BB2425 Glycobiotechnology 7.5 credits

Glykobioteknik

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

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

Establishment

Course syllabus for BB2425 valid from Autumn 2023

Grading scale

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

Education cycle

Second cycle

Main field of study

Biotechnology

Specific prerequisites

Complete course BB1050 Biotechnology or equivalent.

Language of instruction

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

Intended learning outcomes

On completion of the course, the students should be able to:

- Describe the structure of carbohydrates (mono-, oligo-, and polysaccharide) at molecular level and explain the structure–property relationship of carbohydrates at different hierarchical levels
- Describe the molecular mechanisms of key enzymes involved in the biosynthesis, modification, and degradation of carbohydrates across diverse kingdoms and compare the structure of carbohydrate-active enzymes (CAZymes)and carbohydrate binding protein in terms of their biological functions
- Using computer software tools to demonstrate the structural differences in different functional CAZymes and explain the structure/function relationship
- Design, plan and perform experiments on deconstruction and modification of polysaccharides through the combination of different CAZymes and analyze and report the results
- Describe and compare the pathways and mechanisms for the biosynthesis of glycoproteins and glycolipids and discuss their diverse biological functions
- Discuss how CAZymes and glyco-engineering can be used in industries to develop environmentally-friendly sustainable processes in food production, fuel production, materials and medical applications

Course contents

The course provides the student with knowledge spanning from the fundamental theory in glycobiology to the method and technology developments for applications in bioenergy and biomaterials, biopharmaceuticals and vaccines, and healthy food. The course contains both theoretical and practical parts.

Theoretical lectures:

- Chemistry of carbohydrates, hierarchical levels of structure of sugars and glycans and their roles in complex biological systems
- Enzymes for glycan biosynthesis and nucleotide sugar enzymology
- Classification, database and mechanism of carbohydrate-active enzymes (CAZymes) for glycan degradation and modification
- Biosynthesis and biological functions of glycoconjugates in glycoproteins and glycolipids (glycosylation pathways and glyco-engineering in various organisms including plant, animal, and microbial systems)
- Applications of glycobiotechnology in food and nutrition, energy and fuels, materials, and pharmaceuticals.

Practical labs:

- Computer lab – CAZymes 3D structure/function relationship
- Wet lab – Comparison between glucose oxidase enzymatic assay and 3,5-dinitrosalicylic acid (DNS) assay for reducing sugars

- Wet lab – Demonstrate how glycoside hydrolase enzymes with different modes of action act synergistically to deconstruct a polysaccharide

Examination

- LAB1 - Laboratory course, 2.0 credits, grading scale: P, F
- TEN1 - Written exam, 5.5 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.

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.