabolomics 2.0". The main aim of the centre is to support the researchers at Swedish Universities with mass spectrometry-based analysis of metabolites and lipids in biological tissues, furthermore, to become a leading knowledge centre in metabolomics and related areas.

Acceptance of the project is always based on scientific quality where the facility manager decides for small projects (<200 samples). For projects between 200 and 400 samples as well as smaller projects where the facility manager feels unable to make a decision, is the director and/or co-director responsible for the decision. For large projects, > 400 samples, the projects are sent out for external review and decision on the project is taken in consultation with the director and the steering committee. Since 2013 SMC has received more than 250 project requests, where more than 80% of the projects have started. At KBC (UmU, SLU Umeå) more than 40 "open access" user are registered. Open access users can come and have an introduction course in mass spectrometry and thereafter analyze their own samples by "renting" time on instruments.

SMC performs basically two types of analyzes: 1) untargeted metabolite (metabolomics) or lipid profiling by GC-MS and LC-MS; 2) targeted analysis of individual metabolites or metabolite classes with LC-MS or GC-MS (amino acids, fatty acids, TMAO, plant hormones, steroids and others.) The goal is to continue add more methods to the facility's service portfolio, with focus on methods of general interest (see also Metabolomics 2.0).

## Personnel

The director has the overall responsibility for the SMC, including budget and coordination; the three vice-directors have different specific responsibilities with the goal of developing methods of highest class and to integrate them in the service facility's operations. The service platform is led by a facility manager which is the contact person of the facility, and has the daily responsibility for SMC's service business. The facility manager continuously reports to the Director and Vice-Director (responsibility analytical methodology) about the service activity progresses. In addition a the steering group (comprising representatives of several universities, and SciLifeLab) meet twice annually (mainly telephone conferences), decide fees, monitor the platform's performance and customer perceptions, and prioritize projects.

**Thomas Moritz, professor, Director**  
Umeå Plant Science Centre, Dept of Forest Genetics and Plant Physiology

**Anders Nordström, associate professor, Co-director**  
Department of Molecular Biology

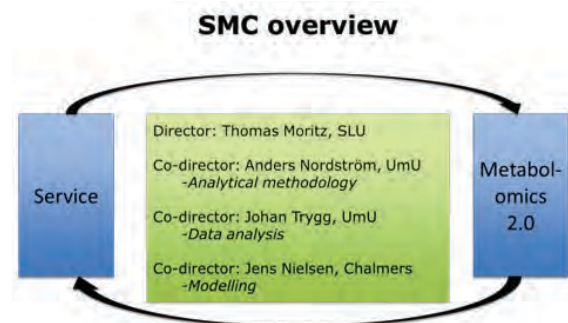
**Jonas Gullberg, PhD, Manager**  
Umeå Plant Science Centre, Department of Forest Genetics and Plant Physiology

## Steering committee

|                   |  |
|-------------------|--|
| Thomas Moritz     | Professor, Umeå Plant Science Centre, SLU (Chair)                |
| Maria Fällman     | Professor, Molecular Biology, Deputy Director MIMS and UCMR, UmU |
| Gunnar von Heijne | Professor, Stockholm University, SciLifelab                      |
| Hindrik Mulder    | Professor, Lund University                                       |
| Jens Nielsen      | Professor, Chalmers Technical University, Gothenburg             |
| Göran Karlsson    | Professor, Gothenburg University                                 |

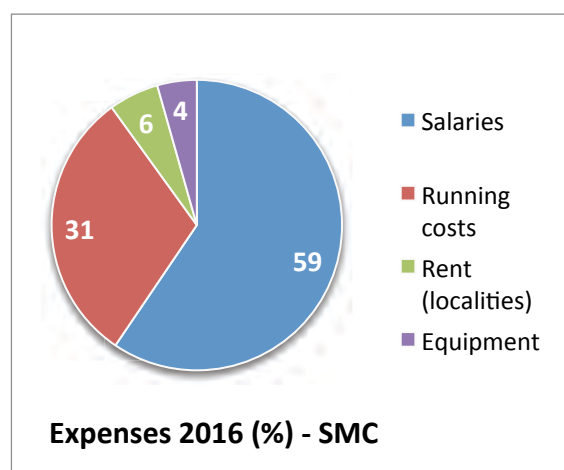
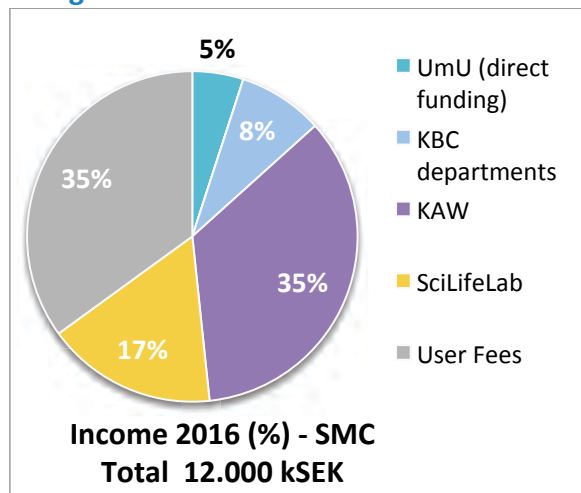
## Contact information for the user/webpage:

Swedish Metabolomics Centre  
KBC Building, Linnaeus väg 6  
SE-901 87 Umeå, Sweden  
[www.swedishmetabolomicscentre.se](http://www.swedishmetabolomicscentre.se)  
[www.kbc.umu.se/platforms/metabolomics.html](http://www.kbc.umu.se/platforms/metabolomics.html)





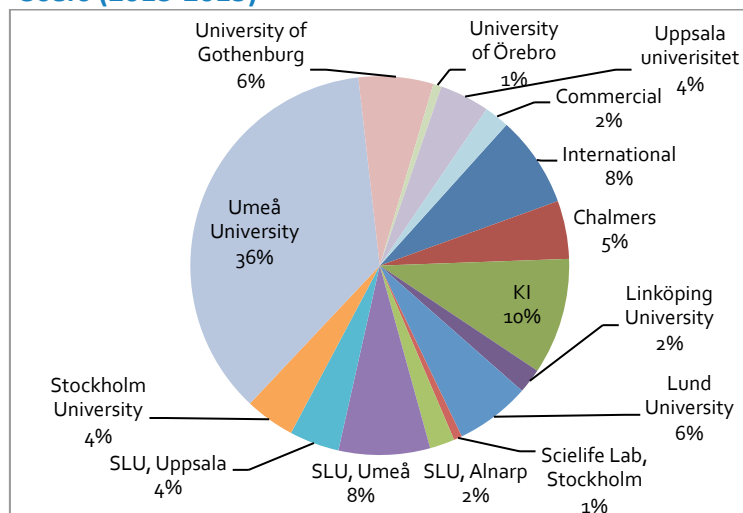
## Budget



(UmU direct funding: Method development call agreed by Metabolomics 2.0 and sponsored by Umeå University)

The facility has currently support from KAW (until 2020) and SciLifeLab (from 2016), besides the co-funding for the Metabolomics 2.0 program. All users must pay a fee for the analysis, which is based on how many samples and the need of help (e.g. sample preparation, statistical analysis, etc.). To make the cost transparent the invoice contains information on full cost and subsidization. During 2016 the expected user fee is approx. 3.5 MSEK.

## Users (2013-2015)



## Teaching activities

Besides the traditional types of courses (PhD courses in metabolomics and related areas on regular basis is the aim) the facility has continued with its development of the “open access lab” where users can come and have an introduction course in mass spectrometry and thereafter analyze their own samples by “renting” time on instruments. Besides optimize the usage of instruments this will also spread practical knowledge about mass spectrometry.

## Future Development: Metabolomics 2.0

SMC has an ongoing research and development program in metabolomics called “Metabolomics 2.0” partly funded by the two universities. The next phase in Metabolomics 2.0 is a call for support for method development relating to metabolite or metabolomics analysis. The call is directed towards principal investigators (PI’s) active in Umeå whose projects either in some aspect already involves small molecules/metabolites or metabolomics analysis or that have a need for the development (or adaptation) of analytical protocols for specific metabolites or metabolomics analysis in sample types for which there currently is not any established protocols available at SMC.

## Selected Publications

Se appendix 6.

# Umeå Core Facility for Electron Microscopy - UCEM

## Summary of the Facility

UCEM gathers all electron microscopy equipment and methodology in Umeå. The facility was started in 2007 by a common initiative from KBC, UPSC and UCMR/MIMS. The facility provides conventional TEM and SEM methods to all UmU faculties and SLU, and has also obligations as a national research infrastructure. With support from individual researchers and the research centres at Umeå University the facility has developed a basic research service unit to a multifunctional core facility for advanced electron microscopy. This development was possible with funding by VR-RFI and the Wallenberg Foundations as result of a MIMS –coordinated funding application of a national network for Electron Microscopy.

UCEM houses a large variety of electron microscopy infrastructure, imaging and sample preparation equipment. The facility staff provides service and training to users. We are now developing the labs into user-friendly environments where students and scientists can perform advanced sample preparation and imaging under facility staff supervision. The facility staff maintains instruments and support users with know-how and method development for interdisciplinary research. Important for UCEM is the collaboration with other local core facilities at UmU/SLU, and the contact to national and international imaging and electron microscopy networks, for example Swedish Bioimaging and its collaborators and the Electron Microscopy Facility at EMBL-Heidelberg, Germany (supported by MIMS in Umeå, the Swedish node in the Nordic EMBL Partnership for Molecular Medicine).

Academic users at UCEM have the same access and subsidised user fees. Non-academic users are welcome for an adequate extra fee. Basic TEM services include cell and tissue fixation, resin embedding methods, ultra microtome sectioning, staining of sections, microorganisms and protein samples, Tokuyasu sectioning, immune labelling and TEM analysis. The Field emission scanning electron microscope (FE-SEM) is a national resource for high-resolution imaging, with a great configuration of multiple detector systems (TTL, ETD, EsB, AsB, STEM, EDS) operating and under room temperature and cryo conditions. The new cryo-EM facility will be established during 2016. Together with the Biochemical Imaging Centre Umeå (BICU), UCEM provides correlative light and electron microscopy (CLEM) imaging on a national basis.

## Personnel

**Linda Sandblad**, Assistant Professor, Molecular Biology,  
Facility coordinator and contact person

**Cheng Choo Lee** (Nikki), PhD, Plant Physiology  
Senior Research Engineer for SEM

**Sara Henriksson**, PhD, Plant Physiology  
Senior Research Engineer for TEM

**Agnieszka Ziolkowska**, PhD, Plant Physiology  
Senior Research Engineer for TEM

## Steering committee

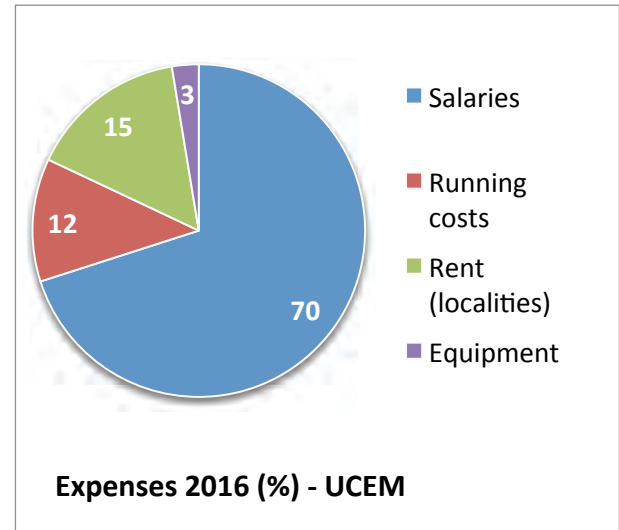
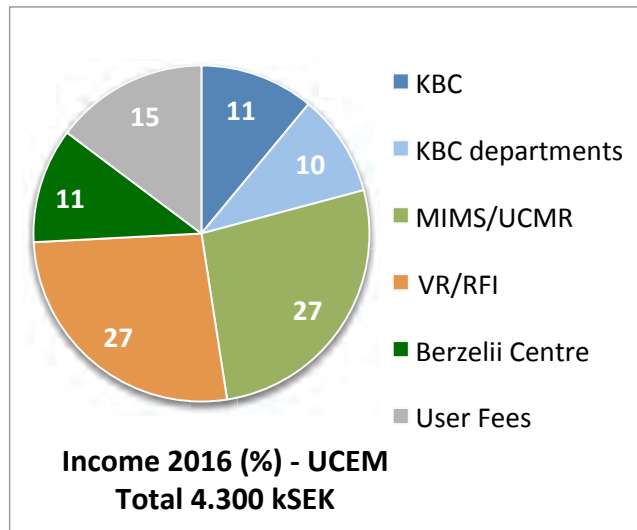
|                     |   |
|---------------------|---|
| Per Gardeström      | Professor, Scientific Coordinator for KBC, Plant Physiology |
| Bernt Eric Uhlin    | Professor, Director of MIMS and UCMR, Molecular Biology     |
| Åke Forsberg        | Lecturer, Molecular Biology                                 |
| Thomas Wågberg      | Lecturer, Physics, UmU                                      |
| Linda Sandblad      | Assistant Professor, Molecular Biology                      |
| Karl-Eric Magnusson | Professor, Clinical and Experimental Medicine, Linköping    |
| Kristian Riesbeck   | Professor, Medical Microbiology, Lund/Malmö                 |

## Contact information for the user/webpage

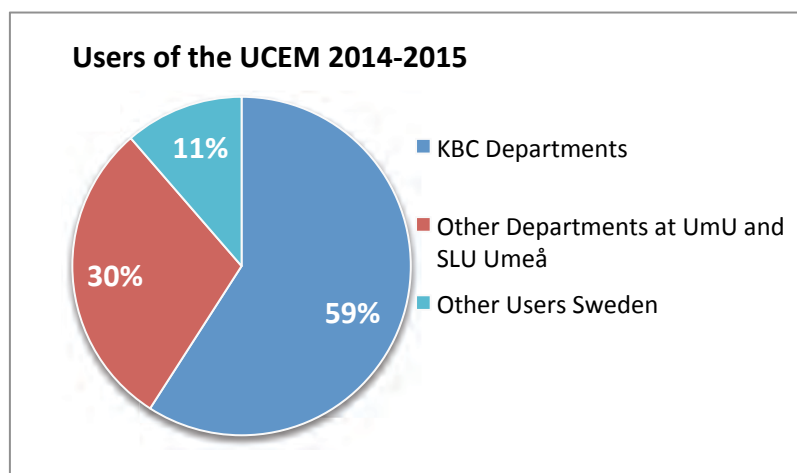
Umeå Core Facility Electron Microscopy (or EM Platform)  
Chemical Biological Centre (KBC) Building, House B, Level 5, Umeå University  
SE-901 87 Umeå, Sweden  
<http://www.kbc.umu.se/platforms/ucem.html>

Contact person:  
Dr. Linda Sandblad  
Department of Molecular Biology  
+46709324936  
[linda.sandblad@umu.se](mailto:linda.sandblad@umu.se)

## Budget – UCEM



## Users/Collaboration partners of the UCEM



## Teaching activities

UCEM is actively taking part in the international development of EM methods. We organize yearly basic and practical courses for our local students, postdoc and staff from both the Faculty of Science and Technology and the Faculty of Medicine and regularly invite to user meetings. UCEM also offers one-to-one training on specimen preparation & microscope operation and organizes international workshops on frontline SEM methods and applications for life sciences and medicine.

## Future Development

A new lab for UCEM is under construction and will house 4 microscope rooms, a humidity controlled lab for cryo-EM sample preparation, a lab for conventional and experimental TEM sample preparation, 3 small offices with total space for 6 employees and/or visitors, space for meetings and PhD students, postdocs and other visitors will be provided.

Depending on the outcome of the installation we hope to welcome users and open for service project proposals during the autumn 2016.

## Selected Publications

*Se appendix 6.*

# Vibrational Spectroscopy Core Facility - ViSP

## Short Summary of the Facility

This uniquely equipped facility provides FT-IR and Raman spectroscopy and microspectroscopy services. It has state-of-the-art instrumentation and methodology to detect (and localise at micron and submicron level) chemical changes in a wide range of samples, at high speed and low cost, non-destructively and label-free. Due to the exceptional versatility of the techniques, example projects covers a wide range of scientific disciplines and applications, from materials sciences (nanotechnology, semiconductors) to plant sciences (high-throughput chemotyping/screening, investigating the effects of gene manipulations or environmental factors), from chemistry (absorption on mineral surfaces, real-time, in situ monitoring of reactions, protein conformational changes) to medicine (assessing tissue compositional changes under various pathological conditions, diagnosing and monitoring disease onset and progression, drug targeting and molecular mechanistic studies)

## Equipment

ViSp provides Fourier-transform infrared (FTIR) and Raman (micro)spectroscopy services, using state-of-the-art instrumentation (vacuum bench FTIR spectrometers, FTIR microscopes with focal plan array detectors, high resolution confocal Raman microspectroscopy, with 5 different laser lines), custom-built accessories and tailor-made data analysis methods to detect, localise and visualise chemical changes in various sample materials. This constellation provides such unique possibilities that international users from e.g. Switzerland, Poland and the UK choose to perform measurements at ViSp instead of their home institutes. The infrastructure is also part of the Euro-Bioimaging Project via the Swedish Bioimaging Network.

## Service provided by the platform

The infrastructure is open access and provides service and access for local KBC and Campus groups as well as Swedish and international academic and industrial partners. In addition to providing service for a large number of users, resulting in a steadily increasing number of publications (see statistics below), there is active method development at ViSp, include both hardware (such as instrument accessories, prompting commercial interest from a large international instrument manufacturer and attracting users from outside Umeå) and software (a free, open-source software package, which set the de facto standard in the field, and resulted in a Nature Protocols publication and wide international interest). Taken together, this grants ViSp an exceptional reputation that reaches far beyond Umeå and Sweden, and even outside of academia.

## Personnel

**András Gorzsás, PhD**  
Platform manager

## Steering committee

**Thomas Wågberg** (chairman)  
**Madeleine Ramstedt**  
**Thomas Moritz**

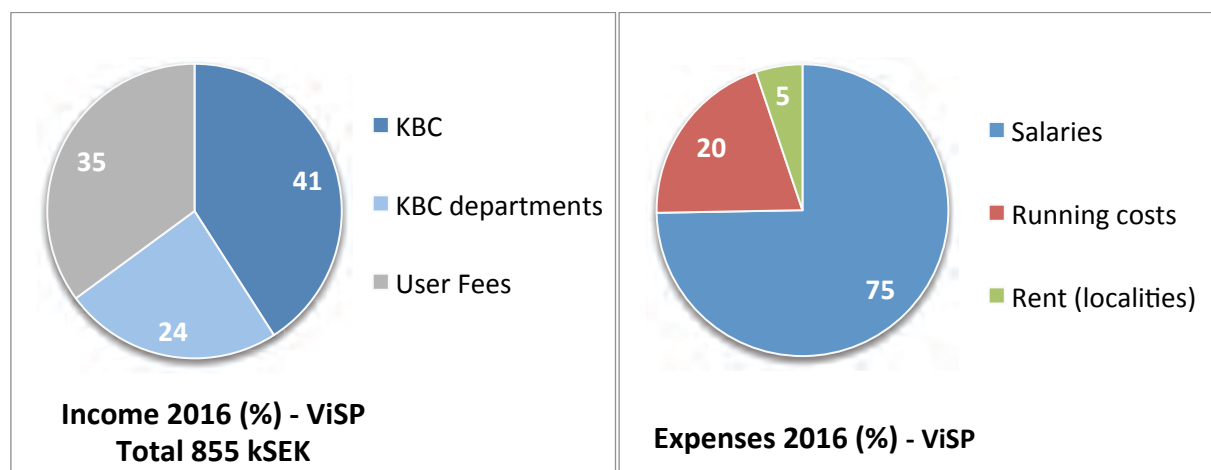
Lecturer, Dept. of Physics, Umeå University  
Researcher, Dept. of Chemistry, Umeå University  
Professor, Dept. of Forest Genetics and Plant Physiology, SLU

## Contact information

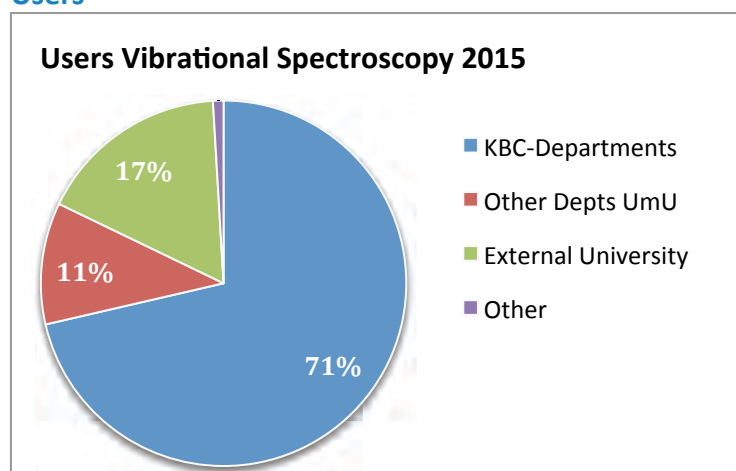
Chemistry Department, B building, floor 1 (microspectroscopy) and floor 6 (spectroscopy)  
Linnaeus väg 10,  
SE-907 36 Umeå

<http://www.kbc.umu.se/platforms/vibrational-spectroscopy-platform.html>

## Budget



## Users



## Teaching activities

The Vibrational Spectroscopy User License Course is developed by the manager specifically to enable users to run their own measurements with minimum setup/supervision. It is run twice a year, giving a basic introduction to vibrational spectroscopy in general and to train users in the practicalities of the instruments available at ViSp. It can accommodate 15 people / course, but interest is generally higher than that, including external participants (from other Swedish universities and even abroad). In addition, ViSp also participates in several undergraduate courses at various departments at Umeå University and SLU.

## Future Development

In order to stay up-to-date and maintain a high research profile (i.e. avoiding to become a service-only facility), method development will continue. Currently, such work is free of charge for the users, but in the future, dedicated research grants and projects should contribute to fund such activities.

Following the departure of the two main founders and users, ViSp is working actively to bring in new major users from different fields of science, including plant sciences and geochemistry (the fields of the main users that have left) as well as microbiology and medicine (fields that are currently underrepresented but have strong research environments in Umeå).

# Other Infrastructures within the KBC environment

Two infrastructures act as core facilities by offering service for a broad user group within and outside of the KBC environment. These infrastructures did not receive any support from the KBC environment yet.

## Protein Expertise Platform - PEP

### Short summary of the facility

PEP started as a spin-off of the "Protein Dynamics, Structure and Function" strong research environment that received funding from the UmU faculty 2011 and 2015. The PEP provides researchers with expert advice and advanced services in questions of bioinformatics, cloning, bacterial growth optimization and protein production.

### Service provided:

PEP provides researchers with the materials necessary for cloning and protein expression, and carries out standard cloning and mutagenesis, e.g. PCR, ligation, sub-cloning, transformation and plasmid preparation. Upon request and after thorough discussion, advanced, non-standard cloning projects can be accepted as well. PEP sets-up small scale growth cultures to screen for expression levels and protein solubility. If customers require large volume cultivation, PEP is able to scale up the culture size up to 20 L.

Protein purification is normally made by Immobilized Metal Affinity Chromatography (IMAC). The concentration of the purified protein is determined by UV spectrophotometry. Upon request PEP can also carry out CD measurements to determine secondary structure content, mass-spectrometric analysis to confirm the molecular weight of full length proteins, or to identify truncations and post-translational modifications. In addition, NMR spectroscopy can be applied to identify flexible parts of the protein or structural disorder.

### Organization and board

Dr. Mikael Lindberg is the platform manager and Dr. Uwe Sauer is the coordinator. The board consists of Prof. Stefan Björklund (Dept. of Med. Chem. & Biophys, Med. faculty), Prof. Elisabeth Sauer-Eriksson, Assoc. Prof. Magnus Wolf-Watz and Assoc. Prof. Uwe Sauer (Dept. of Chemistry, Tech. Nat. faculty).

### Contact:

**Mikael Lindberg**

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Tel: +46907868023

[www.pep-umu.se](http://www.pep-umu.se) and [www.kbc.umu.se/platforms/pep-protein-expertise-platform.html](http://www.kbc.umu.se/platforms/pep-protein-expertise-platform.html) )

**Christin Grundström**

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**Uwe Sauer**

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Tel: +46907865930

### Users

Between 2013 to 2015 the PEP was approached by 47 PI:s who requested about 130 assignments which resulted in more than 360 completed projects. Within Umeå University the customers represented two faculties and over 17 different departments/institutions/research centres. External PEP customers came from 5 Swedish universities (University of Gothenburg, SLU, KI, Uppsala University and Chalmers Technical University).

### Teaching activities

Staff from the PEP has regularly participated in the "Cloning, Protein Expression and Purification" (CPEP) courses, which were part of the joint UCMR & UPSC graduate school. More than 160 PhD-students and post-docs participated over the years. PEP has also contributed to the "Protein Crystallization" and the "Basic Bioinformatics" courses.

### Future Development

It will be crucial for the survival of PEP in Umeå to receive local funding. PEP has also participated in national discussions to form a "Protein Production Network Sweden" (PPNS). The network intends to complement each other with different expression hosts and techniques.

# The NIR-X Platform

## Short summary

Near infrared (NIR) spectroscopy is a technique that measures overtones (harmonics) from the IR region. NIR has a relatively large sample penetration depth so little or no sample preparation is needed. The measurement is fast, typically 0.5 - 4 min, and some equipment can also be used in the field. The technique can be used on all biological and clinical materials and it is also possible to measure inorganic materials (geological and archaeological specimens). Typical measurements on organic materials are: food, feed, biomass, biofuel, clinical samples, pharmaceutical and environmental samples. The platform started in 2013 and provides spectroscopy and image analysis in UV (375 nm), VIS and NIR (400-2500 nm) wavelengths for chemical and physical characterisation of all types of samples.

## Equipment

- Videometer 375-970 nm in 19 wavelengths (UV-VIS-NIR)

Prediktera Sisuchema linescanning 1000-2500 nm (near infrared) 380 pixel x 268 wavelengths. Belt drive for moving the samples. As above but setup for macro imaging in reflection and/or transmission. Best for higher magnification/small samples.

## Service

Hyperspectral imaging using:

- Images with high spatial resolution 2050x2050 nm.
- Software from Prediktera for image registration (Breeze) and analysis (Evince). The images consist of reflection spectra.

NIR spectroscopy using

- Perten reflectance on solids with different sample presentation solutions
- Foss reflectance on solids and liquids using sample cells
- Tec5 Spectrometers reflectance and transmission. For liquids with flow-through cells.
- Xray Fluorescence Thermo, works on solids

## Organization and contact

Paul Geladi, professor, and Torbjörn Lestander, associate professor, both at the Department of Forest Biomaterials and Technology (SLU) are responsible for the NIR-X platform and coordinating the activity.

The steering group represents the users: Richard Bindler (EMG, UmU), Johan Linderholm (Archeology, UmU), Christian Lejon (FOI), Paul Geladi, John Ball and Torbjörn Lestander (SLU).

## Users

The NIR-X platform has users from SLU and UmU and external users: Department of Forest Biomaterials and Technology (SLU), Department of Wildlife, Fish, and Environmental Studies (SLU), Archeology (UmU), FOI Örebro University

## Education

The NIR-X Platform is involved in teaching of basic courses

A short course on hyperspectral image analysis is in preparation. In May 2014 the platform participated in the Hyperspectral Day with international invited speakers organised at KBC.

## Contact

Paul Geladi, professor, Department of Forest Biomaterials and Technology (SLU)

Email: paul.geladi@slu.se

Phone: 090-7868793, 070-2709473

<http://www.slu.se/en/departments/forest-biomaterials-technology/laboratory-facility/near-infrared-nir-spectroscopy/>

[www.kbc.umu.se/nir-x](http://www.kbc.umu.se/nir-x) (new website from 1 May 2016)



# The X-ray Crystallography Platform

## Short summary

The platform started in 2011 and provides crystallographic expertise and access to state of the art equipment. Single crystal X-Ray Diffraction (XRD) allows atomic resolution structure determination of small molecules and macro-molecules such as proteins, DNA, RNA, and their complexes. XRD is ideally suited for "High Throughput Screening" and "Fragment Based Drug Discovery" with the aim to determine the structure of proteins with bound drug candidates. In addition, the equipment has been used for powder and fibre diffraction.

## Equipment

A nano-drop crystallization robot (mosquito<sup>®</sup>, TPP LabTech) is available for screening of crystallization conditions. A state-of-the-art X-ray diffraction system (X8 PROTEUM, Bruker AXS) consisting of a MicroStar-H rotating anode X-ray generator equipped with advanced Helios MX multilayer X-ray focusing optics that produce a high brilliance, fine focused beam of monochromatic Cu-K $\alpha$  radiation ( $\lambda = 1.54 \text{ \AA}$ ). A kappa goniometer positions the crystals in the beam and a CryoStream 700 (Oxford) maintains them at 100K during data collection onto a high sensitivity PLATINUM135 CCD detector. Data collection and analysis is supported by high-end computing equipment and sophisticated software. The platform has direct access to an Agilent 1200 Series High-Throughput LC/UV/Mass-Spec system.

## Service

- Screening of crystallization conditions using the nano-drop pipetting robot (mosquito<sup>®</sup>)
- Evaluation and scoring of crystallization screens
- Optimization of initial screens
- Diffractions tests and iterative crystal optimization (diffraction quality and resolution)
- Full diffraction data collection incl. data processing and data analysis
- X-ray crystal structure determination, refinement and validation
- Deposition of coordinates with the Protein Data Bank (PDB) or the Cambridge Structural Database (CSD)
- Compound screens: co-crystallization with fragments and compounds (in collaboration with LCBU)
- Cryogenic preservation of crystals (vitrification) and storage in liquid nitrogen
- powder data collection

## Organization and contact

Uwe Sauer is in charge of the XRD platform: e-mail: [uwe.sauer@umu.se](mailto:uwe.sauer@umu.se)

The board consists of Prof. Elisabeth Sauer-Eriksson, Dr. Uwe Sauer, Doc. Karina Persson and Dr. Ronnie Berntsson.

Home page: <http://www.kbc.umu.se/platforms/xray-platform.html>

## Users

The XRD platform was used by 35 PI:s from 7 departments/centres, two Universities and FOI.

## Education

Courses given include: Crystallization & Basic X-ray diffraction, part of the Master's program in Chemistry; Structural Biology course for Biotechnology students and methods courses on the PhD level.

## Definitions: Core Facilities – Technical Platforms – User Groups

### *Three categories of research infrastructures exist at KBC*

During 2012 representatives from KBC group and infrastructures at KBC evaluated the organisation of the scientific infrastructures at KBC. The group presented a proposal for re-organisation and new definitions for the infrastructures, which was later in fall 2012 approved by KBC group.

The new definitions **Core Facilities, Technical Platform, User Group** are based on the infrastructure's availability, management and internal organisation, participation in teaching, service and booking system, economy, and follow-up as detailed below.

#### **The following definitions are now valid for KBC infrastructures**

##### **A. Core Facilities (CF)**

This infrastructure offers service in technologies, which are of broad interest for several research groups/departments and faculties at KBC. The core facility should have the ambition to be considered as a national resource-

A KBC Core Facility should have a manager appointed by the KBC group. A broad steering group representing users and funding departments/research organisations is appointed.

The core facility offers research service and established a user fee system. The booking of the service is available by webpage. Updated information about the core facilities' service and contact persons should be available on the KBC webpage and a short information should be regularly presented on KBC days or other meetings.

The core facility offers regularly courses on beginners or more advanced levels.

The KBC group can grant financial support after application and the KBC group is striving after joint financial support. An annual budget is provided by the core facility in agreement with the steering group. The KBC group approves the budget after consulting the head(s) of the department(s) involved.

A core facility is reporting once a year to the KBC group and every third year the infrastructure is evaluated.

##### **B. Technical Platform (TF)**

The technical platform provides a research support, which is needed by research groups from one or more different KBC departments. The management of a technical platform can vary and is not appointed by the KBC group. The steering group is representing local departments and funding organisations.

The technical platform provides service after agreement and a general booking system may be available. The platform publishes updated information on the KBC webpage. The platform may offer courses.

Usually the technical platform is not receiving funding from KBC but the KBC group is writing supporting letters for applications. An annual short report is provided as well as an annual follow-up of the activities.

##### **C. User-group (UG)**

Two or more research groups share research equipment or techniques. The responsible head of a user group is not permanent appointed and the activity is based on collaborations between a few research groups. Service for other research groups is usually not provided.

User groups may organise courses but is not regularly involved in teaching. An annual report is voluntarily provided and the user group will evaluate its activities annually.

## Declaration of interest to be considered as a KBC infrastructure

Application for (a core facility/technical platform/user group) should include the following:

- Name of the infrastructure
- General use of the technique
- Head of the infrastructure/responsible person for the infrastructure
- Service and booking
- Information
- Teaching
- Economy

### Summary in Swedish

|                             | Core facilitet (CF)  | Teknikplattform (TP)  | User-group (UG)  |
|-----------------------------|--|---|--|
| Teknikens "allmängiltighet" | Teknik av brett intresse för många forskar-grupper från flera institutioner/fakulteter. En Core facilitet bör om möjligt sträva efter att klassas som en nationell infrastruktur.  | Teknik/instrument av intresse för forskargrupper från en eller flera institutioner                      | Samutnyttjande av instrument eller teknik mellan två eller flera forskargrupper        |
| Ledning                     | CF manager utsedd av KBC gruppen   | Ledning utsedd av annan än KBC gruppen  | Kan variera  |
| Styrning                    | En bred styrgrupp som representerar olika intressenter bland brukare och finansiärer   | Lokal styrgrupp   | Samarbete mellan forskargrupper  |
| Service och bokning         | Service erbjuds till bestämd taxa och med fast organisation. Lättillgängligt boknings-system finns på KBC:s hemsida  | Service kan erbjudas efter överens-kommelse. Allmänt bokningssystem kan finnas                          | Ingen organiserad service utan detta ordnas på samarbetsnivå. Normalt ej öppen bokning |
| Information                 | Uppdaterad information på KBC:s hemsida. Regelbundna informationsmöten vid KBC dagar eller andra tillfällen.   | Uppdaterad information på KBC:s hemsida.  | Uppdaterad information på KBC:s hemsida.   |
| Undervisning                | Regelbundna kurser på olika avancerade nivåer erbjuds,   | Kan förekomma   | Kan förekomma  |
| Ekonomi                     | Stöd kan erhållas från KBC. KBC gruppen verkar aktivt för en gemensam lösning av finansieringen. Budgetförslag upprättas årligen av respektive CF ansvarig i samråd med styrgruppen och fastställs av KBC gruppen efter samråd med prefekt(er) för berörd(a) värdinstitution(er) | Normalt ej direkt stöd från KBC men stödbrev för ansökningar kan ges efter information till KBC gruppen | Ej direkt stöd från KBC  |
| Rapportering                | Årligen till KBC gruppen   | Kort årlig redogörelse  | Frivilligt   |
| Uppföljning                 | Grundlig översyn vart 3:e år   | Årlig uppföljning   | Årlig uppföljning  |

**Nationalities represented at KBC**

(January 2016, not included Depts of Chemistry and Medical Biochemistry and Biophysics)

| Country        | People | Percent |
|----------------|--------|---------|
| Algeria        | 1      | 0,2     |
| Argentina      | 2      | 0,5     |
| Australia      | 3      | 0,7     |
| Austria        | 2      | 0,5     |
| Belgien        | 2      | 0,5     |
| Brazil         | 2      | 0,5     |
| Bulgaria       | 1      | 0,2     |
| Canada         | 4      | 0,9     |
| Chile          | 3      | 0,7     |
| China          | 26     | 6,0     |
| Czech Republic | 4      | 0,9     |
| Denmark        | 3      | 0,7     |
| Finland        | 11     | 2,5     |
| France         | 18     | 4,2     |
| Germany        | 30     | 6,9     |
| Greece         | 3      | 0,7     |
| Hong Kong      | 1      | 0,2     |
| Hungary        | 5      | 1,2     |
| India          | 11     | 2,5     |
| Iran           | 7      | 1,6     |
| Iraq           | 2      | 0,5     |
| Ireland        | 1      | 0,2     |
| Island         | 1      | 0,2     |
| Italy          | 8      | 1,9     |
| Japan          | 2      | 0,5     |
| Malaysia       | 1      | 0,2     |
| Mexico         | 1      | 0,2     |

|                       |            |              |
|-----------------------|------------|--------------|
| Netherlands           | 1          | 0,2          |
| New Zealand           | 1          | 0,2          |
| Norway                | 2          | 0,5          |
| Poland                | 11         | 2,5          |
| Portugal              | 1          | 0,2          |
| Romania               | 3          | 0,7          |
| Russia                | 3          | 0,7          |
| Rwanda                | 1          | 0,2          |
| Slovakia              | 2          | 0,5          |
| Slovenia              | 1          | 0,2          |
| South Africa          | 2          | 0,5          |
| South Korea           | 1          | 0,2          |
| Spain                 | 7          | 1,6          |
| Sri Lanka (ex-Ceilan) | 1          | 0,2          |
| Sweden                | 210        | 48,6         |
| Switzerland           | 4          | 0,9          |
| Taiwan                | 1          | 0,2          |
| The Netherlands       | 5          | 1,2          |
| Turkey                | 2          | 0,5          |
| Uganda                | 1          | 0,2          |
| Ukraine               | 1          | 0,2          |
| United Kingdom        | 8          | 1,9          |
| USA                   | 6          | 1,4          |
| Venezuela             | 2          | 0,5          |
| <b>Total</b>          | <b>432</b> | <b>100,0</b> |

**People at KBC (January 2016) - overview over positions**

| Male/Female            | Professor | Associate-/Assistant Professor | Postdoc    | Senior Research Engineer | PhD Student | Technician | Administrator | Other     | SUM        |
|------------------------|-----------|--------------------------------|------------|--------------------------|-------------|------------|---------------|-----------|------------|
| <b>EMG</b>             |           |                                |            |                          |             |            |               |           |            |
| male                   | 9         | 22                             | 7          | 5                        | 13          | 6          | 1             | 8         |            |
| female                 | 4         | 8                              | 10         | 6                        | 20          | 4          | 4             | 10        | <b>137</b> |
|                        |           |                                |            |                          |             |            |               |           |            |
| <b>Chemistry</b>       |           |                                |            |                          |             |            |               |           |            |
| male                   | 19        | 27                             | 15         | 32                       | 24          | 7          | 1             | 5         |            |
| female                 | 4         | 9                              | 16         | 17                       | 28          | 5          | 9             | 6         | <b>224</b> |
|                        |           |                                |            |                          |             |            |               |           |            |
| <b>UPSC/Plant Phys</b> |           |                                |            |                          |             |            |               |           |            |
| male                   | 8         | 7                              | 12         | 2                        | 11          | 1          |               | 3         |            |
| female                 | 4         | 5                              | 12         | 5                        | 13          | 2          | 2             | 2         | <b>89</b>  |
|                        |           |                                |            |                          |             |            |               |           |            |
| <b>UPSC/Genfys</b>     |           |                                |            |                          |             |            |               |           |            |
| male                   | 10        | 5                              | 21         | 5                        | 10          | 4          | 1             |           |            |
| female                 | 2         | 7                              | 15         | 4                        | 12          | 14         | 4             |           | <b>114</b> |
|                        |           |                                |            |                          |             |            |               |           |            |
| <b>Physics</b>         |           |                                |            |                          |             |            |               |           |            |
| male                   | 6         | 20                             | 4          | 5                        | 13          | 3          | 0             | 8         |            |
| female                 | 2         | 4                              | 1          | 1                        | 3           | 0          | 4             | 2         | <b>76</b>  |
|                        |           |                                |            |                          |             |            |               |           |            |
| <b>Medchem</b>         |           |                                |            |                          |             |            |               |           |            |
| male                   | 7         | 4                              | 12         | 5                        | 9           | 1          |               | 4         |            |
| female                 | 1         | 2                              | 4          | 13                       | 3           | 5          | 3             | 2         | <b>75</b>  |
|                        |           |                                |            |                          |             |            |               |           |            |
| <b>TFE unit</b>        |           |                                |            |                          |             |            |               |           |            |
| male                   | 3         | 3                              | 1          | 1                        | 8           | 1          |               | 1         |            |
| female                 |           |                                |            | 1                        | 5           |            | 1             |           | <b>25</b>  |
|                        |           |                                |            |                          |             |            |               |           |            |
| <b>SBT</b>             |           |                                |            |                          |             |            |               |           |            |
| male                   | 1         | 6                              |            |                          | 1           | 2          |               |           |            |
| female                 |           | 2                              | 1          |                          | 2           | 1          |               |           | <b>16</b>  |
| <b>Total</b>           | <b>80</b> | <b>131</b>                     | <b>131</b> | <b>102</b>               | <b>175</b>  | <b>56</b>  | <b>30</b>     | <b>51</b> | <b>756</b> |

## The KBC Postdoctoral Programme - supported by the Kempe foundations

| Name/Department/<br>Supervisor/Collaboration | Project   | Supervisors  |
|--|---|--|
| <b>Recruitment 2007</b>                      |   |  |
| <b>Céline Davoine</b>                        | The role of the Mediator complex-co-activator of general RNA polymerase machinery- as an integrator of the environmental cues to the regulation of the transcription, and more particularly the flowering time.             | Stefan Björklund, Medical Biochemistry<br>Ove Nilsson, Gunnar Wingsle UPSC/SLU   |
| <b>Sarantis Giatrellis</b>                   | Protein-mediated remodeling of biological membranes. Exploration of lipid rafts   | Sven Carlsson, Medical Biochemistry and Biophysics, Richard Lundmark, Medical Biochemistry and Biophysics, Göran Lindblom, Chemistry Ove Axner, Physics  |
| <b>Yogesh Mishra</b>                         | Are plants cultivated in growth chamber actually the same plant grown outdoor-A study using cooperative proteomics, metabolomics and transcriptomics?   | Stefan Jansson, UPSC<br>Wolfgang Schröder, Chemistry<br>Uwe Sauer, Chemistry   |
| <b>Gergely Molnar and Ioana Gaboreanu</b>    | A systems biology approach to elucidate the mechanisms underlying enhancement of growth in hybrid aspen   | Rishikesh Bhalariao, UPSC, Johan Trygg, Chemistry; Torgny Näsholm, UPSC<br>Thomas Moritz, UPSC; Vaughan Hurry, UPSC  |
| <b>Shi Tang</b>                              | The light-emitting electrochemical cell (LEC)   | Knut Irgum, Bertil Eliasson, Chemistry<br>Ludvig Edman, Physics  |
| <b>Izabella Surowiec</b>                     | Metabolomics and chemometric bionformatics to find markers for tumor detection, prognosis, progression and therapy prediction: prostate, ovarian and brain malignancies   | Henrik Antti, Chemistry<br>Tommy Bergenheim, Pharmacology and Clinical Neuroscience, Neurosurgery<br>Eva Lundin, Medical Biosciences,<br>Pernilla Wikström, Medical Biosciences,<br>Thomas Moritz, UPSC  |
| <b>Andrea Vincent</b>                        | Speciation and dynamics of organic phosphorus in terrestrial and aquatic ecosystems   | Reiner Giesler, Ecology and Environmental Science; Mats Jansson, Ecology and Environmental Science; Per Persson, Chemistry; Jürgen Schleucher, Medical Biochemistry and Biophysics; Gerhard Gröbner, Chemistry   |
| <b>Felix Christoph Weise</b>                 | Mechanisms of protein aggregation with relevance to disease, with particular emphasis on the formation of amyloid and nuclear magnetic resonance spectroscopy (NMR) as the experimental technique of choice.                | Magnus Wolf-Watz, Chemistry<br>Ludmilla Morozova-Roche, Medical Biochemistry and Biophysics<br>Pernilla Wittung-Stafshede Chemistry<br>Anders Olofsson, Medical Biochemistry and Biophysics; Hans Wolf-Watz, Molecular Biology; Christiane Funk, Chemistry<br>Wolfgang Schröder, Chemistry |
| <b>Adele Williamsson</b>                     | Photosynthetic oxidation of water, protein trafficking in photosystem II  | Göran Samuelsson, UPSC<br>Lennart Johansson, Chemistry<br>Elisabeth Sauer-Eriksson, Chemistry<br>Johannes Messinger, Chemistry<br>Christiane Funk, Chemistry   |
| <b>2009</b>                                  |   |  |
| <b>Kristoffer Brännström</b>                 | Protein folding with respect to neurological disorders, studying both the A $\beta$ peptide associated to Alzheimer's disease as well as superoxide dismutase 1, associated to development of amyotrophic lateral sclerosis | Anders Olofsson, Medical Biochemistry and Biophysics<br>Fredrik Almqvist, Chemistry<br>Gerhard Gröbner, Chemistry<br>Elisabeth Sauer-Eriksson, Chemistry   |
| <b>Guangye Han</b>                           | Hydration of the oxygen-evolving complex in photosystem II probed by water proton NMRD (spin-lattice) relaxation  | Johannes Messinger, Chemistry<br>Göran Samuelsson, UPSC<br>Juergen Schleucher, Medical Biochemistry  |

| Name/Department/<br>Supervisor/Collaboration | Project  | Supervisors  |
|--|--|--|
|  |  | and Biophysics<br>Per-Olof Westlund, Chemistry   |
| <b>Matthew Hogg</b>                          | Crystallization of DNA polymerase epsilon. Increasing yields of DNA polymerase epsilon subunits by expression in <i>Escherichia coli</i> . Investigation of unique properties of DNA polymerase theta.                                       | Erik Johansson, Medical Biochemistry and Biophysics<br>Elisabeth Sauer-Eriksson, Chemistry   |
| <b>Istvan Horvath</b>                        | Small-molecule modulation of protein folding   | Pernilla Wittung-Stafshede, Chemistry<br>Göran Larsson, Medical Biochemistry and Biophysics; Fredrik Almqvist, Chemistry<br>Magnus Wolf-Watz; Christoph Weise, Chemistry; Anders Olofsson, Medical Biochemistry and Biophysics<br>Ludmilla Morozhova-Roche Medical Biochemistry and Biophysics |
| <b>Madhavi Latha Gandla</b>                  | Properties of applications of oxalate-degrading enzymes.   | Leif Jönsson, Chemistry; Bioimprove project at UPSC; Biochemistry and Biophysics; industrial partners including Domsjö Fabriker, EKA Chemicals, Holmen Paper, M-real and Novozymes, SweTree Technologies (STT)   |
| <b>François De Vleeschouwer</b>              | Geochemical composition of the material collected in the sediment trap and the geochemical composition of the material in the sediment varies deposited during the same time period. Changes of geochemical signals by diagenetic processes. | Richard Bindler, Ecology and Environmental Science; Ingemar Renberg, Ecology and Environmental Science; Staffan Sjöberg, Chemistry; Per Persson, Chemistry   |
| <b>2013</b>                                  |  |  |
| <b>Dana Kahra</b>                            | Protein folding and binding in the cell – A biophysical imaging approach   | Pernilla Wittung Stafshede, Chemistry, and Richard Lundmark, Medical Biochemistry and Biophysics   |
| <b>Barange Deepak</b>                        | Comprehensive structure-activity-relationship of new plant growth regulators   | Stéphanie Robert, Forest Genetics and Plant Physiology/SLU, and Frederik Almqvist, Chemistry   |
| <b>Martina Heynen</b>                        | Pharmaceuticals in aquatic systems: effects on species composition and foodweb dynamics  | Tomas Brodin, Micael Jonsson, Jonatan Klaminder, Ecology and Environmental Science, and Jerker Fick, Chemistry   |
| <b>Shaodong Jia</b>                          | Identification and quantification of the non-canonical and damaged building blocks of DNA that contribute to genome instability  | Andrei Chabes, Medical Biochemistry and Biophysics, and Thomas Moritz, Forest Genetics and Plant Physiology, SLU   |
| <b>Junfang Wu</b>                            | Cow's milk allergy in breastfed infants  | Malin L. Nording, Chemistry, Göran Larsson, Medical Biochemistry and Biophysics, Thomas Moritz, Forest Genetics and Plant Physiology/SLU<br>Collaborator: Angela Zivkovic, Food for Health Institute, University of California, Davis  |
| <b>2015</b>                                  |  |  |
| <b>Keshav Kumar</b>                          | The MUREINome: deciphering the unnoticed cell wall variability in bacteria   | Felipe Cava, MIMS/UCMR, Molecular Biology:<br>Co-applicants:<br>Anders Nordström, Molecular Biology and Swedish Metabolomics Centre SMC<br>Johan Trygg, chemistry and CLiC   |
| <b>Rajendra Kumar</b>                        | Modeling the three-dimensional organization of human DNA   | Ludvig Lizana, Physics and IceLab<br>Co-applicant: Per Stenberg, Molecular Biology   |



| Name/Department/<br>Supervisor/Collaboration | Project   | Supervisors   |
|--|---|---|
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| <b>Philipp Semenchuk</b>                     | Back 2 the Roots ---bridging the gap between ecology and plant physiology   | Ann Milbau, Ecology and Environmental Science<br>Co-applicant: Karin Ljung, Forest Genetics and Plant Physiology/UPSC                 |
| <b>Daniela Liebsch</b>                       | Clarifying the regulation of plant mitochondrial functions by light signalling  | Olivier Keech, Plant Physiology / UPSC<br>Co-applicant: Patrik Rydén, Department of Mathematics and Mathematical Statistics, CLiC     |
| <b>Jiawei Xu</b>                             | Utveckling av metodik för datorbaserad kvantifiering och bildanalys av rörelse; ett system för att studera kemikalieinducerade beteendestörningar | Magnus Andersson, Department of Physics and UCMR<br>Co-applicant: Jonathan Klaminder, Department of Ecology and Environmental Science |

## Publications of the KBC Kempe Postdoctoral Programme

### 2016

Wu, J., Gouveia-Figueira, S., Domellof, M., Zivkovic, A. M. & Nording, M. L. (2016) Oxylipins, endocannabinoids, and related compounds in human milk: Levels and effects of storage conditions, *Prostaglandins Other Lipid Mediat.* 122, 28-36.

Wu, J., Domellof, M., Zivkovic, A. M., Larsson, G., Ohman, A. & Nording, M. L. (2016) NMR-based metabolite profiling of human milk: A pilot study of methods for investigating compositional changes during lactation, *Biochem Biophys Res Commun.* 469, 626-32.

Tesfalidet, S., Geladi, P., Shimizu, K. & Lindholm-Sethson, B. (2016) Detection of methotrexate in a flow system using electrochemical impedance spectroscopy and multivariate data analysis, *Anal Chim Acta.* 914, 1-6.

Surowiec, I., Gjesdal, C. G., Jonsson, G., Norheim, K. B., Lundstedt, T., Trygg, J. & Omdal, R. (2016) Metabolomics study of fatigue in patients with rheumatoid arthritis naive to biological treatment, *Rheumatol Int.*

Shaikhali, J., Davoine, C., Bjorklund, S. & Wingsle, G. (2016) Redox regulation of the MED28 and MED32 mediator subunits is important for development and senescence, *Protoplasma.* 253, 957-63.

Nilsson, L., Larsson, A., Begum, A., Iakovleva, I., Carlsson, M., Brannstrom, K., Sauer-Eriksson, A. E. & Olofsson, A. (2016) Modifications of the 7-Hydroxyl Group of the Transthyretin Ligand Luteolin Provide Mechanistic Insights into Its Binding Properties and High Plasma Specificity, *PLoS One.* 11, e0153112.

Moonens, K., Gideonsson, P., Subedi, S., Bugaytsova, J., Romao, E., Mendez, M., Norden, J., Fallah, M., Rakhimova, L., Shevtsova, A., Lahmann, M., Castaldo, G., Brannstrom, K., Coppens, F., Lo, A. W., Ny, T., Solnick, J. V., Vandenbussche, G., Oscarson, S., Hammarstrom, L., Arnqvist, A., Berg, D. E., Muyldermans, S., Boren, T. & Remaut, H. (2016) Structural Insights into Polymorphic ABO Glycan Binding by *Helicobacter pylori*, *Cell Host Microbe.* 19, 55-66.

Karimpour, M., Surowiec, I., Wu, J., Gouveia-Figueira, S., Pinto, R., Trygg, J., Zivkovic, A. M. & Nording, M. L. (2016) Postprandial metabolomics: A pilot mass spectrometry and NMR study of the human plasma metabolome in response to a challenge meal, *Anal Chim Acta.* 908, 121-31.

Kahra, D., Kovermann, M. & Wittung-Stafshede, P. (2016) The C-Terminus of Human Copper Importer Ctr1 Acts as a Binding Site and Transfers Copper to Atox1, *Biophys J.* 110, 95-102.

Horvath, I., Jia, X., Johansson, P., Wang, C., Moskalenko, R., Steinau, A., Forsgren, L., Wagberg, T., Svensson, J., Zetterberg, H. & Morozova-Roche, L. A. (2016) Pro-inflammatory S100A9 Protein as a Robust Biomarker Differentiating Early Stages of Cognitive Impairment in Alzheimer's Disease, *ACS Chem Neurosci.* 7, 34-9.

Heynen, M., Fick, J., Jonsson, M., Klaminder, J. & Brodin, T. (2016) Effect of bioconcentration and trophic transfer on realized exposure to oxazepam in 2 predators, the dragonfly larvae (*Aeshna grandis*) and the Eurasian perch (*Perca fluviatilis*), *Environ Toxicol Chem.* 35, 930-937.

### 2015

Tang, S., Li, Z. H., Wang, M. W., Li, Z. P. & Sheng, R. L. (2015) Metal-free cascade cyclization of alkenes toward perfluorinated oxindoles, *Org Biomol Chem.* 13, 5285-8.

Tang, S., Buchholz, H. A. & Edman, L. (2015) White Light from a Light-Emitting Electrochemical Cell: Controlling the Energy-Transfer in a Conjugated Polymer/Triplet-Emitter Blend, *ACS Appl Mater Interfaces*. 7, 25955-60.

Surowiec, I., Orikiiriza, J., Karlsson, E., Nelson, M., Bonde, M., Kyamanwa, P., Karenzi, B., Bergstrom, S., Trygg, J. & Normark, J. (2015) Metabolic Signature Profiling as a Diagnostic and Prognostic Tool in Pediatric *Plasmodium falciparum* Malaria, *Open Forum Infect Dis*. 2, ofv062.

Soudham, V. P., Raut, D. G., Anugwom, I., Brandberg, T., Larsson, C. & Mikkola, J. P. (2015) Coupled enzymatic hydrolysis and ethanol fermentation: ionic liquid pretreatment for enhanced yields, *Biotechnol Biofuels*. 8, 135.

Shaikhali, J., Davoine, C., Brannstrom, K., Rouhier, N., Bygdell, J., Bjorklund, S. & Wingsle, G. (2015) Biochemical and redox characterization of the mediator complex and its associated transcription factor GeBPL, a GLABROUS1 enhancer binding protein, *Biochem J*. 468, 385-400.

Raut, D. G., Sundman, O., Su, W., Virtanen, P., Sugano, Y., Kordas, K. & Mikkola, J. P. (2015) A morpholinium ionic liquid for cellulose dissolution, *Carbohydr Polym*. 130, 18-25.

Petzoldt, S., Kahra, D., Kovermann, M., Dingeldein, A. P., Niemiec, M. S., Aden, J. & Wittung-Stafshede, P. (2015) Human cytoplasmic copper chaperones Atox1 and CCS exchange copper ions in vitro, *Biomaterials*. 28, 577-85.

Nors Perdersen, M., Fodera, V., Horvath, I., van Maarschalkerweerd, A., Norgaard Toft, K., Weise, C., Almqvist, F., Wolf-Watz, M., Wittung-Stafshede, P. & Vestergaard, B. (2015) Direct Correlation Between Ligand-Induced alpha-Synuclein Oligomers and Amyloid-like Fibril Growth, *Sci Rep*. 5, 10422.

Latha Gandla, M., Derba-Maceluch, M., Liu, X., Gerber, L., Master, E. R., Mellerowicz, E. J. & Jonsson, L. J. (2015) Expression of a fungal glucuronoyl esterase in *Populus*: effects on wood properties and saccharification efficiency, *Phytochemistry*. 112, 210-20.

Kahra, D., Mondol, T., Niemiec, M. S. & Wittung-Stafshede, P. (2015) Human Copper Chaperone Atox1 Translocates to the Nucleus but does not Bind DNA In Vitro, *Protein Pept Lett*. 22, 532-8.

Jonna, V. R., Crona, M., Rofougaran, R., Lundin, D., Johansson, S., Brannstrom, K., Sjöberg, B. M. & Hofer, A. (2015) Diversity in Overall Activity Regulation of Ribonucleotide Reductase, *J Biol Chem*. 290, 17339-48.

Jia, S., Marjavaara, L., Buckland, R., Sharma, S. & Chabes, A. (2015) Determination of deoxyribonucleoside triphosphate concentrations in yeast cells by strong anion-exchange high-performance liquid chromatography coupled with ultraviolet detection, *Methods Mol Biol*. 1300, 113-21.

Iakovleva, I., Brannström, K., Nilsson, L., Gharibyan, A. L., Begum, A., Anan, I., Walfridsson, M., Sauer-Eriksson, A. E. & Olofsson, A. (2015) Enthalpic Forces Correlate with the Selectivity of Transthyretin-Stabilizing Ligands in Human Plasma, *J Med Chem*. 58, 6507-15.

Backström, T., Heynen, M., Brannas, E., Nilsson, J., Winberg, S. & Magnhagen, C. (2015) Social stress effects on pigmentation and monoamines in Arctic charr, *Behav Brain Res*. 291, 103-7.

Backström, T., Heynen, M., Brannas, E., Nilsson, J. & Magnhagen, C. (2015) Dominance and stress signalling of carotenoid pigmentation in Arctic charr (*Salvelinus alpinus*): lateralization effects?, *Physiol Behav*. 138, 52-7.

Yu, C., Gan, H., Han, J., Zhou, Z. X., Jia, S., Chabes, A., Farrugia, G., Ordog, T. & Zhang, Z. (2014) Strand-specific analysis shows protein binding at replication forks and PCNA unloading from lagging strands when forks stall, *Mol Cell*. 56, 551-63.

## 2014

Weise, C. F., Login, F. H., Ho, O., Gröbner, G., Wolf-Watz, H. & Wolf-Watz, M. (2014) Negatively charged lipid membranes promote a disorder-order transition in the *Yersinia* YscU protein, *Biophys J*. 107, 1950-61.

Vincent, A. G., Sundqvist, M. K., Wardle, D. A. & Giesler, R. (2014) Bioavailable soil phosphorus decreases with increasing elevation in a subarctic tundra landscape, *PLoS One*. 9, e92942.

Liebsch, D., Sunaryo, W., Holmlund, M., Norberg, M., Zhang, J., Hall, H. C., Helizon, H., Jin, X., Helariutta, Y., Nilsson, O., Polle, A. & Fischer, U. (2014) Class I KNOX transcription factors promote differentiation of cambial derivatives into xylem fibers in the *Arabidopsis* hypocotyl, *Development*. 141, 4311-9.

Hogg, M., Osterman, P., Bylund, G. O., Ganai, R. A., Lundstrom, E. B., Sauer-Eriksson, A. E. & Johansson, E. (2014) Structural basis for processive DNA synthesis by yeast DNA polymerase varepsilon, *Nat Struct Mol Biol*. 21, 49-55.

Han, G., Huang, Y., Koua, F. H., Shen, J. R., Westlund, P. O. & Messinger, J. (2014) Hydration of the oxygen-evolving complex of photosystem II probed in the dark-stable S1 state using proton NMR dispersion profiles, *Phys Chem Chem Phys*. 16, 11924-35.

Brodin, T., Piovano, S., Fick, J., Klaminder, J., Heynen, M. & Jonsson, M. (2014) Ecological effects of pharmaceuticals in aquatic systems--impacts through behavioural alterations, *Philos Trans R Soc Lond B Biol Sci.* 369.

Brännström, K., Öhman, A., Nilsson, L., Pihl, M., Sandblad, L. & Olofsson, A. (2014) The N-terminal region of amyloid beta controls the aggregation rate and fibril stability at low pH through a gain of function mechanism, *J Am Chem Soc.* 136, 10956-10964.

Biswal, A. K., Soeno, K., Gandla, M. L., Immerzeel, P., Pattathil, S., Lucenius, J., Serimaa, R., Hahn, M. G., Moritz, T., Jonsson, L. J., Israelsson-Nordstrom, M. & Mellerowicz, E. J. (2014) Aspen pectate lyase PtxtPL1-27 mobilizes matrix polysaccharides from woody tissues and improves saccharification yield, *Biotechnol Biofuels.* 7, 11.

Angelcheva, L., Mishra, Y., Antti, H., Kjellsen, T. D., Funk, C., Strimbeck, R. G. & Schroder, W. P. (2014) Metabolomic analysis of extreme freezing tolerance in Siberian spruce (*Picea obovata*), *New Phytol.* 204, 545-55.

Åberg, A., Gideonsson, P., Vallström, A., Olofsson, A., Öhman, C., Rakhimova, L., Boren, T., Engstrand, L., Brännström, K. & Arnqvist, A. (2014) A repetitive DNA element regulates expression of the *Helicobacter pylori* sialic acid binding adhesin by a rheostat-like mechanism, *PLoS Pathog.* 10, e1004234.

## 2013

Wallgren, M., Lidman, M., Pedersen, A., Brannstrom, K., Karlsson, B. G. & Grobner, G. (2013) Reconstitution of the anti-apoptotic Bcl-2 protein into lipid membranes and biophysical evidence for its detergent-driven association with the pro-apoptotic Bax protein, *PLoS One.* 8, e61452.

Tang, S., Tan, W. Y., Zhu, X. H. & Edman, L. (2013) Small-molecule light-emitting electrochemical cells: evidence for in situ electrochemical doping and functional operation, *Chem Commun (Camb).* 49, 4926-8.

Tang, S., Pan, J., Buchholz, H. A. & Edman, L. (2013) White light from a single-emitter light-emitting electrochemical cell, *J Am Chem Soc.* 135, 3647-52.

Mahdavi, J., Royer, P. J., Sjolinder, H. S., Azimi, S., Self, T., Stoof, J., Wheldon, L. M., Brannstrom, K., Wilson, R., Moreton, J., Moir, J. W., Sihlbom, C., Boren, T., Jonsson, A. B., Sultanas, P. & Ala'Aldeen, D. A. (2013) Pro-inflammatory cytokines can act as intracellular modulators of commensal bacterial virulence, *Open Biol.* 3, 130048.

Johansson Jankapaa, H., Frenkel, M., Zulfugarov, I., Reichelt, M., Krieger-Liszkay, A., Mishra, Y., Gershenzon, J., Moen, J., Lee, C. H. & Jansson, S. (2013) Non-photochemical quenching capacity in *Arabidopsis thaliana* affects herbivore behaviour, *PLoS One.* 8, e53232.

Horvath, I., Sellstedt, M., Weise, C., Nordvall, L. M., Krishna Prasad, G., Olofsson, A., Larsson, G., Almqvist, F. & Wittung-Stafshede, P. (2013) Modulation of alpha-synuclein fibrillization by ring-fused 2-pyridones: templation and inhibition involve oligomers with different structure, *Arch Biochem Biophys.* 532, 84-90.

Hoeberichts, F. A., Davoine, C., Vandorpe, M., Morsa, S., Ksas, B., Stassen, C., Triantaphylides, C. & Van Breusegem, F. (2013) Cryptogein-induced transcriptional reprogramming in tobacco is light dependent, *Plant Physiol.* 163, 263-75.

Deswal, R., Gupta, R., Dogra, V., Singh, R., Abat, J. K., Sarkar, A., Mishra, Y., Rai, V., Sreenivasulu, Y., Amalraj, R. S., Raorane, M., Chaudhary, R. P., Kohli, A., Giri, A. P., Chakraborty, N., Zargar, S. M., Agrawal, V. P., Agrawal, G. K., Job, D., Renaut, J. & Rakwal, R. (2013) Plant proteomics in India and Nepal: current status and challenges ahead, *Physiol Mol Biol Plants.* 19, 461-77.

Brännström, K., Öhman, A., Lindhagen-Persson, M. & Olofsson, A. (2013) Ca<sup>2+</sup> enhances Aβ polymerization rate and fibrillar stability in a dynamic manner, *Biochem J.* 450, 189-97.

Aden, J., Weise, C. F., Brännström, K., Olofsson, A. & Wolf-Watz, M. (2013) Structural topology and activation of an initial adenylate kinase-substrate complex, *Biochemistry.* 52, 1055-1061.

## 2012

Zhou, Y., Smith, D., Leong, B. J., Brännström, K., Almqvist, F. & Chapman, M. R. (2012) Promiscuous cross-seeding between bacterial amyloids promotes interspecies biofilms in *J Biol Chem* pp. 35092-103

Vestergren, J., Vincent, A. G., Jansson, M., Persson, P., Ilstedt, U., Grobner, G., Giesler, R. & Schleucher, J. (2012) High-resolution characterization of organic phosphorus in soil extracts using 2D 1H-31P NMR correlation spectroscopy, *Environ Sci Technol.* 46, 3950-6.

Tang, S., Sandstrom, A., Fang, J. & Edman, L. (2012) A solution-processed trilayer electrochemical device: localizing the light emission for optimized performance, *J Am Chem Soc.* 134, 14050-5.

Mishra, Y., Jankapaa, H. J., Kiss, A. Z., Funk, C., Schroder, W. P. & Jansson, S. (2012) *Arabidopsis* plants grown in the field and climate chambers significantly differ in leaf morphology and photosystem components, *BMC Plant Biol.* 12, 6.

Magnhagen, C., Hellstrom, G., Borchering, J., Heynen, M. & Genner, M. (2012) Boldness in two perch populations - long-term differences and the effect of predation pressure, *J Anim Ecol.* 81, 1311-8.

Jankanpaa, H. J., Mishra, Y., Schroder, W. P. & Jansson, S. (2012) Metabolic profiling reveals metabolic shifts in *Arabidopsis* plants grown under different light conditions, *Plant Cell Environ.* 35, 1824-36.

Horvath, I., Weise, C. F., Andersson, E. K., Chorell, E., Sellstedt, M., Bengtsson, C., Olofsson, A., Hultgren, S. J., Chapman, M., Wolf-Watz, M., Almqvist, F. & Wittung-Stafshede, P. (2012) Mechanisms of protein oligomerization: inhibitor of functional amyloids templates alpha-synuclein fibrillation, *J Am Chem Soc.* 134, 3439-44.

Hogg, M. & Johansson, E. (2012) DNA polymerase epsilon, *Subcell Biochem.* 62, 237-57.

Hammer, N. D., McGuffie, B. A., Zhou, Y., Badtke, M. P., Reinke, A. A., Brannstrom, K., Gestwicki, J. E., Olofsson, A., Almqvist, F. & Chapman, M. R. (2012) The C-terminal repeating units of CsgB direct bacterial functional amyloid nucleation, *J Mol Biol.* 422, 376-89.

Frost, S., Ho, O., Login, F. H., Weise, C. F., Wolf-Watz, H. & Wolf-Watz, M. (2012) Autoproteolysis and intramolecular dissociation of *Yersinia* YscU precedes secretion of its C-terminal polypeptide YscU(CC), *PLoS One.* 7, e49349.

Blomberg, J., Aguilar, X., Brannstrom, K., Rautio, L., Olofsson, A., Wittung-Stafshede, P. & Bjorklund, S. (2012) Interactions between DNA, transcriptional regulator Dreb2a and the Med25 mediator subunit from *Arabidopsis thaliana* involve conformational changes, *Nucleic Acids Res.* 40, 5938-50.

## 2011

Surowiec, I., Koc, M., Antti, H., Wikstrom, P. & Moritz, T. (2011) LC-MS/MS profiling for detection of endogenous steroids and prostaglandins in tissue samples, *J Sep Sci.* 34, 2650-8.

Mishra, Y., Hall, M., Chaurasia, N., Rai, L. C., Jansson, S., Schroder, W. P. & Sauer, U. H. (2011) Expression, purification, crystallization and preliminary X-ray crystallographic studies of alkyl hydroperoxide reductase (AhpC) from the cyanobacterium *Anabaena* sp. PCC 7120, *Acta Crystallogr Sect F Struct Biol Cryst Commun.* 67, 1203-6.

Marcinowska, R., Trygg, J., Wolf-Watz, H., Mortiz, T. & Surowiec, I. (2011) Optimization of a sample preparation method for the metabolomic analysis of clinically relevant bacteria, *J Microbiol Methods.* 87, 24-31.

Han, D., Leyva, C. A., Matheson, D., Mineo, D., Messinger, S., Blomberg, B. B., Hernandez, A., Meneghini, L. F., Allende, G., Skyler, J. S., Alejandro, R., Pugliese, A. & Kenyon, N. S. (2011) Immune profiling by multiple gene expression analysis in patients at-risk and with type 1 diabetes, *Clin Immunol.* 139, 290-301.

Hall, M., Mishra, Y. & Schroder, W. P. (2011) Preparation of stroma, thylakoid membrane, and lumen fractions from *Arabidopsis thaliana* chloroplasts for proteomic analysis, *Methods Mol Biol.* 775, 207-22.

Hainzl, T., Huang, S., Merilainen, G., Brannstrom, K. & Sauer-Eriksson, A. E. (2011) Structural basis of signal-sequence recognition by the signal recognition particle, *Nat Struct Mol Biol.* 18, 389-91.

Elfving, N., Davoine, C., Benlloch, R., Blomberg, J., Brannstrom, K., Muller, D., Nilsson, A., Ulfstedt, M., Ronne, H., Wingsle, G., Nilsson, O. & Bjorklund, S. (2011) The *Arabidopsis thaliana* Med25 mediator subunit integrates environmental cues to control plant development, *Proc Natl Acad Sci U S A.* 108, 8245-50.

Brännström, K., Öhman, A. & Olofsson, A. (2011) Abeta peptide fibrillar architectures controlled by conformational constraints of the monomer, *PLoS One.* 6, e25157.

Wibom, C., Surowiec, I., Moren, L., Bergstrom, P., Johansson, M., Antti, H. & Bergenheim, A. T. (2010) Metabolomic patterns in glioblastoma and changes during radiotherapy: a clinical microdialysis study, *J Proteome Res.* 9, 2909-19.

## 2010

Thysell, E., Surowiec, I., Hornberg, E., Crnalic, S., Widmark, A., Johansson, A. I., Stattin, P., Bergh, A., Moritz, T., Antti, H. & Wikstrom, P. (2010) Metabolomic characterization of human prostate cancer bone metastases reveals increased levels of cholesterol, *PLoS One.* 5, e14175.

Pozdnyakova, I. & Wittung-Stafshede, P. (2010) Non-linear effects of macromolecular crowding on enzymatic activity of multi-copper oxidase, *Biochim Biophys Acta.* 1804, 740-4.

Aksenova, A., Volkov, K., Maceluch, J., Pursell, Z. F., Rogozin, I. B., Kunkel, T. A., Pavlov, Y. I. & Johansson, E. (2010) Mismatch repair-independent increase in spontaneous mutagenesis in yeast lacking non-essential subunits of DNA polymerase epsilon, *PLoS Genet.* 6, e1001209.

## Courses and Workshops organized at KBC

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| Basic English Writing fall 2008  |
| Basic English Writing spring 2009  |
| Basic English Writing fall 2009  |
| Basic English Writing spring 2010  |
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| Advanced English Writing fall 2013   |
| Basic Bioinformatics spring 2008   |
| Basic Bioinformatics spring 2009   |
| Basic Bioinformatics spring 2010   |
| Basic Bioinformatics fall 2010   |
| Basic Bioinformatics spring 2011   |
| Basic Bioinformatics spring 2012   |
| Basic TEM and SEM fall 2009  |
| Basic EM fall 2010   |
| Basic EM fall 2011   |
| Basic EM fall 2012   |
| Basic TEM and SEM spring 2014  |
| Course in TEM and SEM fall 2015  |
| Basic TEM and SEM spring 2015  |
| Practical TEM and SEM fall 2009  |
| Advanced SEM, TEM, Cryo ultramicrotomy, spring 2010                            |
| Practical EM fall 2010   |
| Practical TE; and SEM spring 2011  |
| Practical Course in Transmission and Scanning Electron Microscopy, spring 2012 |
| Practical SEM biology spring 2013  |
| Practical SEM material science spring 2013                                     |
| Practical TEM biology spring 2013  |

EM Workshop: Field Emission Scanning Electron Microscopy for Life Science 2014, 17-19 Nov

TEM sample preparation course II,  
Practical course at UCEM, 25 - 29 January 2016

Cloning Protein Expression and Purification spring 2009

Cloning Protein Expression and Purification fall 2009

Cloning Protein Expression and Purification spring 2010

Cloning Protein Expression and Purification fall 2010

Cloning Protein Expression and Purification fall 2011

Cloning Protein Expression and Purification, spring 2012

Cloning Protein Expression and Purification fall 2012

Cloning Protein Expression and Purification spring 2013

Cloning Protein Expression and Purification fall 2013

Cloning Protein Expression and Purification fall 2014

Creativity fall 2009

Creativity spring 2010

Design of Experiments spring 2010

Effective writing and publishing, spring 2013

Elements of Bioinformatics I 2010

Elements of Bioinformatics fall 2011

Elements of Bioinformatics fall 2012

IceLab Camp *in vitro* and *in vivo* meet *in silico* at Vindel River 2010 29 Sept -2 Oct

IceLab Camp 2011 26-29 Sept

IceLab Camp 2012 17-20 Sept

IceLab Camp 2013 16-19 Sept

IceLab Camp 2014 15-18 Sept

IceLab Camp 2015 14-19 Sept

Introduction to high throughput screening - 2 ECTS; Organised by LCBU 2014-2015 Web based

MatLab spring 2012 12-16 March 2012

MatLab fall 2012 3-4, 10-12 Dec

Microarray Technology - data analysis 18-22 May 2009

Molecular Modeling fall 2010 2 ECTS

Multivariate Data Analysis spring 2009

Multivariate Data Analysis fall 2009

Multivariate Data Analysis spring 2011

Multivariate Data Analysis fall 2011

Multivariate Data Analysis spring 2012

Multivariate Data Analysis spring 2013

Multivariate Analysis for metabolomics data spring 2014

Introduction to multivariate analysis, Org by CLiC, 2015 Oct 19-21

Metabolomics spring 2012 8-11 May

Metabolic Ecology and Scaling in Biology, fall 2013, 23-27 Sept IceLab / EMG

Next generation sequencing fall 2010

Next generation sequencing spring 2012

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| NMR I spring 2009   |
| NMR I fall 2009   |
| NMR I spring 2011   |
| NMR I spring 2012   |
| NMR I spring 2013   |
| NMR I fall 2013   |
| NMR II spring 2010  |
| NMR II spring 2012  |
| NMR Spectroscopy in Structural Biology – NMR for Life and NMR Core Facility 20140303-07 |
| Oral Presentation fall 2010   |
| Oral Presentation spring 2011   |
| Oral Presentation spring 2012   |
| qPCR spring 2010  |
| qPCR spring 2011  |
| qPCR spring 2012  |
| qPCR spring 2013  |
| qPCR spring 2015  |
| Photomicrography and Image Processing for Science spring 2009, 20 Jan                   |
| Photomicrography spring 2010  |
| Photomicrography spring 2011  |
| Photomicrography spring 2012  |
| Photomicrography spring 2013  |
| Photomicrography spring 2015 <i>organized by MIMS</i>                                   |
| Poster Course spring 2009   |
| Poster Course spring 2010   |
| Poster Course spring 2012   |
| Presentation Techniques fall 2009   |
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| Protein Crystallization spring 2010   |
| Protein Crystallization spring 2011   |
| Protein Crystallization spring 2012   |
| Proteomics fall 2009  |
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| Vibrational Spectroscopy fall 2011   |
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| Vibrational Spectroscopy fall 2013   |
| Vibrational Spectroscopy - User License, spring 2014   |
| Vibrational Spectroscopy - User License, spring 2015   |
| Vibrational Spectroscopy - User License, fall 2015   |
| Wood Biology spring 2011   |
| Wood Biology spring 2012   |
| Wood Biology spring 2013   |
| Wood: Clonal Propagation techniques and applications in woody plants spring 2012   |
| Wood: Clonal Propagation techniques and applications in woody plants spring 2013   |
| Single Workshops - Symposia  |
| Adaptive Dynamics 17-22 Oct 2011   |
| Agilent Workshop and Webinar - 4 September 2014 organised by SMC   |
| Atomic Force Microscopy Workshop organized with Bruker   |
| Basic image analysis: focused on microscopy applications 2013  |
| Presentation of BILS and "Biosupport.se" organized by BILS and CLiC, 2012 Sept 21  |
| Barents summer school, 21-26 June 2015, organized by CIRC/EMG and ARCUM, 21  |
| Biolmaging 2016 15-19 February   |
| Biological Imaging Mini Symposium Probing Life 1 June 2010   |
| Biological Imaging Mini Symposium Probing Life 2011 1-13 June  |
| Biological Imaging Mini Symposium Probing Life June 2012   |
| BILS "What can BILS do for you"? Together with UCMR /MIMS 2014   |
| Bioluminescence seminar and demo, Biochemical Imaging Centre together with Olympus, 20150609-10                                      |
| Introduction to Bioinformatics using NGS data 2 ECTS   |
| National Course organised by SciLifeLab in Umeå 20141114   |
| Career outside academia workshops organized by UPSC  |
| CellASIC ONIX Live Cell Analysis System Presentation 2015 March 3  |
| Clean room technology – User License Course – org by Physics dept 2015 Sept 23-24  |
| Computer Programming Languages and Algorithms in Bioinformatics 2010 May 24-28   |
| Course "Computational Methods for Massively Parallel Sequencing" given SciLifeLab in cooperation with CLiC and BILS; Nov 2012, 19-23 |
| Crash course in pulping – 26-28 May 2014 org by UPSC –KBC  |
| Cutting Edge Biophysics 2012   |
| EMBL Advanced Course: Computational Aspects of High-Throughput Screening planning and analysis, 2013 Oct 14-16                       |
| Flow cytometry and cell sorting Theoretical and practical course spring 2012, 24-28 Jan, 14-18 Feb                                   |
| FroSpects Workshop on Species Interactions and Speciation 2013 16-18 Jan   |
| High Throughput Screening, spring 19-23 March 2012   |
| Hypospectral Day 2014, 20 May organized by KBC and UmBio   |
| Information and Workshop about SciFinder 2013, March 5; org by KBC and Chemical Abstracts Service CAS Europé                         |
| Invasion in Northern Ecosystems, Workshop organized by Karin Nilsson, EMG, 20150224  |
| MAX IV Laboratory Information Day organized by KBC; Scientists from Lund and Umeå discuss service and research at MAX IV 2014-09-02  |

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| Maximum Entropy and Ecology IceLab and EMG/KBC  |
| Research school, John Hartie Berkeley, 2012, 1-5 October  |
| Mass Spectrometry Day at KBC 2011-10-11 organized by Proteomic Facility   |
| Metabolic Ecology and Scaling in Biology 23 - 27 Sept 2013  |
| Metabolomics Discussion Meeting 2012 Oct 24-25  |
| Swedish Metabolomics Centre SMC Education Day, 20150507   |
| Microscale Thermophoresis Workshop, organized by dept. of Chemistry (Elofsson, Spjut), 13 May 2014                    |
| Demonstration of MODDE 9 and SIMCA-P + 12 org by CLiC, 2010 Oct 19  |
| National Workshop in Super Resolution and 4D Confocal Imaging March 2011 November 22-23 org by BICU                   |
| National Workshop in Super Resolution and 4D Confocal Imaging March 2012  |
| Networks in Ecology, Workshop in Norrbyn, organised by Magnus Lindh, EMG, IceLab (UmU) 2014 19-23 May                 |
| Organic Synthesis spring 2012 23 May -5 June  |
| Quick and clean: Python for biological data processing 2015 27-29 April   |
| RNA seq. Course organised by Bioinformatics Long-term Support 2015 20-22 Oct  |
| SPE (Solid Phase Extraction) Workshop and Webinar with Waters Sverige AB May 14 2014 org by SMC /KBC                  |
| Thin Film Deposition Technology 2-4 Dec 2014  |
| Thin Film Deposition Technology (Physical Vapor Deposition), 18-20 November 2015, Org by Physics                      |
| Understanding your science, Per Lundberg, Lund University 2012 26-30 March  |
| Using indirect methods to reveal food web interactions and community structure, PhD course organised by EcoChange EMG |
| International Workshop on Vibrational Spectroscopy 2012 Sept 6-7 org by ViSP  |
| Workshop for PhD-students and Post-docs at KBC  |
| on values/vision/mission and leadership styles, Douglas Reeve, University of Toronto, Canada, May 2012                |
| Workshop om kemikalier, hälsa och miljö, Swetox 20140821; org by Chemistry  |

## Conferences organized by/at KBC

| Conference  | Organising departments           |
|---|----------------------------------|
| IceLab Day 29/10/2009   | IceLab                           |
| Bioteknikdagarna bioteknikdagarna.se, 20091120  | Chemistry                        |
| Workshop day on ecological and evolutionary modeling 20100312   | EMG, IceLab                      |
| Umeå Renewable Energy Workshop 2010- From structures and mechanism of biological enzymes to biomass production and utilization 16-17 March 2010                         | Chemistry/UPSC                   |
| Mini-Symposium Technical Chemistry 2010-03-25   | Chemistry                        |
| Symposium on Plant Proteomics   | KBC                              |
| CDIO - Nordic Meeting at Umeå University  | EMG                              |
| KBC Days 2010; 10-11 November 2010  | KBC                              |
| Umeå Renewable Energy Meeting 2011; 17-18 March 2011  | Chemistry/UPSC                   |
| Symposium on Chemometrics in Metabolomics and Proteomics: 2011-05-02  | Chemistry                        |
| Chemometrics in Metabolomics and Proteomics 2011-05-02  | CLiC                             |
| Workshop in Electrochemistry in Practice: 2011-05-11  | Chemistry                        |
| Mini-Symposium on MD Simulations with Bio-Applications 31/05/11   | Chemistry                        |
| Mini-Symposium on Plant Proteomics 2011-09-15   | Chemistry, UPSC                  |
| Visit of VR at KBC 22/9/2011  | KBC                              |
| Symposium on "Biogeochemical Processes and Chemical Speciation in Soils" 2011-09-28   | Chemistry                        |
| Mass Spectrometry Day 11/10/11  | Chemistry                        |
| IceLab mini-symposium 13/10/11  | EMG and IceLab                   |
| 8-9 November 2011 KBC DAYS  | KBC                              |
| The 3rd Swedish Meeting on Mathematics in Biology, 14-16 December 2011  | EMG, Mathematics, IceLab         |
| Symposium on "Biogeochemical Processes and Chemical Speciation in Soils" 2011-09-28   | Chemistry                        |
| Umeå Renewable Energy Meeting Umeå 2011, 14/03/11   | UPSC, Chemistry                  |
| Presentation of "Trees and Crops for the Future" (TC4F - www.tc4f.se 24/01/12   | UPSC                             |
| Umeå Renewable Energy Meeting Umeå 2012, 14-16 March  | UPSC, Chemistry                  |
| Mercury biogeochemistry seminars 16/02/12   | Chemistry                        |
| Workshop: Finnish-Indian-Swedish 'FIS seminarium' on Biorefining, Heterogeneous Catalysis, and its Applications 21/03/12  | Chemistry                        |
| UPSC-ONRA (UPRA) bilateral meeting 26-28 March 2012   | UPSC                             |
| Significance of river-bound transport of natural and anthropogenic material for coastal and open-sea ecosystems   | EMG/UMF                          |
| Open access to research data ; Open access to environment and climate data – the ECDS-initiative 04/04/12   | EMG/UMF                          |
| Minisymposium in Organic Chemistry; speakers: Christina Moberg , KTH, Petri Pihko, University of Jyväskylä, Finland 26/04/12  | Chemistry                        |
| Workshop on Next Generation Sequencing-, Stockholm Li Li, BGI Genomics Core opening 23/04/12  | CLiC SciLifeLab                  |
| UCMR Mini – Symposium: Research projects and networks at LCBU and X-ray crystallography research within UCMR research groups. 29/05/12                                  | UCMR/MIMS                        |
| Scandinavian Plant Proteomics Day 19-20 September 19-20/09/2012   | Chemistry<br>Proteomics Platform |
| International Workshop on Vibrational Spectroscopy, 6-7 September 2012  | Chemistry/ KBC                   |
| The Swedish Society for Biochemistry, Biophysics and Molecular Biology, Symposium and Meeting on "Cutting Edge Biophysics" 9-12 September 2012, Tällberg (www.sfbbm.se) | Chemistry                        |

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|---|---|
| Risk Assessment and Remediation of Dioxin Contaminated Land- A knowledge and experience exchange project between Vietnam and Sweden concerning contamination of dioxin and other POPs in soil, water and sediment 11-12 Sept.2012 | Chemistry                                   |
| Workshop on Plant Proteomics with focus on redox proteomics 19 Sept. 2012, 20/09/12   | KBC   |
| UPSC DAYS 2012 2-3 October  | UPSC  |
| UCMR Mini Symposium, 15/10/12   | UCMR  |
| Metabolomics Discussion Meeting; 24-25 October 2012   | Metabolomics CLiC, SLU. UMU                 |
| KBC DAYS 2012 13-14 November and inauguration of NMR Facility at KBC  | KBC   |
| Inauguration of the new 850 MHz instrument 13/11/12   | KBC, Chemistry                              |
| Computational Methods for Massively Parallel Sequencing 19-23 November in cooperation with CLiC and BILS  | CLiC  |
| FroSpects Workshop on "Species Interactions and Speciation; 17-18 January 2013  | EMG IceLab                                  |
| ProCoGen Workshop "Genome sequencing and gene discovery", 30-31 January 2013  | EMG   |
| Inauguration of Swedish Metabolomics Centre 11-12 March 2013  | SMC   |
| Umeå Renewable Energy Meeting 2013, 25-27 February  | KBC Departments                             |
| 5th International HILIC DAY - An international mini-symposium on liquid chromatographic separation and analysis of polar hydrophilic compounds 02/05/13   | Chemistry                                   |
| Inauguration of UCEM, 23/05/13  | UCEM, KBC, Molecular Biology, MIMS and UCMR |
| Working on Walls - UPSC 2013 Symposium, 3-4 July 2013   | UPSC  |
| Metabolic Ecology and Scaling in Biology 23/09/13   | IceLab, EMG                                 |
| Consequences of spatial, temporal and ontogenetic asymmetries in ecological interactions 14/02/14   | EMG   |
| Workshop "Reindeer grazing in a changing climate: New findings and future challenges 20/02/14   | EMG   |
| Trends in organic chemistry: Natural Product Inspired Chemistry 11/03/14  | Chemistry                                   |
| UMEÅ RENEWABLE ENERGY MEETING 2014, 17-19 March.  | KBC   |
| MIMS/UCMR Mini Symposium 2014, 10/06/14   | UCMR  |
| 11th International Workshop on Pathogenesis and Host Response in Helicobacter Infections 02/07/14   | MedicalBiochemistry and Biophysics          |
| Lignin 2014 – biosynthesis and utilization 24/08/14   | Chemistry                                   |
| 5th Scandinavian Symposium on "Amyloid Diseases and Amyloid Mechanisms (ADAM 5)", 24/09/14  | Medical Biochemistry and Biophysics         |
| Swedish Developmental Biology Organization (SWEDBO), 02/10/14   | Medchem, Molbiol                            |
| Swedish Marine Sciences Conference / Havsforskningsdagarna, 10/11/14  | EMG, EcoChange                              |
| KBC-days 11/11/14   | KBC   |
| Ecosystem dynamics in the Baltic Sea in a climate change perspective Conference at Umeå University, 10/02/15  | EMG   |
| EMG - Ecochange Conference 12/03/15   | EMG   |
| "Ecosystem dynamics in the Baltic Sea in a climate change perspective   | EMG   |
| Umeå Renewable Energy Meeting 2015, 27/03/15  | KBC, Chemistry, UPSC, Physics               |
| Seminarium "Återintroduktion av skogvildren till Sverige - vilka är förutsättningarna?" 09/04/15  | EMG   |
| The Swedish Metabolomics Centre Education Day in Umeå   | Vibrational Spectroscopy Core Facility      |
| Hyperspectral Day, organised by UmBio and KBC, 20/05/15   | The Swedish Metabolomics Centre SMC at KBC  |

|   |                         |
|---|-------------------------|
| Fascination of Plants Day 2015"   | KBC, Chemistry,<br>UPSC |
| UPSC Symposium for young plant scientists: 28/05/15   | UPSC                    |
| 1st Swetox-UmU Seminar, Speakers: Åsa Gustafsson, Swetox/FOI, Jonatan Klaminder, EMG,<br>09/10/15 | Chemistry               |
| KBC days 10-11 November 2015  | KBC                     |
| Umeå Renewable Energy Meeting 2016, 23-25 Feb   | Chemistry, SLU          |
| SciLifeLab Day at KBC 6 /April 2016   | KBC-Departments         |

## Selected key publications with involvement of the KBC Core Facilities

Only 10 publications have been selected where the service from the involved core facility was crucial and/or the publication reflects the interdisciplinarity of the service.

### Publications- Biochemical Imaging Centre Umeå

#### Publications Light Microscopy

Francis, M.K., Holst, M.R., Vidal-Quadras, M., Henriksson, S., Santarella-Mellwig, R., Sandblad, L., and Lundmark, R. Endocytic membrane turnover at the leading edge is driven by a transient interaction between Cdc42 and GRAF1. *J Cell Sci*. 2015 Nov 15;128(22):4183-95

Lindström, M., Tjust, A.E., and Pedrosa Domellöf, F. Pax7-Positive Cells/Satellite Cells in Human Extraocular Muscles. *Invest Ophthalmol Vis Sci* 56, 6132-6143.

Lopes, J.P., Stylianou, M., Nilsson, G., and Urban, C.F. Opportunistic pathogen *Candida albicans* elicits a temporal response in primary human mast cells. *Sci Rep* 5, 12287.

Mohan, J., Moren, B., Larsson, E., Holst, M.R., and Lundmark, R. Cavin3 interacts with cavin1 and caveolin1 to increase surface dynamics of caveolae. *J Cell Sci* 128, 979-991.

#### Publications Biacore ITC and Proteom 2015

Iakovleva, I., Brannstrom, K., Nilsson, L., Gharibyan, A.L., Begum, A., Anan, I., Walfridsson, M., Sauer-Eriksson, A.E., and Olofsson, A. Enthalpic Forces Correlate with the Selectivity of Transthyretin-Stabilizing Ligands in Human Plasma. *J Med Chem* 58, 6507-6515.

Jonna, V.R., Crona, M., Rofougaran, R., Lundin, D., Johansson, S., Brannstrom, K., Sjöberg, B.M., and Hofer, A. Diversity in Overall Activity Regulation of Ribonucleotide Reductase. *J Biol Chem* 290, 17339-17348.

Kovermann, M., Aden, J., Grundstrom, C., Elisabeth Sauer-Eriksson, A., Sauer, U.H., and Wolf-Watz, M. Structural basis for catalytically restrictive dynamics of a high-energy enzyme state. *Nat Commun* 6, 7644.

Shaikhali, J., Davoine, C., Brannstrom, K., Rouhier, N., Bygdell, J., Bjorklund, S., and Wingsle, G. Biochemical and redox characterization of the mediator complex and its associated transcription factor GeBPL, a GLABROUS1 enhancer binding protein. *Biochem J* 468, 385-400.

Aberg, A., Gideonsson, P., Vallstrom, A., Olofsson, A., Ohman, C., Rakhimova, L., Boren, T., Engstrand, L., Brannstrom, K., and Arnqvist, A. A repetitive DNA element regulates expression of the *Helicobacter pylori* sialic acid binding adhesin by a rheostat-like mechanism. *PLoS Pathog* 10, e1004234.

Aguilar, X., Blomberg, J., Brannstrom, K., Olofsson, A., Schleucher, J., and Bjorklund, S. Interaction studies of the human and *Arabidopsis thaliana* Med25-ACID proteins with the herpes simplex virus VP16- and plant-specific Dreb2a transcription factors. *PLoS One* 9, e98575.

Brannstrom, K., Lindhagen-Persson, M., Gharibyan, A.L., Iakovleva, I., Vestling, M., Sellin, M.E., Brannstrom, T., Morozova-Roche, L., Forsgren, L., and Olofsson, A. A generic method for design of oligomer-specific antibodies. *PLoS One* 9, e90857.

Brännström K, Ohman A, Nilsson L, Pihl M, Sandblad L, Olofsson A. The N-terminal Region of Amyloid  $\beta$  Controls the Aggregation Rate and Fibril Stability at Low pH Through a Gain of Function Mechanism. *J Am Chem Soc*. 2014 Aug 6;136(31):10956-64

Mohan, J., Moren, B., Larsson, E., Holst, M., and Lundmark, R. Cavin3 interacts with cavin1 and caveolin1 to increase surface dynamics of caveolae. *J Cell Sci*.

### Publications – Computational Life Science Cluster - Proteomics Core

Obudulu O, Bygdell J, Sundberg B, Moritz T, Hvidsten TR, Trygg J, Wingsle G. Quantitative proteomics reveals protein profiles underlying major transitions in aspen wood development. *BMC Genomics*. 2016;17(1) 119. doi:10.1186/s12864-016-2458-z.  
www.kbc.umu.se

Xu H, Bygdell J, Wingsle G, Byström AS. Yeast Elongator protein Elp1p does not undergo proteolytic processing in exponentially growing cells. *Microbiologyopen*. 2015 Dec;4(6) 867-878. doi:10.1002/mbo3.285.

Shaikhali, J., Davoine, C., Brännström, K., Rouhier, N., Bygdell, J., Björklund, S. & Wingsle, G. (2015) Biochemical and redox characterization of the mediator complex and its associated transcription factor GeBPL, a GLABROUS1 enhancer binding protein, *Biochem J*. 468, 385-400.

Businge, E., Bygdell, J., Wingsle, G., Moritz, T. & Egertsdotter, U. (2013) The effect of carbohydrates and osmoticum on storage reserve accumulation and germination of Norway spruce somatic embryos, *Physiol Plant*. 149, 273-285.

Srivastava, V., Obudulu, O., Bygdell, J., Lofstedt, T., Ryden, P., Nilsson, R., Ahnlund, M., Johansson, A., Jonsson, P., Freyhult, E., Qvarnstrom, J., Karlsson, J., Melzer, M., Moritz, T., Trygg, J., Hvidsten, T. R. & Wingsle, G. (2013) OnPLS integration of transcriptomic, proteomic and metabolomic data shows multi-level oxidative stress responses in the cambium of transgenic hipl- superoxide dismutase *Populus* plants, *BMC Genomics*. 14, 893.

Nilsson, R., Bernfur, K., Gustavsson, N., Bygdell, J., Wingsle, G. & Larsson, C. (2010) Proteomics of plasma membranes from poplar trees reveals tissue distribution of transporters, receptors, and proteins in cell wall formation, *Mol Cell Proteomics*. 9, 368-387.

## **Publications NMR Core Facility**

### **Chemical biology: ca. 46 inclusive**

Margery L, E. Chorell, J. Åden, P. Wittung-Stafshede, F. Almqvist, M. R. Chapman. The Bacterial Curli System Possesses a Potent and Selective Inhibitor of Amyloid Formation. *Molecular Cell* (2015) 57, 445-455.

### **Structural biology: ca 14 inclusive**

M. Kovermann, E. Sauer-Eriksson, U. Sauer, M. Wolf-Watz (2015) "Structural basis for catalytically restrictive dynamics of a high-energy enzyme state" *Nature Communications* (2015) 6, 7644

### **Metabolomics/fluxes, physiology: ca. 10 inclusive**

A.Mahboubi, P. Linden, M. Hedenström, T. Moritz, Totte Niittylä (2015) "Carbon-13 tracking after <sup>13</sup>CO<sub>2</sub> supply revealed diurnal patterns of wood formation in aspen." *Plant Physiology*, 2015. 168. 478-489

Anders Öhman, Lars Forsgren (2015) "NMR Metabonomics of Cerebrospinal Fluid distinguishes between Parkinson's Disease and Controls" *Neuroscience Letters* 594, 36-39

I Ehlers, A Augusti, TR. Betson, MB. Nilsson, JD Marshall, and J Schleucher (2015) "Detecting long-term metabolic shifts using isotopomers: CO<sub>2</sub>-driven suppression of photorespiration in C3 plants over the 20th century." *PNAS* 112(51):15585-15590. doi: 10.1073/pnas.1504493112

### **General: ranging from material research to plants, ecology etc): ca. 10 inclusive**

P. Rogne, T. Sparrman, I Anugwom, J-P Mikkola, M. Wolf-Watz (2015) "In Realtime <sup>31</sup>P NMR Investigation on the Catalytic Behavior of the Enzyme Adenylate kinase in the Matrix of a Switchable Ionic Liquid." *ChemSusChem* 2015, 8, 3764–3768. **Selection of publications in area of technical chemistry/Bio4Energy:**

Anugwom, I., Eta, V., Virtanen, P., Mäki-Arvela, P., Hedenström, M., Hummel, M., Sixta, H., Mikkola, J-P., Switchable Ionic Liquids as Delignification Solvents for Lignocellulosic Materials. *Chemsuschem*, 2014. 7(4): p. 1170-1176.

Anugwom, I. et al. Towards optimal selective fractionation for Nordic woody biomass using novel amine-organic superbase derived switchable ionic liquids (SILs). *Biomass & Bioenergy* 70, 373-381, doi:10.1016/j.biombioe.2014.08.005 (2014).

Öman, T., Tessem, M-B., Bathen, T. F., Bertilson, H., Angelsen, A., Hedenström, M., Andreassen, T., Identification of metabolites from 2D (1)H-(13)C HSQC NMR using peak correlation plots. *BMC bioinformatics*, 2014. 15: p. 413.

Mahboubi, A., Linden, P., Hedenström, M., Moritz, T., Niittylä, T., C-13 Tracking after (CO<sub>2</sub>)-C-13 Supply Revealed Diurnal Patterns of Wood Formation in Aspen. *Plant Physiology*, 2015. 168(2): p. 478-489.

Normark, M., Pommer, L., Gräsvik, J., Hedenström, M., Gorzås, A., Winstrand, S., Jönsson, L., Biochemical Conversion of Torrefied Norway Spruce after Pretreatment with Acid or Ionic Liquid. *Bioenergy Res*, 2015. Accepted manuscript.



Jogunola, O., Eta, V., Hedenström, M., Sundman, O., Salmi, T., Mikkola, J-P., Ionic liquid mediated technology for synthesis of cellulose acetates using different co-solvents. *Carbohydrate Polymers*, 2016. 135: p. 341-348.

P. Rogne, T. Sparrman, I Anugwom, J-P Mikkola, M. Wolf-Watz (2015): Io Realtime 31 P NMR Investigation on the Catalytic Behavior of the Enzyme Adenylate kinase in the Matrix of a Switchable Ionic Liquid." *ChemSusChem*, 2015. 8: p. 3764–3768.

Martin Lidman, Šárka Pokorná, Artur P.G. Dingeldein, Tobias Sparrman, Marcus Wallgren, Radek Šachl, Martin Hof, Gerhard Gröbner (2016): The oxidized phospholipid PazePC promotes permeabilization of mitochondrial membranes by Bax" *Biochimica et Biophysica Acta* 1858 (2016) 1288–1297.

Kenichi Shimizu, Gordon William Driver, Marie Lucas, Tobias Sparrman, Andrey Shchukarev, Jean-Francois Boily (2016) "Bifluoride ([HF<sub>2</sub>]<sup>-</sup>) formation at the fluoridated aluminium hydroxide/water interface" *Dalton Transactions* 2016, Advance Article, Accepted 19 Feb 2016 DOI: 10.1039/C5DT04425A.

## Publications Proteomics Core Facility

vanTeeseling MC, Mesman RJ, Kuru E, Espaillet A, Cava F, Brun YV, VanNieuwenhze MS, Kartal B, van Niftrik L. (2015) Anammox Planctomycetes have a peptidoglycan cell wall. *Nat Commun.* 6: 6878. doi: 10.1038/ncomms7878.

Kieselbach T, Zijngé V, Granström E, Oscarsson J. (2015) Proteomics of *Aggregatibacter actinomycetemcomitans* outer membrane vesicles. *PLoS One* 10:e0138591. doi: 10.1371/journal.pone.0138591.

Srivastava V, Obudulu O, Bygdell J, Löfstedt T, Rydén P, Nilsson R, Ahnlund M, Johansson A, Jonsson P, Freyhult E, Qvarnström J, Karlsson J, Melzer M, Moritz T, Trygg J, Hvidsten TR, Wingsle G. (2013) OnPLS integration of transcriptomic, proteomic and metabolomic data shows multi-level oxidative stress responses in the cambium of transgenic hipl-superoxide dismutase *Populus* plants. *BMC Genomics* 14, 893. doi: 10.1186/1471-2164-14-893.

Niemiec M.S., Weise C.F., Wittung-Stafshede P. (2012). In vitro thermodynamic dissection of human copper transfer from chaperone to target protein. *PLoS One* 7:e36102. doi: 10.1371/journal.pone.0036102.

Zijngé V., Kieselbach T. and Oscarsson J. (2012) Proteomics of protein secretion by *Aggregatibacter actinomycetemcomitans*. *PLoS One* 7:e41662

Zetterström P., Graffmo K.S., Andersen P.M., Brännström T. and Marklund S.L. (2011) Proteins that bind to misfolded mutant superoxide dismutase-1 in spinal cords from transgenic amyotrophic lateral sclerosis (ALS) model mice. *J Biol Chem* 286, 20130-6.

Bäckström S, Elfving N, Nilsson R, Wingsle G, Björklund S (2007) Purification of mediator from *Arabidopsis thaliana* identifies PFT1 as the Med25 subunit. *Mol Cell* 26: 717-729.

Nilsson R, Bernfur K, Gustavsson N, Bygdell J, Wingsle G, Larsson C (2010). Proteomics of plasma membranes from poplar trees reveals tissue distribution of transporters, receptors, and proteins in cell wall formation. *Mol Cell Proteomics*. 9:368-387.

Onishchenko, E, Stanton, LH, Madrid, AS, Kieselbach, T, Weis, K (2009). Role of the NDC1-interaction network in yeast nuclear pore complex assembly and maintenance. *J Cell Biol.* 185:476-491.

Goulas E, Schubert, M, Kieselbach T, Kleczkowski LA, Gardeström P, Schröder W, and Hurry V (2006). Cold acclimation: a proteomic study of the chloroplast lumen and stroma of *Arabidopsis thaliana* by fluorescence two-dimensional difference gel electrophoresis and mass spectrometry. *The Plant Journal* 47: 720-734. Impact factor: 6.5, citations 128

Bylesjö M, Nilsson R, Srivastava V, Grönlund A, Johansson AI, Jansson S, Karlsson J, Moritz T, Wingsle G, Trygg J. (2009) Integrated Analysis of Transcript, Protein and Metabolite Data to Study Lignin Biosynthesis in Hybrid Aspen. *J. Prot. Res.* 8:199-210

## Publications Swedish Metabolomics Centre

Näsström E, Vu Thieu NT, Dongol S, Karkey A, Voong Vinh P, Ha Thanh T, Johansson A, Arjyal A, Thwaites G, Dolecek C, Basnyat B, Baker S, Antti H. (2014) Salmonella Typhi and Salmonella Paratyphi A elaborate distinct systemic metabolite signatures during enteric fever. *Elife*. 2014 Jun 5;3. doi: 10.7554/eLife.03100.

Wuolikainen A, Jonsson P, Ahnlund M, Antti H, Marklund SL, Moritz T, Forsgren L, Andersen PM, Trupp M. Multi-platform mass spectrometry analysis of the CSF and plasma metabolomes of rigorously matched amyotrophic lateral sclerosis,

Parkinson's disease and control subjects. *Mol Biosyst*. 2016 Apr 22;12(4):1287-98. doi: 10.1039/c5mb00711a. Epub 2016 Feb 17.

Bergström SH, Rudolfsson SH, Bergh A. Rat Prostate Tumor Cells Progress in the Bone Microenvironment to a Highly Aggressive Phenotype. *Neoplasia*. 2016. Mar;18(3):152-61. doi: 10.1016/j.neo.2016.01.007.

Lindén P, Keech O, Stenlund H, Gardeström P, Moritz T. Reduced mitochondrial malate dehydrogenase activity has a strong effect on photorespiratory metabolism as revealed by <sup>13</sup>C labelling. *J Exp Bot*. 2016 Feb 17. pii: erw030. [Epub ahead of print].

Mehlem A, Palombo I, Wang X, Hagberg CE, Eriksson U, Falkevall A. PGC-1 $\alpha$  coordinates mitochondrial respiratory capacity and muscular fatty acid uptake via regulation of VEGF-B. *Diabetes*. 2016 Jan 28. pii: db151231. [Epub ahead of print].

Stäubert C, Krakowsky R, Bhuiyan H, Witek B, Lindahl A, Broom O, Nordström A. Increased lanosterol turnover: a metabolic burden for daunorubicin-resistant leukemia cells. *Med Oncol*. 2016 Jan;33(1):6. doi: 10.1007/s12032-015-0717-5. Epub 2015 Dec 23.

Missailidis C, Hällqvist J, Qureshi AR, Barany P, Heimbürger O, Lindholm B, Stenvinkel P, Bergman P. Serum Trimethylamine-N-Oxide Is Strongly Related to Renal Function and Predicts Outcome in Chronic Kidney Disease. *PLoS One*. 2016 Jan 11;11(1):e0141738. doi: 10.1371/journal.pone.0141738. eCollection 2016.

Stagge S, Cavka A, Jönsson LJ. Identification of benzoquinones in pretreated lignocellulosic feedstocks and inhibitory effects on yeast. *AMB Express*. 2015 Dec;5(1):62. doi: 10.1186/s13568-015-0149-9. Epub 2015 Sep 17.

Matrosova A, Bogireddi H, Mateo-Peñas A, Hashimoto-Sugimoto M, Iba K, Schroeder JI, Israelsson-Nordström M. The HT1 protein kinase is essential for red light-induced stomatal opening and genetically interacts with OST1 in red light and CO<sub>2</sub>-induced stomatal movement responses. *New Phytol*. 2015 Dec;208(4):1126-37.

Stäubert C, Broom OJ, Nordström A. Hydroxycarboxylic acid receptors are essential for breast cancer cells to control their lipid/fatty acid metabolism. *Oncotarget*. 2015 Aug 14;6(23):19706-20.

Petersson SV, Lindén P, Moritz T, Ljung K. Cell-type specific metabolic profiling of *Arabidopsis thaliana* protoplasts as a tool for plant systems biology. *Metabolomics*. 2015;11(6):1679-1689.

Mattsson A, Kärrman A, Pinto R, Brunström B. Metabolic Profiling of Chicken Embryos Exposed to Perfluorooctanoic Acid (PFOA) and Agonists to Peroxisome Proliferator-Activated Receptors. *PLoS One*. 2015 Dec 1;10(12):e0143780

Gouveia-Figueira S, Späth J, Zivkovic AM, Nording ML. Profiling the Oxylipin and Endocannabinoid Metabolome by UPLC-ESI-MS/MS in Human Plasma to Monitor Postprandial Inflammation. *PLoS One*. 2015 Jul 17;10(7):e0132042.

Gamm M, Peviani A, Honsel A, Snel B, Smeekens S, Hanson J. Increased sucrose levels mediate selective mRNA translation in *Arabidopsis*. *BMC Plant Biol*. 2014 Nov 18;14:306.

Keefover-Ring K, Ahnlund M, Abreu IN, Jansson S, Moritz T, Albrechtsen BR. No evidence of geographical structure of salicinoid chemotypes within *Populus tremula*. *PLoS One*. 2014 Oct 9;9(10):e107189.

## Publications Umeå Core Facility Electron Microscopy

Sandström A, Asadpoordarvish A, Enevold J, Edman L. Spraying light: ambient-air fabrication of large-area emissive devices on complex-shaped surfaces. *Adv Mater*. 2014 Aug 6;26(29):4975-80.

Ruhal R, Antti H, Rzhepishevskaya O, Boulanger N, Barbero DR, Wai SN, Uhlin BE, Ramstedt M. A multivariate approach to correlate bacterial surface properties to biofilm formation by lipopolysaccharide mutants of *Pseudomonas aeruginosa*. *Colloids Surf B Biointerfaces*. 2015 Mar 1;127:182-91. doi:10.1016/j.colsurfb.2015.01.030.

www.kbc.umu.se

Sharifi, T., Valvo, M., Gracia-Espino, E., Sandstrom, R., Edstrom, K. & Wagberg, T. (2015) Hierarchical self-assembled structures based on nitrogen-doped carbon nanotubes as advanced negative electrodes for Li-ion batteries and 3D microbatteries, *J Power Sources*. 279, 581-592.

Sjöström AE, Sandblad L, Uhlin BE, Wai SN. Membrane vesicle-mediated release of bacterial RNA. *Sci Rep*. 2015 Oct 20;5:15329 of bacterial RNA. *Sci Rep*. 2015 Oct 20;5:15329. doi: 10.1038/srep15329.

Francis MK, Holst MR, Vidal-Quadras M, Henriksson S, Santarella-Mellwig R, Sandblad L, Lundmark R. Endocytic membrane turnover at the leading edge is driven by a transient interaction between Cdc42 and GRAF1. *J Cell Sci*. 2015 Nov 15;128(22):4183-95.

Hugosson, F., Sjogren, C., Birve, A., Hedlund, L., Eriksson, T. & Palmer, R. H. (2014) The *Drosophila* Midkine/Pleiotrophin Homologues Miple1 and Miple2 Affect Adult Lifespan but Are Dispensable for Alk Signaling during Embryonic Gut Formation, *Plos One*. 9.

Derba-Maceluch M, Awano T, Takahashi J, Lucenius J, Ratke C, Kontro I, Busse-Wicher M, Kosik O, Tanaka R, Winzél A, Kallas Å, Leśniewska J, Berthold F, Immerzeel P, Teeri TT, Ezcurra I, Dupree P, Serimaa R, Mellerowicz EJ. Suppression of xylan endotransglycosylase PtxtXyn10A affects cellulose microfibril angle in secondary wall in aspen wood. *New Phytol*. 2015 Jan;205(2):666-81.

Talyzin, A. V., Hausmaninger, T., You, S. J. & Szabo, T. (2014) The structure of graphene oxide membranes in liquid water, ethanol and water-ethanol mixtures, *Nanoscale*. 6, 272-281.

Brännström K, Öhman A, Nilsson L, Pihl M, Sandblad L, Olofsson A. The N-terminal region of amyloid  $\beta$  controls the aggregation rate and fibril stability at low pH through a gain of function mechanism. *J Am Chem Soc*. 2014 Aug 6;136(31):10956-64.

Fleury, C., Su, Y. C., Hallstrom, T., Sandblad, L., Zipfel, P. F. & Riesbeck, K. (2014) Identification of a *Haemophilus influenzae* Factor H-Binding Lipoprotein Involved in Serum Resistance, *J Immunol*. 192, 5913-5923.

Kindgren, P., Dubreuil, C. & Strand, A. (2015) The Recovery of Plastid Function Is Required for Optimal Response to Low Temperatures in *Arabidopsis*, *Plos One*. 10.

Jones, I., Hagglund, A. C., Tornqvist, G., Nord, C., Ahlgren, U. & Carlsson, L. (2015) A novel mouse model of tuberous sclerosis complex (TSC): eye-specific Tsc1-ablation disrupts visual-pathway development, *Dis Model Mech*. 8, 1517-1529.

Thay, B., Damm, A., Kufer, T. A., Wai, S. N. & Oscarsson, J. (2014) *Aggregatibacter actinomycetemcomitans* Outer Membrane Vesicles Are Internalized in Human Host Cells and Trigger NOD1- and NOD2-Dependent NF- $\kappa$ B Activation, *Infect Immun*. 82, 4034-4046.

Pietrzykowska, M., Suorsa, M., Semchonok, D. A., Tikkanen, M., Boekema, E. J., Aro, E. M. & Jansson, S. (2014) The Light-Harvesting Chlorophyll a/b Binding Proteins Lhcb1 and Lhcb2 Play Complementary Roles during State Transitions in *Arabidopsis*, *Plant Cell*. 26, 3646-3660.

Bergström U, Ekstrand-Hammarström B, Hägglund L, Wingfors H. Comparing acute toxicity of gunshot particles, from firing conventional and lead-free ammunition, in pulmonary epithelial cell cultures. *J Toxicol Environ Health A*. 2015;78(10):645-61.

### **Publications Vibrational Spectroscopy Core Facility**

Felten J, Hall H, Jaumot J, Tauler R, de Juan A. A Gorzsás (2015) Vibrational spectroscopic image analysis of biological material using multivariate curve resolution-alternating least squares (MCR-ALS), *Nature Protocols*, 10(2): 217-240. (Field: Method Development)

Serk H, Gorzsás A, Tuominen H, Pesquet E (2015) Cooperative Lignification of Xylem Tracheary Elements, *Plant Signalling & Behaviour*. 10:4, e1003753. (Field: Plant Sciences)

Anoshkin I V, Talyzin A V, Nasibulin A G, Krashennnikov A V, Jiang H, Nieminen R M, Kauppinen E I (2014) Coronene Encapsulation in Single-Walled Carbon Nanotubes: Stacked Columns, Peapods, and Nanoribbons, *Chem Phys Chem*, 15, 1660 – 1665. (Field: Nanotechnology)

Biswal AK, Soeno K, Latha Gandla M, Immerzeel P, Pattathil S, Lucenius J, Serimaa R, Hahn MG, Moritz T, Jönsson LJ, Israelsson-Nordström M, Mellerowicz EJ. (2014) Aspen pectate lyase PtxtPL1-27 mobilizes matrix polysaccharides from woody tissues and improves saccharification yield. *Biotechnology for Biofuels* 7:11. (Field: Biotechnology)

Hagvall K, Persson P, Karlsson T (2014) Spectroscopic characterization of the coordination chemistry and hydrolysis of gallium(III) in the presence of aquatic organic matter, *Geochimica et Cosmochimica Acta*, 146, 76-89. (Field: Geochemistry)  
Barbero DR, Boulanger N, Ramstedt M, Yu J (2014) Nano-Engineering of SWNT Networks for Enhanced Charge Transport at Ultralow Loading, *Advanced Materials*, 26, 19, 3111-3117 (Field: Material Sciences)

Cunningham L, Vogel H, Nowaczyk N, Wennrich V, Juschus O, Persson P, Rosén P (2013) Climatic variability during the last interglacial inferred from geochemical proxies in the Lake El'gygytyn sediment record, *Palaeogeography, Palaeoclimatology, Palaeoecology*, 386, 408-414 (Field: Environmental Sciences)

Ellström M, Shah F, Johansson T, Ahrén D, Persson P, Tunlid A (2015) The carbon starvation response of the ectomycorrhizal fungus *Paxillus involutus*, *FEMS Microbiology Ecology*, 91, fiv027 (Field: Microbiology)

Sheng M, Gorzsás A, Tuck S (2016) Fourier transform infrared microspectroscopy for the analysis of the biochemical composition of *C. elegans* worms. *Worm*, 5:1, e1132978 (Field: Medicinal Sciences)

Gorzsás A, Kenney JPL (2012) Fourier Transform Infrared Spectroscopy. *AWE International*, 31: 12-19 (Field: Popular Science for non-academic audiences)