Course syllabus

Metabolic engineering
Metabolic Engineering

KMBN05, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED B/K
Date of Decision: 2023-04-18

General Information

Main field: Biotechnology.
Compulsory for: B4-pt
Elective Compulsory for: MBIO2
Elective for: B4-mb
Language of instruction: The course will be given in English

Aim

Based on previous knowledge obtained from courses, particularly in gene technology, mathematics and microbiology, the course aims to introduce the students to the field of metabolic engineering, discuss tools and strategies used in the field and give the students insight in how the technology can be used in industrial biotechnology.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- understand the fundamentals of metabolic engineering tools (including mass balances, metabolic flux modeling, metabolic control analysis, omics)
- understand how these tools can be applied for the analysis of metabolically engineered microorganisms
- have acquired in depth knowledge on metabolic pathways and their regulation and on how metabolic pathways can be engineered for the improvement of various bioprocesses.

Competences and skills
For a passing grade the student must

Obtain skills to

- show ability to carry out relevant calculations concerning mass balances, metabolic flux analysis, metabolic control analysis in biological systems
- show ability to analyse experimental work aiming at characterising genetically modified microorganisms and corresponding control organisms
- show ability to understand and master the terminology in the field in verbal and written form and to organise and structure the scientific content into a whole
- show ability to critically report, both in oral and writing forms results from scientific papers and/or his/her own experimental work

Judgement and approach
For a passing grade the student must

- show ability to do assessments of other student and researcher contributions in the field of metabolic engineering
- show ability to relate and distinguish between evidence and argument

Contents

- the course includes *lectures* on the following topics: strain engineering, advanced genetic tools, metabolic pathways, metabolic control analysis, metabolic flux analysis, omics and systems biology.
- the *literature study* consists of a thorough study of research strategies on a specific topic within metabolic engineering.
- in the *lab simulation*, the objective is to critically evaluate data arising from a set of experiments where a biofuel or bulk chemical is produced from sugars with wild-type and genetically engineered microorganisms. This includes the analysis of growth and product formation, enzyme activity and omics data, among others.
- *exercises* will be performed on carbon balance, redox balance, flux analysis and metabolic control analysis.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: A written examination, a graded oral presentation based on a literature study and a graded lab simulation report

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Admission requirements:

- KBK041 Gene Technology or KBKF01 Gene Technology or KBTN20 Molecular Biotechnology
- KMB060 Microbiology or KMBA01 Microbiology or KMBF05 Food Microbiology

The number of participants is limited to: No
Selection: Completed university credits within the programme. Priority is given to students enrolled on programmes that include the course in their curriculum.
The course overlaps following course/s: KMB040

Reading list

- Online compendium in metabolic engineering.

Contact and other information

Course coordinator: Professor Marie Gorwa-Grauslund, Marie-Francoise.Gorwa-Grauslund@tmb.lth.se
Teacher: Ed van Niel, ed.van_niel@tmb.lth.se
Teacher: Daniel Brink, daniel.brink@tmb.lth.se
Course homepage: http://www.tmb.lth.se
Further information: The course contains obligatory sessions: introduction lecture, lab simulation sessions, literature study presentation.