Kursnamn på svenska BIOMOLECULAR NMR SPECTROSCOPY
Swedish course title

Kursnamn på engelska BIOMOLECULAR NMR SPECTROSCOPY
English course title

Omfattning (högskolepoäng) 5
Higher education credits

Undervisningsspråk English
Language of instruction

Rekommenderade förkunskaper
Recommended prerequisites
Either of the following will be sufficient: (1) 180 credits with 60 credits in chemistry, including 20 credits in biochemistry, or (2) 180 credits with 30 credits in chemistry and 30 credits in biology, including 20 credits in biochemistry, or (2) 180 credits within a related discipline.

Kursens syfte och mål
General course objectives and learning outcomes

After completing the course, the student should be able to

- Describe the basic principles and operation of NMR instrumentation
- Use the range of available NMR experiments needed to solve different structural problems (large biomolecules)
- Describe the limitations in sensitivity, precision, and accuracy
- Describe sample requirements and its capabilities of a specific NMR experiment
- Perform the operation, calibration, performance and experimental set-up
- Describe how NMR can be used to analyze different aspects of biomolecules
- Make backbone assignment and structure determination of a 6 kDa protein
- Apply different strategies for preparing samples for bioNMR
- Apply different applications of biomolecule beyond their 3D structures
- Setup and run simple bioNMR experiments

Kursinnehåll
Course contents

The aim of the course is to introduce the basics - both theory and practice - of NMR-spectroscopy of biomolecules. This includes:

- The principles of how to perform NMR measurements and structure elucidation.
- Theoretical basis of bio-NMR spectroscopy including: the vector model, the product operator formalism, relaxation, nuclear Overhauser effect, polarization transfer, scalar and dipolar coupling, population and coherence transfer, chemical shift, NMR signal assignment and multidimensional NMR spectroscopy, isotope labelling and spectral editing strategies (e.g. HSQC, HMQC, TOCSY-HSQC, HNCO, HNCA, HNCACB, HCCH-TOCSY NOESY),
• The basics of NMR structure calculation, including data collection, resonance assignment (ccpnmr and Topspin), collection of structural restraints and quality assessment.
• Strategies for structure determination of larger proteins (> 30 kDa) using specific labelling schemes and assignment.
• Strategies to extract dynamic information (T1, T2, hetNOE and order parameters) parameters.
• Strategies to determine exchange parameters and conformational sub-states (such as CPMG, CEST).
• Basic design and implementation of an NMR experiment or pulse sequence.
• Using NMR to answer basic questions about protein-ligand interactions
• Monitoring post-translation modification in-live cells.
• NMR spectroscopy of nucleic acids and carbohydrates.
• Using the structure calculation program CYANA.

Undervisning (kursens uppläggning)
Instruction (course structure)
The course will be both lectures and practicals

Examination
Assessment (form of examination)
Assessment will be based on solving a practical exercise and on oral presentation. The grade will be pass or fail. To earn a pass, students will be required to complete the assignment of a 15-residue peptide (fragment from a larger protein), solve the structure and give an oral presentation.

Huvudansvarig institution Department of Chemistry/NMR Uppsala
Department with main responsibility

Kontaktperson/er (namn, e-postadress)
Contact person (name, e-mail address)
Celestine Chi

Kurs datum/period 2019-02/2019-03
Course dates/period

Antal platser 20
Maximum number of participants

Anmälan om antagning till kursen ska skickas till
Application for admission to the course is to be sent to
chi.celestine@kemi.uu.se

Skicka anmälan senast 2018-10-30
Submit application not later than

Målgrupp/er (om möjligt, specifera ämnen/inriktningar)
Target group/s (specify, if possible, subject/specialization) Master students. PhD and postdocs