SI2700 Protein Physics 7.5 credits

Proteinfysik

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

Establishment

The course syllabus is valid from Spring 2022 according to the school principal's decision: S-2022-0529 Decision date: 2022-02-24

Grading scale

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

Education cycle

Second cycle

Main field of study

Physics

Specific prerequisites

English B / English 6

Language of instruction

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

Intended learning outcomes

This is an advanced level course in collaboration between Stockholm University and KTH that covers structure, self-organization, and function of the biological macromolecules of life - primarily proteins.

Course contents

Biophysical chemistry: Amino acid conformations & properties, Ramachandran plots. Hydrogen bonds. Thermodynamics, entropy, free energy, and hydrophobic interactions. Electrostatics in biomolecules and solution, disulphide bonds. Properties of polypeptide chains. Alpha, 3-10, and Pi-helices. Parallel and anti-parallel beta sheets. Turns and loops. Conformational changes, helix-coil transitions, stability of secondary structure elements in water and other solvents. Non-polar, polar, and charged amino acid side chains.

Protein structure: Packing of helices and sheets, supersecondary structure. Collagen, keratin, silk, and other simple structures. Structure and function of water-soluble proteins, classification of protein folds. Protein aggregation/misfolding, prions (mad cow disease). Membranes and membrane proteins. Evolution and natural selection of structures.

Protein folding & structure prediction: Anfinsen's Hypothesis. Levinthal's paradox. Kinetics of protein folding. Two-state folding and intermediates. Molten globule or folding nuclei. Energy landscapes. Pathways. Prediction of structure from amino acid sequence. Threading.

Protein function: Docking and binding. Enzyme function. Active sites. Induced fit. Specificity and allostery. Membrane protein function. Protein engineering and design.

Examination

- TEN1 - Examination, 7.5 credits, grading scale: A, B, C, D, E, FX, 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.

Other requirements for final grade

Exam (TEN1; 7,5 university credits).

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.