SI2720 Biophysics 7.5 credits

Biofysik

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

Establishment

Course syllabus for SI2720 valid from Spring 2017

Grading scale

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

Education cycle

Second cycle

Main field of study

Biotechnology, Engineering Physics

Specific prerequisites

Prerequisites:

One year of physics studies, no biology studies are required.

Language of instruction

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

Intended learning outcomes

With this general course in biophysics the student will learn fundamental physical, quantitative, and structural aspects of living systems. Importantly, the student will be equipped with a physics toolbox to understand biological experimental results and observations. After a completed course the student will be able to:

- describe how and why water molecules affect biological structure and reactions.
- discuss RNA, DNA and proteins with regards to structure, energetic stability and function.
- display and analyse protein structure using a computational approach.
- describe and compare biosystems at the structural levels of the cell, larger aggregates and assemblies, down to a single molecule.
- explain and exemplify how light interacts with biological matter to convey function and how this interaction can be used to study biological molecules and phenomena.
- demonstrate how the principles of classical and statistical mechanics can explain motion and dynamics of biological systems.
- analyse biological processes by using the principles of thermodynamics to quantify the associated energetics and kinetics.

Course contents

This introductory course in biophysics is aimed at students interested in learning about biological systems - regardless of the specific student programme/background. Biophysics describes the very fundamentals of biological structure and function. This means that we can understand why muscle tissue contracts, how plants convert solar energy to chemical energy, or why a certain drug molecule activates a protein receptor in the brain while another drug inactivates the same receptor. The course will be equally suitable for the physics student wanting to learn how to use the tools of physics to understand the biological world - and the more biologically oriented student who wants to understand his/her experiments/computations on a more fundamental level. In addition, this course was specifically designed to equip students with a solid biophysics background and a toolbox to be used either in academia or in an industrial biotech setting.

Specifically, this course in Biophysics will show how physical, mathematical, and computational tools, such as randomness, distributions, graphing, calculus, and visualization tools can be used to interpret experiments and model biological systems. The biological systems will be covered at different levels of structural detail; ranging from water molecules and ions surrounding these systems to the amino acids that build up the proteins, different sizes of soluble and membrane proteins, larger assemblies of proteins and ultimately the whole cell and its compartments. Describing the fundamental energetics governing these biological structures and their functions will provide the student with the necessary physical understanding to characterize living systems using theoretical and experimental methods.

Course literature

The primary text for the course is "An Introduction to Biophysics", 1st ed. by Thomas M. Nordlund, CRC Press, ISBN 978-1-4200-8972-1, and is available at amazon.com. Additional reading will be distributed during the course.

Examination

- INL1 - Home assignments, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- TEN2 - Examination, 2.5 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory work, 2.0 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.

The written exam (2.5 credits) consists of a multiple-choice part covering central concepts in the course and a part with essay questions of various topics. To pass the course, >80% of the multiple-choice questions should be correct. In addition, all three assignments (1 credit each) and the laboratory exercise (2 credits) need to be graded with grade E ("pass"). The final grade A-D will be determined using essay questions covering various topics covered during the course.

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.