BB2450 The Cell Factory 7.5 credits

Cellfabriken

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 BB2450 valid from Autumn 2010

Grading scale

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

Education cycle

Second cycle

Main field of study

Biotechnology

Specific prerequisites

- BB1080 Biochemistry (theory) or equivalent
- BB1030 Microbiology or equivalent

Language of instruction

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

Intended learning outcomes

Upon completion of this course, the students will be able to:

- Differentiate cellular organization and signaling systems between prokaryotic and eukaryotic cells

- Describe the function of cellular compartments, in particular the sub-cellular localization and integration of metabolic pathways

- Describe the different types of transport systems across biological membranes

- Describe the impact of the complexity and element composition of substrates on the growth of micro-organisms and how these growth conditions affects metabolic pathways and the cellular accumulation of specific macromolecules (e.g. culture media based on acetic acid, ethanol, nitrogen or phosphorous based substrates, etc)

- Describe the flux of carbon in prokaryotic and eukaryotic (including yeast, fungi, algae and higher plants) organisms in relation with carbohydrate metabolism

- Describe lipid metabolic pathways in prokaryotes and eukaryotes and distinguish the specific features of the different classes of organisms

- Describe pathways specific to certain types of micro-organisms whose products have potential industrial applications (e.g. leading to the production of building blocks and polymers)

- Describe complex gene regulation processes in prokaryotes, plants and fungi

- Understand integrated pathways and regulation processes for metabolic engineering of prokaryotes and eukaryotes leading to the production of biomaterials and biofuels

- Exploit the fundamental knowledge from the course for the development of bioprocesses and the large scale production of products derived from the manipulation of metabolic pathways

- Understand processes that exploit the formation of secondary metabolites produced by engineered organisms

Course contents

- Introduction to microbial physiology: cellular organization and signaling systems

- Prokaryotic and eukaryotic cell structures and cellular compartment function, including sub-cellular localization of specific metabolic pathways

- Uptake of substrates and types of transports across biological membranes

- Prokaryotic and eukaryotic carbon flux and energy generation, with emphasis on carbohydrate metabolism

- Lipid metabolism, comparison between prokaryotes and eukaryotes

- Specific microbial pathways (e.g. formation of polyhydroxyalkanoates, polylactic acids, alginates, cellulose, xanthans, etc)

- Regulation of gene expression in prokaryotes (e.g. operons) and eukaryotes and exploitation for the manipulation of metabolic pathways

- Metabolic engineering of prokaryotes and production of biomaterials

- Metabolic engineering of yeast, fungi and plants, with particular emphasis on biomaterials production, including transformation systems (e.g. plastid targeting, **Agrobacterium**) – emphasis on carbohydrates, plasticizers, lipid-derivatives), and punctually on biofuel production

- Exploitation of algal systems and their metabolic pathways for energy production.

Disposition

The course is worth 7.5 credits (ECTS) and runs over a period of approximately 8 weeks. This is equivalent to approximately 200 hours of full-time study, i.e. ca. 25 hours/week including lectures, reading, continuous assignment and preparation for the final examination. The total number of lectures will be of 28 double lectures

2 intermediate evaluations of 1.5 hours each will be held. The score obtained from these intermediate evaluations will represent 10% of the score of the final examination. Attendance to all lectures is highly recommended; in any case, each student must have attended at least 85% of the scheduled course periods to qualify to take the final examination.

Course literature

Reading chapters from the following textbooks is recommended: Biochemistry (Voet and Voet, latest edition); Microbiology: principles and explorations (Black, 7th Edition); Microbial Physiology (Moat et al., 4th Edition); Genes IX (Lewin)

This course is however broad in scope and more specialized material will be made available during the course. Material will be prepared from some of the following book examples: Plant Biotechnology, the genetic manipulation of plants (Slater, Scott and Fowler, 2nd Edition); Microbial production of biopolymers and polymer precursors (Rehm, 1st edition); Plant lipids: biology, utilization and manipulation); etc

Examination

- KON1 - Intermediate Exam 1, 1.0 credits, grading scale: P, F
- KON2 - Intermediate Exam 2, 1.0 credits, grading scale: P, F
- NÄR1 - Mandatory Participation at Lectures, 1.0 credits, grading scale: P, F
- TEN1 - Written Exam, 4.5 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.

The final grade will be based on performance on the final written examination (90% of final score) and the two intermediate evaluations (representing altogether 10% of the final score). The course is worth 7.5 ECTS.

Scale: **A to F**, **A** being the **highest**, **F** being a **failing mark**

Other requirements for final grade

Minimum 85% attendance

Passing grade on the two intermediate exams

Passing grade on the final exam

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.