BB2165 Biomolecular Structure and Function 7.5 credits

Biomolekylers struktur och funktion

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for BB2165 valid from Autumn 2019

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Biotechnology

Specific prerequisites

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

- Describe, formulate, analyze and evaluate fundamental concepts in biomolecular structural biology.
- Suggest, motivate and discuss strategies for solving problems related to the function and applications of biomolecules in biology and biotechnology from a structural perspective.
- Based on knowledge and concepts acquired in the course, be able to propose, discuss and evaluate the role of biomolecular structural biology to advance understanding of biological and biotechnological scientific problems.
- Use computer software tools and relevant databases to generate, visualize, investigate, analyze, evaluate and validate biomolecular structure information and to estimate the free energy change for various macromolecular association process and for binding to small ligands.
- Evaluate and discuss biomolecular structure from the perspective of contributing to a sustainable development.
- Design, plan, execute and present in written and oral form an independent project focusing on biomolecular structure and function.
- Critically evaluate own and others chosen strategies for targeting scientific problems from a biomolecular structure perspective, including assessing published recent advances in the current subject area.

Course contents

Structural biology is a young science and research in this area is moving forward rapidly. The course contents ranges from fundamentals in structural biology to contemporary research, and the precise topics are subjects of change to appropriately reflect the research frontier.

• Basics of protein structure (building blocks, intramolecular and intermolecular interactions, levels of protein structure, canonical protein databases) and other relevant biomolecules.

• Concepts of thermodynamics in the context of protein structure, stability and function (e.g. folding, ligand binding, complex formation).

• Central structure-function concepts in biology (e.g. signal transduction, transcription and translation, molecular transport, molecular motors).

• Overview of methods for experimental structure determination of biomolecules (e.g. crystal structure analysis, single particle cryo-electron microscopy, nuclear magnetic resonance); and biophysical methods for characterization (neutron scattering, circular dichroism, electron paramagnetic resonance, infrared spectroscopy, Raman spectroscopy, optical imaging).

• Computational approaches for modeling of biomolecules and related energetics (e.g. homology modeling, molecular dynamics, Monte Carlo, course-grained approach, molecular docking, free energy calculations, entropy calculations).

• Validation and critical analysis of experimentally derived biomolecular structures.

Course literature

Branden C, and Tooze J., Introduction to Protein Structure, 2nd Ed. Garland Publishing Inc., 1999.

Andrew Leach, Molecular Modeling: Principles and Applications, 2nd Ed. Prentice-Hall.

Handouts and selected articles.

Examination

- LIT1 - Literature task, 2.0 credits, grading scale: P, F
- TEN1 - Written exam, 4.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory work, 1.5 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.