BB2450 The Cell Factory 7.5 credits

Cellfabriken

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

Establishment

Director of undergratuate studies, Torbjörn Gräslund, School of CBH, Date of decision 2025-10-16

Grading scale

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

Education cycle

Second cycle

Main field of study

Biotechnology

Specific prerequisites

Completed degree project 15 credits, 7.5 credits in biochemistry. English B/ 6.

Intended learning outcomes

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

- Describe and differentiate microorganisms and eukaryotic cellular systems, including mammalian cells, and their biochemical pathways.

- Discuss with reference to scientific literature the challenges and potential opportunities in using genetically engineered cell factories for the production of biopharmaceuticals/biomolecules/chemicals/fuels at an industry scale.
- Design a cell factory approach to the production of a given product, with reference to supporting scientific literature.
- Design a cultivation process using mammalian cell system for the production of biologics fit for industrial purpose, i.e. robust and reproducible process using appropriate mammalian cell line and expression system, integrating scale-up constraints, Good Manufacturing Practice (GMP), and awareness of patient safety, as well as describe and discuss how such a process is developed
- Design, evaluate, execute and present in written form an independent laboratory project report.

Course contents

- Prokaryotic and eukaryotic cell structure, including plant and mammalian cells, and cellular compartment functions, including sub-cellular localization of specific metabolic pathways
- Specific prokaryotic and eukaryotic pathways for the production of complex biomolecules, including cellulose, alginate, chitins, glycoproteins and fatty acids, etc.
- Describe prokaryotic and eukaryotic cell factories, including special features of eukaryotic hosts, such as codon usage, post-translational modifications, protein folding, protein processing, of disulfide bond formation
- Metabolic engineering of fungi and plant systems, including transformation system (e.g. plastid targeting, Agrobacterium)- emphasis on carbohydrate polymers, plasticizer, lipid-derivatives, and punctually on biofuel production
- Exploitation on other cell factory systems, such as algal system, and their metabolic pathways for the bioproduction.
- Describe new technologies in synthetic biology, and how this has impact in bioproduction
- Cost-benefit analysis (including environmental and social economical impact) for the sustainable production in the pathways specific/certain types of organisms which the products have potential applications
- Process of mammalian cell-based system (e.g. Chinese Hamster Ovary cells, HEK293) for the manufacturing of biologics Development of mammalian cell-based processes, fed-batch and perfusion, aimed at commercial production for the production of biopharmaceuticals including scale-up aspects, requirements of patient safety and compliance to regulatory constraints
- Demonstration of fed-batch bioreactor process using Chinese Hamster Ovary cell for the production of monoclonal antibody

Examination

- TEN1 - Written Exam, 4.5 credits, grading scale: A, B, C, D, E, FX, F
- NÄR1 - Mandatory Participation at Lectures, 1.0 credits, grading scale: P, F
- KON1 - Intermediate Exam 1, 1.0 credits, grading scale: P, F

- LAB1 - Laboratory work, 1.0 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.

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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.