BB2420 Glycobiology and Carbohydrate Technology 7.5 credits

Glykobiologi och kolhydratsteknologi

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

Establishment

Course syllabus for BB2420 valid from Autumn 2009

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

Glycobiology and Carbohydrate Technology will provide the student with an overview of carbohydrates (sugars) as an important class of biomolecules involved in numerous biological functions and industrial applications. The course is designed to build upon and compliment the student's knowledge of molecular biology/biotechnology, protein structure & function, and molecular enzymology obtained from other courses in the Biotechnology program.

Carbohydrate structure-function relationships will be highlighted using numerous examples from plant, animal, and microbial systems. Particular attention will be paid to the enzymes responsible for carbohydrate biosynthesis and biodegradation. The interactions of carbohydrates with various non-catalytic proteins (lectins and carbohydrate-binding modules) will also be covered. Through specific examples and case studies, special focus will be placed on carbohydrate-protein/enzyme interactions in the context of important applications, including: glycoprotein pharmaceutical development, biofuel production, modification of wood and textile fibers, food production and human nutrition, treatment of inherited metabolic disorders, and treatment/prevention of pathogen infection.

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

- describe carbohydrate structure on the mono-, oligo-, and polysaccharide organisational levels,

- 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,

- describe the biosyntheses of protein **N-** and **O**-glycans and discuss their diverse biological functions as key post-translational modifications,

- discuss glycolipid structure in the context of cellular processes and disease states,

- describe molecular details of selected examples of "carbohydrate biotechnology" in biofuel, biofiber, food, and medical applications

- understand contemporary research literature dealing with various aspects of carbohydrate structure, biochemistry, enzymology, and applications thereof,

- use the complete knowledge base from the course in future studies and/or industrial employment involving glycobiology and carbohydrate technology.

Course contents

Lectures:

Classical lectures (ca. 35 hours) will form the basis of the course. A complete syllabus (schedule) is available as a separate document on the course website (see **Online resources**, below). Attendance of all the lectures is strongly encouraged; the student must attend 85% of the scheduled course periods to qualify to take the final examination[1]. Lecture periods will serve as the primary mode of instructor-student interaction, including passing various practical information to the students. A certain amount of time scheduled for lectures will be used for questions/answer sessions and to go over practical assignments.

The majority of the lectures will be taught by the course organizer, Docent Harry Brumer. Other lectures will be given by Docents or Professors of the School of Biotechnology who are experts on specific course topics. See the course syllabus for details.

Assignments & computer graphics laboratory:

Throughout the course, exercises will be assigned which are designed to improve learning of various topics in the course. These will not counted toward the final course grade, but will form the basis for in-class discussion. Further, successful completion of these assignments will greatly improve chances for success on the final examination. Similarly, a computer graphics laboratory exercise will provide important understanding of structure-function relationships in carbohydrate-active enzymes.

[1] Limited exceptions may be made, e.g., in the case of a documented medical emergency, etc.

Examination

- LIT1 - Literiature Task, 1.5 credits, grading scale: A, B, C, D, E, FX, F
- TEN1 - Examination, 6.0 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

The student's final grade in the course will be based on performance on two written examinations. Both will consist exclusively of essay questions which will test the student's overall comprehension of the various topics covered in the course. The first, mid-term examination, will count toward 25% of the final grade for the course. The second, final examination will count toward 75% of the final grade for the course. The course is worth 7.5 ECTS points and will be graded on a scale from **A** to **F**, with **A** being the highest mark and **F** a failing mark.

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.