BB2425 Glycobiotechnology 7.5 credits

Glykobioteknik

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

Establishment

Course syllabus for BB2425 valid from Spring 2019

Grading scale

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

Education cycle

Second cycle

Main field of study

Biotechnology

Specific prerequisites

20 ECTS in biochemistry, microbiology and gene technology/molecular biology; 20 ECTS in chemistry; 20 ECTS in mathematics/numerical analysis/computer science

Language of instruction

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

Intended learning outcomes

Upon completion of the course, the student will be able to:

- describe carbohydrate structure on the mono-, oligo-, and polysaccharide organizational levels and discuss the interaction of carbohydrates with other biopolymers as structural components in various cell types
- describe the importance of the pool of sugar phosphates as precursors in carbohydrate biosynthesis
- describe the molecular mechanisms of key enzymes involved in the biosynthesis and biodegradation of carbohydrates across diverse kingdoms
- discuss the structural diversity of carbohydrate-active enzymes and carbohydrate binding proteins in terms of their biological functions, and outline how these biocatalysts can be used in enzyme technology to develop environmentally-friendly sustainable processes in vitro or increase plant biomass in planta
- describe and use the CAZy database, and identify candidate genes encoding enzymes potentially relevant for bioconversion
- describe the biosyntheses of glycoproteins and glycolipids and discuss their diverse biological functions including disease states
- understand and discuss the importance of carbohydrates as raw material for sustainable development and describe molecular details of selected examples of "carbohydrate biotechnology" in biorefinery (biofuels and biofiber), food, and medical application
- understand and critically evaluate contemporary research literature dealing with various aspects of carbohydrate structure, biochemistry, enzymology, and applications thereof

explain and discuss influenza pandemics and understand the risk and threat of a new pandemic as well as discuss ethical and social aspects of bioethanol production, enzymatic HFCS conversion, production of gum arabic, use of phytases, GMOs, and lab-modified influenza

Course contents

The course will provide the student with an overview of carbohydrates (glycans, saccharides or sugars), a for life essential class of biomolecules involved in many crucial biological functions and industrial applications. Students will learn about how every living cell is covered by an array of glycans, and how these sugars play a central role in inter- and intracellular communication. Knowledge of carbohydrate and glycoconjugate functions, structures, modifications and biosynthesis will prepare the students for problem solving in the areas of food, feed, health, energy and materials. Especially possibilities and challenges related to sustainable development using renewable carbohydrate raw materials will be emphasized. A main theme of the course is glycogenomics and the enzymes responsible for carbohydrate biosynthesis, modification and biodegradation: carbohydrate-active enzymes (CAZymes). In addition, sugar-binding non-catalytic proteins (lectins and carbohydrate-binding modules will be covered, and carbohydrate structure-function relationships will be highlighted using numerous examples from plant, animal, and microbial systems. The course will address diverse and important applications such as glycoprotein pharmaceutical development, biofuel production, modification of wood and textile fibers, food production and human nutrition, brewing, treatment of inherited metabolic disorders, and treatment/prevention of pathogen infection, including influenza.

Course literature

Course book(s), if any, will be posted on the course web site at least four weeks prior to course start. For course content not covered by the book additional course literature consists of current research articles, web resources and lecture handouts that will be available online in the learning platform Canvas.

Examination

- TEN1 - Written exam, 5.5 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory course, 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.

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.