Welcome to the UCMR Research School!

The main goal of the UCMR Research School is to stimulate graduate research education in new research interfaces between medicine-biology-chemistry-physics and to promote the recruitment of young researchers to new emerging research areas that encompass chemical-biology approaches. By training young researchers, we will develop a strong, sustainable research environment for infection biology and molecular infection medicine research at Umeå University.

The research school operates within the interdisciplinary UCMR research environment that includes successful research groups from different departments and faculties as well as National and International research programs like the Swedish EMBL node in Molecular Medicine, MIMS.

Training includes state-of-the-art technologies within core facilities and technical platforms, workshops covering latest developments in research areas related to infection biology. In addition, the research school also offers courses that promote personal development.

The research school is open to external students and postdocs and is increasingly engaged in National and International collaborations with a growing number of external students attending our courses. Thereby further opportunities for are provided for our students for scientific networking and experience multidisciplinary approaches in solving scientific questions.

How to sign up for a course

All courses are given in English.

Registration is via on-line format.

The most update information about the exact date and place for each course can be found on the UCMR homepage

http://www.ucmr.umu.se/research-school/course-catalogue.html
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Photos: Marie Andersson, © UCMR/Umeå
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Basic Bioinformatics - 2 ECTS

Instructor  Uwe Sauer, tel. 090-786 5930, uwe.sauer@chem.umu.se, http://www.chemistry.umu.se/forskning/group-leaders/uwe-sauer/ http://clicumu.se/

Department  Chemistry, KBC & Computational Life Science Cluster, CLiC
Participants  10
Duration 5 days: the course includes lectures (12 h), computer labs (21 h), group discussions (5 h), and work projects.
Exam All PC-lab reports must be passed, as well as 2 short tests

Course content

The course applies hands-on bioinformatics methods in a problem-oriented way and is built around a relevant biological case study. You will learn how “Raw” bioinformatics data are produced, stored and manipulated. A brief introduction to the UNIX/Linux operating system is followed by exercises using the GCG Wisconsin package on a UNIX computer.

Skills are developed to become efficient in finding and comparing DNA as well as protein sequences. Starting from DNA sequencing fragments, you will learn how to manipulate DNA sequences and identify genes.

On the protein level, you will analyze the peptide sequence to find signal sequences, transmembrane regions, domains and interaction sites. You will learn how to compare DNA and protein sequences and you will use dot-plots and perform both pair-wise and multiple sequence alignments.

The problems are centered around tasks that will introduce you to various public databases available on the WWW and to the theory of pair-wise and multiple sequence alignments and origins of substitution matrices such as PAM250 or BLOSUM62, dynamic programming algorithms, global and local alignment methods. Unknown sequences are analyzed to find homologous proteins in other organisms and to find functional and structural motifs. Gene mapping projects and simple phylogenetic reconstruction are included. Sequence patterns (regular expressions) and profiles will be introduced, as well as the use of hidden Markov models. You will learn how to download and display files describing protein structures (PDB-files) and visualize them with molecular graphics programs.

Literature

Central Concepts in Molecular Modelling (Computational Chemistry) Related to Biological and Medicinal Chemistry - 2 ECTS

Instructor  Anna Linusson, tel. 090-786 6890 and David Andersson, tel. 090-786 5006,
E-mail  anna.linusson@chem.umu.se, david.andersson@chem.umu.se
http://www.chemistry.umu.se/forskning/group-leaders/anna-linusson/
http://clicumu.se/

Department  Chemistry
Participants  18
Duration  6 days, which means 6 meetings, 3h per meeting, all meetings are mandatory.

Course content

Interactions between small molecules (ligands) and macromolecules, such as an enzyme, DNA or receptor, play a key role in many biological processes. The molecular recognition is due to geometrical and physicochemical complementarity of ligands and their biological targets. The utilization of computers to identify, evaluate and design small molecules for interactions with macromolecules is widely used today. A common understanding of the mechanisms behind molecular interactions and knowledge of methods by which we can assess these interactions is very important before initializing a computational study.

This course will deal with many of the basic concepts in molecular modelling. The students will meet on six separate occasions to discuss one of six pre-determined topics. Each occasion (3 hours) will be planned by at least two students. Relevant literature/articles will be sent out to the participants two week in advance. The Durations for the meetings may be altered so that as many students as possible can participate. All students are encouraged to bring their own research into the discussions.

- Molecular interactions (protein-ligand interactions, binding energies, entropy and enthalpy and influence of solvent and molecular flexibility).
- Ligand properties (treatment of ligands in computation, PKa-calculations and tautomerism, force fields and atom type considerations, conformational searches and statistical molecular design).
- Protein structures (X-ray crystallography, NMR, evaluation of protein structure quality, preparation of all atom protein structures and molecular dynamics simulations).
- Computational methods (Structure-based and ligand-based design, molecular docking, pharmacophore modelling, and molecular interaction fields).
- How to quantify molecular interactions (experimental techniques such as Microcalorimetry and computational methods such as scoring functions and molecular modelling Poisson-Boltzmann/generalized Born methods).
- Modelling - validation and evaluation (Statistics, quantitative structure-activity relationships and chemometrics and support vector machines for regression analysis and classification).
Computer Programming Languages and Algorithms in Bioinformatics - 2 ECTS

Instructor  Torgeir Hvidsten, tel. 090-786 5248
torgeir.hvidsten@plantphys.umu.se
http://clicumu.se/

Department  Umeå Plant Science Centre, Computational Life Science Cluster
Participants  15
Duration  5 days: the course includes lectures (12 h) and exercises (18 h).
Exam  Written report

Course content

The course targets PhD students and others who have come to realize that existing software tools are not enough to solve their problems, and want to learn how to write basic programs themselves. The course will cover basic Perl to run programming, algorithm design and the use of Perl to access online resources and run external programs. No previous programming skills are required. The course will teach programming through tutorial-based exercises with a step-by-step introduction to the programming language Perl.
Design of Experiments for Biological and Chemical Applications - 1.5 - 3 ECTS

Instructor  Erik Johansson, Ph.D., Senior Application Specialist, Umetrics AB,  
tel. 073-682 4851, erik.johansson@umetrics.com  
http://clicumu.se/

Department  Umetrics  
Participants  16  
Duration  4 days: lectures 12 hours, exercises 8 hours, practical DoE 8 hours. Students should bring their own laptop. Umetrics software package MODDE will be installed and used in the exercises.

Exam  For 1.5 ECTS: Participation in the first three days of lectures and exercises. On Day 4 the student will apply this gained knowledge and construct an experimental design related to the student’s own current research project.  
For 3 ECTS: Students go back to their labs and perform experiments according to the constructed design of experiments, evaluate the experiments using MODDE software package, and write a short report that needs to be approved by course leader.

Course content
Design of experiments is a rational and cost-effective approach to practical experimentation that allows the effect of variables to be assessed using a minimum of resources. Discover how to optimise your experiments, products and processes for increased throughput and enhanced profitability. The course is split between lectures and hands-on analysis of real data using Umetrics’ state-of-the-art software package MODDE. After completing the course, participants will know how to create efficient designs to match the experimental objectives, analyse experimental data using sound statistical principles, improve and optimise products and processes, report results in a simple graphical format, design, measure, analyse, interpret, and optimise, construct predictive models and apply them in practice.

Schedule
Day 1  
09:00  Course start.  
17:00  How and when should design of experiments be used? Problem formulation, selection of goals, factors, responses, type of model and design. Full factorials, the basis of other designs. Analysis of full factorial designs I, evaluation of raw data, regression analysis and model interpretation. Computer exercises followed by discussions.

Day 2  
09:00  Analysis of full factorials II. Fault detection.  
17:00  Screening designs, which factors dominate and what are their optimal ranges. What to do after screening, optimisation or modification of the design. Optimisation designs, how do we find an optimum or a compromise? Computer exercises followed by discussions.

Day 3  
09:00  Robustness testing, verification that the method or process is robust within given specifications.  
15:00  Exercises using participants’ or Umetrics’ examples. Discussion of participants’ own data including creation of new designs. Course summary.

Day 4  
Setting up a practical design.
Elements of Bioinformatics - 4 ECTS

Instructor Torgeir R. Hvidsten, tel. 090-786 5248
torgeir.hvidsten@plantphys.umu.se
http://clicumu.se/

Department Umeå Plant Science Centre, Computational Life Science Cluster
Participants 10 – 15
Duration 10 days: the course includes lectures (20 h), computer labs (16 h) and self-study
Exam Labs and exercises

Course content

The course gives a brief introduction to basic bioinformatics programming. A more complete programming introduction is given in the research school course Computer Programming Languages and Algorithms in Bioinformatics.

The research school course Basic Bioinformatics focuses more on sequence analysis and databases. We recommend attending both courses to cover all the most important topics in bioinformatics. The two courses marginally overlap on some topics (sequence analysis, phylogenetics and protein structure) where this course gives a more in-depth treatment.

Literature
Introduction to Bioinformatics. Arthur M. Lesk, Oxford University Press
MatLab - theory and practical applications - 2 ECTS

Instructor  Rui Pinto, tel. 090-786 5304, Pär Jonsson, tel. 090-786 5358
            rui.pinto@chem.umu.se, par.jonsson@chem.umu.se
            http://www.chemistry.umu.se/
            http://clicumu.se/

Department  Chemistry
Participants 15
Duration  6 days: the course includes lectures (24 h) and laborations (6 h).

Course content

This hands-on Matlab course will be entirely lectured by two instructors in the computer lab, focused on getting students familiar with Matlab and learning them basic programming skills by practice.

The objective is that in the end of the course the students may work independently to solve simple problems using Matlab.

Subjects: Matlab environment, read data from external sources, variables, scripts/functions, matrix calculations, plotting, debugging, strings, data structures, control flow, mathematical functions, programming.
Multivariate Data Analysis with Biological and Medical Applications - 2 ECTS

Instructor  Patrik Rydén, tel. 090-786 9562, 
patrik.ryden@math.umu.se 
http://www.math.umu.se/om-institutionen/personal/patrik-ryden/ 
http://clicumu.se/

Department  Mathematics and Mathematical Statistics 
Participants  16 
Duration  5 days: the course includes lectures (16 h) and laborations (8 h). 
Exam  Individual reports

Course content

The course covers the most commonly used methods for multivariate data analysis, including methods for cluster analysis and classification. The principals and general theory are presented together with medical and biological examples. Special emphasis will be on data analysis with the software SPSS.
Statistics for Life Sciences - 3 ECTS

Instructor  Patrik Rydén, tel. 090-786 9562
            patrik.ryden@math.umu.se
            http://www.math.umu.se/om-institutionen/personal/patrik-ryden/
            http://clicumu.se/

Department  Mathematics and Mathematical Statistics, Computational Life science Cluster (CLiC)
Participants 12
Duration 10 days
Exam The students will work in groups solving a real problem using either R or SPSS, identify appropriate summary measures, construct confidence intervals and perform relevant hypothesis tests.

Course content

The course aims to give a short introduction to statistical concepts and methods used in life sciences. It covers basic measures, estimation, hypothesis testing, ANOVA, correlation and linear regression. All theory is introduced through biological and medical examples. For most examples a solution using the statistical software R is presented. The course literature presents examples using the software SPSS. The course may serve as an introductory course, but is also useful for students that want to refresh their statistical knowledge.

Literature
The Microarray Technology – a course on Data Analysis - 2 ECTS

Instructor  Patrik Rydén, tel. 090-786 9562,  
patrik.ryden@math.umu.se  
http://www.math.umu.se/om-institutionen/personal/patrik-ryden/  
http://clicumu.se/

Department  Mathematics and Mathematical Statistics  
Participants  16  
Duration  5 days: the course includes lectures (16 h) and laborations (12 h).  
Exam  Individual reports

Course content

The course gives an introduction to the microarray technology and its applications for students and scientists with experience in molecular biology. It is designed to give students experience in handling the flood of information that accompanies microarray experiments. In addition it aims to give an understanding of the risks and possibilities using the technology.

The course covers pre-processing of cDNA and Affymetrix data, quality control, cluster analysis and classification. To some degree, it also covers experimental design and validation.
Basic qPCR and Advanced qPCR and Biostatistics - 1 ECTS when attending both days

Instructor: tataa Biocenter
Contact: marianne.sommarin@plantphys.umu.se, ake.forsberg@molbiol.umu.se
Department: Umeå Plant Science Centre
Duration: 2 days: the course has two separate days. Participation is possible on one or both days. Day 1 Basic qPCR; Day 2 Advanced qPCR and Biostatistics

Schedule

**Day 1**

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<th>Time</th>
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<td>09.00-10.00</td>
<td>Basic PCR and qPCR theory and applications</td>
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<tr>
<td>10.00-10.45</td>
<td>Data analysis</td>
</tr>
<tr>
<td>10.45-11.15</td>
<td>Primer and probe design and considerations</td>
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<tr>
<td>11.15-11.45</td>
<td>Principle of RT and different RT priming strategies</td>
</tr>
<tr>
<td>12.45-13.45</td>
<td>Principle of RT and different RT priming strategies</td>
</tr>
<tr>
<td>14.00-15.00</td>
<td>Normalization of qPCR data</td>
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<td>15.15-16.00</td>
<td>The MIQE guidelines</td>
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<td>17.00-17.15</td>
<td>Discussion and Q&amp;A</td>
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**Day 2**

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<th>Time</th>
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<td>09.00-10.00</td>
<td>Introduction to qPCR theory</td>
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<tr>
<td>10.15-11.15</td>
<td>Standard curves and absolute quantification</td>
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<tr>
<td>11.15-11.45</td>
<td>Validation of assays</td>
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<tr>
<td>12.45-13.45</td>
<td>Statistical tests</td>
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<tr>
<td>13.45-14.45</td>
<td>Experimental design</td>
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<tr>
<td>15.00-16.00</td>
<td>Relative quantification</td>
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<tr>
<td>16.00-17.00</td>
<td>Introduction to expression profiling</td>
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</table>
Next Generation Sequencing - Techniques and Applications - 1.5 ECTS

Instructor  
Jeanette Tångrot, Molecular Biology, 090-785 0811 and Per Stenberg, Molecular Biology, CLiC, 090-785 6777  
jeanette.tangrot@molbiol.umu.se, per.stenberg@molbiol.umu.se  
http://www.molbiol.umu.se/english/research/researchers/per-stenberg/  
http://clicumu.se/

Department  
Molecular Biology

Participants  
10-15

Duration  
5 days: lectures 14 hours, Computer labs 6 hours, Discussions

Course content

The course will introduce the dominating deep sequencing techniques currently in use. The advantages and drawbacks of the different techniques will be presented as well as costs and Swedish infrastructure in the field. Researchers actively working with deep sequencing based projects will present applications and share their experience on advantages and possible pitfalls. In addition, the course will cover examples of downstream analysis and the third generation sequencing techniques that soon will be available.

The course is ideal for PhD students and Postdocs that plan to start working on deep sequencing applications or that just want to get up to Duration with this rapidly evolving technique that has started to replace array based techniques.
NMR Spectroscopy Workshop in Structural Biology

The workshop consists of lectures and practical sessions at basic (module I), advanced (module II) and specialized (module III) levels with topics covering:

- Structure Determination of Biomolecules (Proteins, DNA, RNA, Carbohydrates, Lipids, Biopolymers).
- Checking quickly synthesized or fragmented small molecules
- Drug Screening
- NMR in Proteomics and Metabolomics: Basic Information; Biomarkers (Diseases)
- Dynamics: Molecules, Enzymatic Reactions – Kinetics
- Molecular Interactions: Protein-Protein, Protein-DNA, Drug-Target Protein
- MRI in Life and Material Science (e.g. water diffusion in wood)

The course contains three major modules including a thorough theoretical and practical understanding of NMR spectroscopy in Structural Biology using KBC’s NMR Platform.

NMR Module I - 2 ECTS: Basics

| Instructor | Gerhard Gröbner, Tobias Sparrman  
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<tr>
<td></td>
<td><a href="mailto:gerhard.grobner@chem.umu.se">gerhard.grobner@chem.umu.se</a></td>
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<td><a href="http://www.chemistry.umu.se/forskning/group-leaders/gerhard-grobner/">http://www.chemistry.umu.se/forskning/group-leaders/gerhard-grobner/</a></td>
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<tr>
<th>Participants</th>
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<tr>
<td>Duration</td>
<td>10 days, 2 weeks: week 1 (3 days theory + 2 days hands on NMR practicals), week 2 (2 days theory + 3 days NMR practicals), Lectures in basic NMR, Practicals with basic NMR experiments. Software Training for Processing and Analysis of NMR Spectra</td>
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</table>

Course content

The students acquire sufficient routine to run basic NMR experiments on their own in the future at the KBC NMR platform. They learn theoretical NMR knowledge to understand basic NMR experiments and information which can be derived from them. (Principle: NMR does not have to be a black box tool approach.)

This basic knowledge is essential to take advanced NMR modules to learn tools to obtain structural and dynamic information on complex biomolecules. The students get a first overview in the use of advanced NMR approaches in life science, ranging from structure determination of large biomolecules, lipid membranes to enzyme kinetics.
# NMR Module II - 2 ECTS: Advanced Level

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Juergen Schleucher, Göran Larsson, Magnus Wolf-Watz, Gerhard Gröbner, Matthias Hedlund</th>
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<tbody>
<tr>
<td>Contact</td>
<td><a href="mailto:magnus.wolf-watz@chem.umu.se">magnus.wolf-watz@chem.umu.se</a></td>
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<tr>
<td>Participants</td>
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<tr>
<td>Duration</td>
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<td>Multidimensional NMR Experiments on Proteins, Assignment Concepts, Analysis of NMR</td>
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<td>Spectra, NMR based calculation of Structures, Concepts for Membrane Proteins and</td>
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<td>insoluble Biopolymers. NMR Detection of Dynamics and Protein Kinetics. Assignment</td>
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<td></td>
<td>and Modelling Strategies. Practicals with multi-dimensional NMR experiments on</td>
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<td>peptides. Software training for assignment and modeling approaches. First solid</td>
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<td>state MAS NMR experiments (basics).</td>
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</table>

## Course content

The student obtains a comprehensive teaching of modern NMR spectroscopy concepts in structural biology related to medically and biologically relevant questions. Main focus is to give a broad understanding of the basics of multi-dimensional NMR strategies and their application on the determination of three-dimensional structures of soluble proteins, but also membrane proteins and their lipid environment. Students learn solution and solid state techniques in various laboratory moments using state of the art equipment with the goal to obtain structural information of important biomolecules.

Photos: © NMR platform, Umeå University
NMR Module III - 2 ECTS: Specialized Level

Instructor Contact
Gerhard Gröbner, Henrik Antti, Juergen Schleucher, Göran Larsson
gerhard.grobner@chem.umu.se
http://www.chemistry.umu.se/forskning/group-leaders/gerhard-grobner/
http://www.kbc.umu.se/platforms/nuclear-magnetic-resonance.html

Participants Duration
10 5 days: morning lectures and seminars with afternoon practicals.
Lectures in NMR strategies for structural and dynamical information on DNA, RNA and their complexes with proteins.
NMR as structural tool in protein folding and misfolding.
Determination of folding dynamics and time scale.
Drug and ligand screening by NMR using target proteins (or other biotargets).
NMR methods as used in metabolomic approaches.
Solid State NMR on insoluble biopolymers: Which concepts are used and which information can be obtained.
Practicals will include NMR labs on RNA, drug screening and multi-dimensional solid-state NMR experiments on samples provided by graduates.

Course content

Students acquire the necessary background and skills to use specialized NMR approaches to obtain information on DNA and RNA species. In addition, they use NMR as a tool to study protein folding and apply NMR to characterize structural changes coupled with biological activities and modifications induced by drugs and other small molecules which can interact with biological target molecules.

They learn how to use NMR in metabolomics to provide complementary information compared to other (often MS based) approaches and the necessary theoretical and practical background for solid state NMR techniques used to obtain structural information on large – often insoluble – biopolymers (fibers).

Photo: © NMR platform, Umeå University
**Vibrational Spectroscopy Course - User Licence Course - 2 ECTS**

**Instructor**  András Gorzsas  
andras.gorzsas@chem.se  
http://www.kbc.umu.se/platforms/vibrational-spectroscopy-platform.html

**Department**  Vibrational Spectroscopy Platform, KBC building

**Participants**  15, of which a maximum of 3 people can be external users

**Duration**  5 days: the course includes lectures (16 h) and laborations (12 h).

**Exam**  Individual reports

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**Course content**

Introduction to the usage of FT-IR spectrometers and microscopes as well as a Raman microscope. The course covers applications from biology and medicine to chemistry and physics, such as high-throughput transgenic screening, chemical imaging of biological tissues, surface sensitive measurements of minerals, and the analysis of compositional changes in a range of materials from bacteria to semiconductors.

Aim of the course: To provide the users the necessary knowledge to safely operate the instruments of the Vibrational Spectroscopy Platform on their own, without supervision. The instruments include FT-IR spectrometers and microscopes as well as a Raman microscope, and the course covers applications from biology and medicine to chemistry and physics, such as high-throughput transgenic screening, chemical imaging of biological tissues, surface sensitive measurements of minerals, and the analysis of compositional changes in a range of materials from bacteria to semiconductors.

Users should be able to demonstrate during the course practice that they are able to perform measurements safely in order to gain their Licences. The Licence enables the user to book the instruments online without the assistance of the Platform Manager. The licence will be valid until retraction and while working within UmU and SLU in Umeå.

Applicants should have affiliation to UmU or SLU in Umeå with preference given to KBC group members. A limited number of spots are reserved for external (non-UmU/SLU) users.

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Photo: © Vibrational Spectroscopy Platform, Umeå University
High Throughput Screening - 1-2 ECTS

Instructor  Mikael Elofsson, phone: 090-786 9328
mikael.elofsson@chem.umu.se,
http://www.chemistry.umu.se/forskning/group-leaders/mikael-elofsson/

Department  Laboratories for Chemical Biology Umeå, Department of Chemistry LCBU,
Chemical Biology Consortium Sweden CBCS,
Umeå Centre for Microbial Research UCMR,
Laboratories for Molecular Infection Medicine Sweden, MIMS

Participants  Theoretical course: 24
Theoretical and practical course: 12 from the theoretical course
Duration  2+2 days: Theoretical course 2 days, 1 ECTS
Theoretical + practical course 4 days, 2 ECTS
Exam  None at the theory course, oral and written report at practical course.

Course content

The aim of the course is to give an introduction to small molecule screening as a strategy in basic and applied research.

The theory course will cover a general introduction and lectures on specific topics including assay development, screening, instrumentation, informatics, medicinal chemistry and selected case studies. The course will also include a demonstration of the screening facility at Laboratories for Chemical Biology Umeå. Time will also be given for personal consultation regarding potential screening projects.

The practical course will allow the course participants to carry out a small screening campaign against an established protein target. The participants will gain hands-on experience from liquid handling instruments, plate readers and dedicated software to analyze and interpret screening data.

Literature
Recent research articles applying screening technology.
Metabolomics I - 2 ECTS

Instructor  Thomas Moritz, thomas.moritz@slu.se,  
Anders Nordström, anders.nordstrom@molbiol.umu.se  
Miles Trupp, miles.trupp@neuro.umu.se
Contact  Thomas Moritz, tel. 090-786 8456, thomas.moritz@slu.se  
http://www.kbc.umu.se/platforms/metabolomics.html
Department  Metabolomics Platform, KBC building  
Participants  25  
Duration  4 days: lectures in the morning, project work in the afternoon

Course content

The aim of the course is giving the participants a theoretical overview of the metabolomics field, including technical aspects and relevant applications areas, and putting it in context to other omics-technologies. The course also includes a project study in group where the aim is that the group via literature studies present an own view of a given topic.

Schedule

Day 1  9:00-10:00  Introduction to Metabolomics: history, different type of metabolite analysis; general overview of the field; why metabolomics?
          10:00-11:00  Overview of problems associated with metabolomics studies: from design of study to sampling preparation and conclusion.
          11:00-12:00  Analytical methodology: overview of technical platforms used in metabolomics.
          12:00-13:00  Lunch  
          13:00-16:00  Introduction to group projects

Day 2  9:00-10:00  Plant metabolomics  
          10:00-12:00  Metabolomics in clinical medicine and related areas?  
          12:00-13:00  Lunch  
          13:00-16:00  Projects

Day 3  9:00-12:00  Statistical analysis: overview of methodology used in metabolomics. From design of experiment to statistical validation.  
          12:00-13:00  Lunch  
          13:00-16:00  Projects

Day 4  10:00-12:00  Pathway analysis and databases  
          13:00-16:00  Projects presentations
Practical Course on Rapid Cloning, Protein Expression and Purification - 3 ECTS

Instructor: Gunter Stier, Ruhr University Bochum, Germany  
Contact: Uwe Sauer, Umeå University, tel. 090-786 5930, uwe.sauer@chem.umu.se  
http://www.chemistry.umu.se/forskning/group-leaders/uwe-sauer/

Department: Chemistry  
Participants: 12  
Duration: 8 days: 6 h laboratory work per day  
This course is based on the annual, one week EMBO PEPC5 course held at the EMBL-Hamburg Outstation. For more information about the EMBO course please go to their homepage at http://babel.ucmp.umu.se/cpep/

Course content

Aims of the practical course are:

- Insights in project planning via working on your own project!  
- Use of bioinformatics in analysis and planning of a protein expression project  
- Primer design and gene optimization.  
- Insights in medium throughput cloning and protein expression in E. coli.  
- Fast parallel cloning of your gene(s) into vectors containing different tags and fusion proteins.  
- Use a protein expression mini-screen.  
- Test different strains, growth conditions, and fusion partners to optimize the quality of your favorite protein.  
- Mutagenesis techniques.  
- Use of fusion proteins with associated purification strategies.  
- Use co-expression and purification strategies.  
- Test positive candidatures in a protein midi-preparation using purification machines.  
- Test labeling techniques like 15N-labeling of proteins for quick NMR analysis.  
- Insights in various trouble shooting problems and strategies to solve them.  
- Simple introduction into NMR and crystallization techniques.  
- Introduction to BiaCore analysis.

Additional demonstrations will include the use of the “Äkta” machines for protein purification, the Mosquito crystallization robot, construct characterization by NMR, the BiaCore interaction studies

The practical sessions will be complemented with lectures, roundtable discussions about techniques, problems and their solutions. We encourage the registered participants to bring their own projects. It is also possible to work on a project provided by the course leader.
Protein Crystallization - 1 ECTS

Instructor  Uwe Sauer, tel. 090-786 5930, Elisabeth Sauer-Eriksson, tel. 090-786 5923, Karina Persson, uwe.sauer@chem.umu.se, elisabeth.sauer-eriksson@chem.umu.se, karina.persson@odont.umu.se
http://www.chemistry.umu.se/forskning/group-leaders/uwe-sauer/
http://www.chemistry.umu.se/forskning/group-leaders/elisabeth-sauer-eriksson/

Department Chemistry
Participants 10-12
Duration 4 days: The course includes lectures (6 h), crystallization labs (~8 h). The course is divided into 50% lectures and 50% lab sessions.
Exam Practicals must be passed, as well as one short written test
Note! This course can be considered as part two in the three course series starting with: the Cloning, Protein Expression and Purification, course, and ending with the Basic Bioinformatics course.

Course content
The goal of this course is to present different methods for macromolecular crystallization and to provide hands-on experience for setting up crystallization experiments. Participants may bring their own proteins.

Theory
Brief introduction to protein crystallography, basic and conventional crystallization techniques, parameters that affect crystallization, choosing the proper materials and high throughput crystallization screening using crystallization robots.

Practicals
You will learn how to prepare proteins for crystallization, plan a crystallization experiment, set up crystallization drops manually and with a crystallization robot, evaluate the crystal setups.

Who should participate
Ph.D. students, laboratory technicians/engineers, post-docs new to crystallography and biochemists who purify proteins with the aim of crystallizing them.

Schedule
Day 1 9:00-11:00 “Crystallization of macromolecules” Robotics, DLS, (US)
11:00-12:00 Discussion: protein sample preparation for crystallization (KP, US)
13:00-15:00 Introduction to protein crystallography (ESE)

Day 2 09:00-12:00 Hands on crystallization of proteins.
Setup crystals of Hen Egg White Lysozyme and your own protein (CG)
13:00-15:00 Crystallization room: Use nano-drop pipetting robot to set-up crystallization screens in 96 well trays. Bring your own protein or use HEW Lysozyme (US)

Day 3 9:00-11:00 Inspection of your crystals set-ups (US)
11:15-12:00 Short test

Day 4 or by appointment 09:00-12:00 Crystallization room: Inspection of your protein crystals set-ups (US)

Literature
Instructor: Thomas Kieselbach, thomas.kieselbach@chem.umu.se
http://www.chemistry.umu.se/forskning/group-leaders/thomas-kieselbach/

Participants: 8
Duration: 5 days: the course includes lectures, laboratory teaching and demonstrations. In addition, opportunities for supervised own work will be given. After the course each participant will have to hand in a comprehensive lab report that is required to receive full credits. As this course involves relatively much laboratory work, a maximum number of eight students divided in two lab groups will be admitted. Please, note that attending the course means full-time work.

Course content

The theoretical education will cover topics as follows: Introduction to proteomics, 2-D electrophoresis including 2-d DIGE, MALDI-MS and ESI-LC-MS/MS, quantitative LC-MS, basic bioinformatics covering database resources and database searches using Mascot, Phenyx and ProteinScape. The practical laboratory work will guide the participants through the principal steps of a proteomics experiment and offer opportunities to perform parts of this experiment. The practical lab work will include 2-D electrophoresis, preparations of in-gel digests, MALDI-MS, demonstrations of LC-MS/MS and evaluation and documentation of MS data. The course is suited for post-graduate students and researchers who are in the beginning of a proteomics project or who need background knowledge in basic proteomics techniques in their work for other reasons.
Theoretical and practical course in flow cytometry and cell sorting for plant and medical research applications - 3 ECTS

Instructor  Morten Løbner, Application Specialist, BD Biosciences
           Sara V. Petersson, UPSC
Contact    Karin Ljung, karin.ljung@slu.se, 090-786 8355
           http://www.upsc.se/
Department UPSC, KBC building
Participants 8
Duration    6 days

Course content

The course covers the theory, techniques and fundamental operating principles of flow cytometry and fluorescence activated cell sorting (FACS). The course includes both lectures and laboratory components (demonstrations and hands-on practice). Depending on the interest of the course participants, the hands-on practices can be performed on either samples from plants (e.g. protoplasts, cell cultures, organelles) or animals (e.g. blood and stem cells).
Basic Course in Transmission and Scanning Electron Microscopy- 1 ECTS

Instructor: Per Hörstedt and Lenore Johansson
http://www.kbc.umu.se/platforms/electron-microscopy.html

Department: EM platform, KBC building
Participants: 24
Duration: 3 days

Course content

The course covers the theory, specimen preparation techniques and fundamental operating principles of transmission electron microscopy (TEM) and scanning electron microscopy (SEM). The course includes both lectures and laboratory components (demonstrations and practice).
Practical course in Transmission and Scanning Electron Microscopy - 2 ECTS

Instructor: Per Hörstedt and Lenore Johansson
http://www.kbc.umu.se/platforms/electron-microscopy/home-em-platform.html

Department: EM platform, KBC building
Participants: 6 for TEM and 6 for SEM
Duration: 4 days

Course content

The course is open to students who have completed the “Basic course in Transmission and Scanning Electron Microscopy” or have corresponding experience of EM-techniques.

If the number of applicants exceeds 6, the participants will be selected based on their research information. (The course does not include cryo-ultramicrotomy-Tokuyasu technique.)

Note: The two courses are run in parallel, so you can only attend one of these.

The students should bring their own specimens and together with the electron microscopy platform personnel process their cells/tissues in all the steps from fixation to final microscopy and evaluation of images.

TEM course - After the course the student should:
- understand the basic principles of specimen preparation for TEM analysis
- be able to practically perform all steps in TEM specimen preparation from fixation to final microscopy
- possess basic knowledge in “how to interpret TEM images”.

SEM course - After the course the student should:
- understand the basic principles of specimen preparation for SEM analysis.
- be able to practically perform all steps in SEM specimen preparation.
- understand, interpret and evaluate collected data from specimen analyzed by SEM.
Workshop in Photomicrography and Image Processing for Science- 1.5 ECTS

Instructor         Michael Peres, Staffan Larsson, BergmanLabora AB
Contact            Åke Forsberg, tel. 090-785 2595 or ake.forsberg@molbiol.umu.se

Department        Molecular Biology
Participants       21
Duration           4 days

Course content

This course is team taught by several scientific microscopy photographers and experts. Michael Peres, a registered biological photographer, is a professor at the School of Photographic Arts and Sciences at Rochester Institute of Technology and has 22 years experience in teaching courses in photography using light microscopes and magnification imaging systems.

Staffan Larsson is a research engineer and scientific photographer at the Royal Institute of Technology, Huddinge and at the Department of Biosciences and Nutrition at Karolinska Institute, Huddinge.

BergmanLabora AB sponsors this course with Nikon microscopes, imaging equipment and their product specialists who sell Nikon microscopes, cameras and software and answer questions regarding the equipment.

The course gives theoretical knowledge on the mechanics of light/fluorescence microscopy and on the use of Photoshop for image processing. Hands-on training is coupled with theoretical learning. You are encouraged to bring samples of your own and to have a laptop computer with Adobe Photoshop version CS4.
Creativity Workshop- 1 ECTS

Instructor  Peter Viksten, Creative Consultant
Contact    Åke Forsberg, tel. 090-785 2595 or ake.forsberg@molbiol.umu.se

Department  Molecular Biology
Participants 20
Duration    1 day

Course content
The workshop is given by Peter Viksten a Creative Consultant from Umeå and focuses on creativity challenges of entrepreneurship. In particular, he discusses how you create new ideas and develop existing ideas. Peter has 15 years experience in introducing and re-introducing products and trademarks. He has worked with various companies such as Nike, CocaCola and small local enterprises. The course consists of a seminar followed by group activities that test methods for developing creativity.
English Writing Workshop: Basic- 1.5 ECTS

Instructor  Hossein Ordoubadian, Accent Språkservice AB
           http://www.accent-sweden.com/
Contact    Åke Forsberg, tel. 090-785 2595 or ake.forsberg@molbiol.umu.se

Participants 10
Duration     3 days

Course content

In this course, you learn how native English speakers read so you can diagnose the readability of your own writing. After learning how to identify how your writing may be difficult for native English speakers to follow, you apply several techniques to improve the readability of your writing. The focus of the workshop is on principles rather than rules; very little technical language is used. About ten new concepts will be introduced. We will only focus on punctuation that affects readability. Of course, if you have specific questions, we will address them.

There are four main goals of the course:
1. To identify in your own writing where you ignore these principles. Remember they are only guidelines and at times they should be ignored
2. To understand the principles (not rules) of good writing.
3. To revise your writing using these principles and specific strategies.
4. To use these revisions to help you clarify your own understanding of the material.
English Writing Workshop: Advanced- 1.5 ECTS

Instructor  Hossein Ordoubadian, Accent Språkservice AB  
http://www.accent-sweden.com/  
Contact  Åke Forsberg, tel. 090-785 2595 or ake.forsberg@molbiol.umu.se

Participants  6  
Duration  3 days

Course content

The Basic course given by Accent Språkservice AB is a requirement for this course. This course is designed for students who have already taken an Accent writing course and who have a complete (or nearly complete) article that they plan to submit for publication or to use as part of a thesis (kappa). Building on the principles and strategies discussed in the first course, we will revise several paragraphs (maybe even pages if time allows) from each student's text. In addition to using some of the concepts discussed in the first course, we will discuss and practice more subtle strategies that deal with organization, sentence clarity, sentence transitions, paragraph cohesion, and paragraph transitions in light of your audience's needs and expectations. There will be plenty of time for each student to revise their work in class and to receive feedback from fellow students and the instructor.

What to bring with you to the course:
- the Accent Writing Notebook from the first course,
- your laptop,
- a hardcopy of your text,
- a digital copy of your text.
IceLab Camp- 2 ECTS

Instructor  Martin Rosvall  
martin.rosvall@physics.umu.se  
http://www.physics.umu.se/om-institutionen/personal/martin-rosvall

Department  IceLab (Integrated Science Lab), http://www.org.umu.se/icelab/english/

Duration  4 days

Course content

Do you think your experimental research would benefit from causal understanding through mathematical or computational modeling? Would your theoretical work profit from valuable insights through empirical studies? Are you open-minded and would like to improve your creative power or develop your innovation skills? We welcome you to join us in a research camp together with about 25 other Master’s, PhD, and Postdoctoral researchers from all of the natural sciences.

Vision
To bridge the traditional departmental boundaries of universities and initiate new cross-disciplinary collaborations.

Method
To approach research questions from different scientific directions through cumulative cycles of generation, analysis, rejection, and acceptance of ideas, and, in the collaborative process of repeatedly zooming in on the details and out on the big picture, improve each participant’s ability to express ideas, give and take constructive criticism, and interact with researchers from a wide range of backgrounds.

How
Participants work in multidisciplinary teams to develop, write, and present a small research project. We use the first day or two to converge on different research questions and the following days to find the best theoretical or experimental framework to answer those questions. On the last day, each team presents its approach. Between sessions of projectwork, we will sandwich in SciFoo²-type opportunities to promote unconventional interaction and collaboration, presentations of several researchers’ biographies to highlight the wide variety of possible scientific careerpaths, and interactive games to break open the boundaries of creativity.

A few senior researchers will work as coaches/mediators to promote interactions and creative thinking. Applicants are young researchers from universities in Sweden or abroad. Together with a CV, applicants should provide a summary of what they hope to gain from this event and how they would contribute to the collaborative outcome.
Oral Presentation Course- 2 ECTS

Instructor: Thomas Fritz, UPC, Jonas Lampe Persson, UPC, Inger Hellgrén, Institut för språkstudier. thomas.fritz@upc.umu.se, jonas.lampe@upc.umu.se

http://www.upc.umu.se

Department: The Centre for Teaching and Learning, Umeå University

Duration: 5 days

Schedule:

Day 1  09-12 Start of course. Body language
       13-16 How to prepare and plan a presentation using PowerPoint

Day 2  09-12 Reading and preparing
       13-16 Video recording of presentation (1)

Day 3  09-12 Look at own presentation + prepare feedback
       13-16 Feedback to presenters

Day 4  09-12 Reading and preparing
       13-16 Video recording of presentation (2)

Day 5  09-12 Look at own presentation + prepare feedback
       13-16 Feedback to presenters, course summary
# Poster Course - 2 ECTS

**Instructor**  Ester Roos-Engstrand, Dep. of Food and Nutrition  
John Baker, Language Studies  
ester.roos-engstrand@adm.umu.se, john.baker@engelska.umu.se  
http://www.sprak.umu.se/om-institutionen/personal/john-baker

**Department**  The Centre for Teaching and Learning, Umeå University

**Duration**  4 days and 1 day for own studies

## Schedule

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>Any day</td>
<td>09-16</td>
<td>Reading on poster techniques, prepare poster</td>
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<tr>
<td>Day 1</td>
<td>09-12</td>
<td>Start of course, poster session (criteria for &quot;good&quot; posters)</td>
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<td>13-16</td>
<td>Methods for preparing posters (templates, software, printing options)</td>
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<tr>
<td>Day 2</td>
<td>09-12</td>
<td>Prepare poster</td>
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<td></td>
<td>13-16</td>
<td>Poster Workshop (bring laptop and poster, discuss ideas and problems with participants and faculty)</td>
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<tr>
<td>Day 3</td>
<td>09-12</td>
<td>Prepare poster</td>
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<tr>
<td></td>
<td>13-16</td>
<td>Poster Workshop (bring laptop and poster, discuss ideas and problems with participants and faculty)</td>
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<tr>
<td>Day 4</td>
<td>09-12</td>
<td>Poster presentations (show poster proposals)</td>
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<tr>
<td></td>
<td>13-16</td>
<td>Revision of posters, send to printer</td>
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# Workshop on Presentation Techniques - 1 ECTS

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<tr>
<td>Contact</td>
<td>Åke Forsberg, tel. 090-785 2595 or <a href="mailto:ake.forsberg@molbiol.umu.se">ake.forsberg@molbiol.umu.se</a></td>
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### Department
Molecular Biology

### Participants
10

### Duration
2 days

## Course content

The workshop is given by Jörgen Bodner, an actor, director, and speech trainer, who has experience in working with individuals to bring forward their ability to communicate. Jörgen has worked both within academics as well as the industrial environment. The workshop will cover techniques in verbal exercises, dialogue communication, rhetoric, argumentation and the importance of body language.

### Workshop goals are:

1. to learn to use your individual traits to enhance the message communicated in your talk
2. to increase the desire, will, and ability to see the challenge of a presentation as a good possibility instead of necessary pain by offering a number of tools and methods to achieve this
3. to improve your presentation technique by using both theory and practice to achieve greater presentation challenges at the individual level and by watching how others improve their techniques
4. to use tools and methods for a more effective oral communication
UCMR is an interdisciplinary research centre that was formed in 2005/2006 representing medical and molecular microbiology, infection biology, molecular and structural biology, chemistry and physics. The consortium aims to initiate and coordinate supportive efforts at Umeå University in the research fields of UCMR: e.g. to promote collaboration, to organize seminars, workshops, and conferences. Several technology platforms and core facilities have been established and are jointly financed by UCMR and Chemical Biology Centre (KBC) at Umeå University.

The theme of UCMR research is to combine chemical biology with a strong molecular biology program to clarify molecular mechanisms of microbial infections and disease, and to solve modern day problems with resistance to current antibiotics and antimicrobial treatment. Groups within UCMR consortium are pioneers in demonstrating the power of chemical biology in combination with molecular genetics to understand microbial virulence for the development of antimicrobials.

UCMR researchers were 2008 awarded a 10 year grant of 90 MSEK by the Swedish Research Council (VR) for the **UCMR Linnaeus Program** (ULP) “Understanding and preventing infectious disease” and a 5 year grant of 12.5 MSEK for the “UCMR Graduate College Program”. The ULP funding has been essential to secure availability and establishment of core facilities and technical platforms.

UCMR also hosts **“Molecules for the Future”**, a program within Laboratories for Chemical Biology Umeå (LCBU) that is funded by Knut & Alice Wallenberg Foundation and Vinnova. This program is collaboration with the University of Tromso is focused on development of natural products from arctic marine organisms into new antimicrobial molecules. LCBU is the Swedish partner in the EU infrastructure initiative **EU Open Screen** as well as the **Chemical Biology Consortium Sweden** (CBCS). Another program within UCMR is the **Laboratory for Molecular Infection Medicine Sweden** (MIMS), the Swedish node of the Nordic EMBL Partnership for Molecular Medicine that was established 2007 with support from VR and UmU.

**How to find us**

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Department of Molecular Biology  
Umeå University  
901 87 Umeå  
Sweden

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University Hospital, buildings 6 K and 6 L

**Contact**

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Scientific coordinator and director  
bernt.eric.uhlin@molbiol.umu.se

http://www.ucmr.umu.se/