



27460 Synthetic biology

2024/2025

Course information

Danish title	Syntesebiologi
Language of instruction	English
Point(ECTS)	5
Course type	MSc Offered as a single course General competence course (MSc) Biotechnology Programme specific course (MSc) Biotechnology
Schedule	Autumn E5A (Wed 8-12)
Location	Campus Lyngby
Scope and form	The lecture series introduces the basic concepts of Synthetic Biology and molecular biological tools for genetic engineering of production organisms. In the weekly theoretical exercises, we develop competences in the design, building, testing, and learning in SynBio experiments and how to evaluate designs. In parallel, the students work in smaller teams to solve an exam project, giving the opportunity to apply the course topics in relation to the exam project.
Duration of Course	13 weeks
Date of examination	Decide with teacher, Last teaching session in the 13 week period
Type of assessment	Oral examination and reports 1. Individualized group report (80%) covering project work, must be handed in one week prior to the oral exam. 2. Oral exam (20%) covering project work, held the last session of the 13-weeks period.
Aid	All Aids - with access to the internet
Evaluation	7 step scale , internal examiner
Previous Course	27060
Not applicable together with	27060
Academic prerequisites	27022.27026.27051 , Ideally you have hands-on experience from experimental molecular biological work (BSc project or larger special course) so you can participate in the discussions and relate to the theoretical exercises.

Participants restrictions	Minimum 10
Responsible	Rasmus John Normand Frandsen , Building 223, Ph. (+45) 4525 2708 , rasf@bio.dtu.dk
Course co-responsible	Gerd Seibold , Lyngby Campus, Building 223, Ph. (+45) 4525 2501 , gesei@dtu.dk
Department	27 Department of Biotechnology and Biomedicine
Registration Sign up	At the Studyplanner
Green challenge participation	This course gives the student an opportunity to prepare a project that may participate in DTU's Study Conference on sustainability, climate technology, and the environment (GRØN DYST). More information http://www.groendyst.dtu.dk/english

General course objectives

The course introduces the basic terminology and concepts of synthetic biology and the mindset on which it depends. The course, further, equips the students with the necessary analytical tools to evaluate and design the complex molecular biological experiments needed for implementing bioengineering solutions to industry-relevant problems

Learning objectives

A student who has met the objectives of the course will be able to:

- Explain the difference between parts, devices and circuits in synthetic biology
- Explain and apply standardized approaches for DNA assembly (molecular cloning)
- Design biological parts, devices and basic circuits
- Create and analyze mathematical models of simple regulatory circuits and genetic switches
- Evaluate the feasibility of existing experimental designs for the implementation of SynBio solutions
- Design detailed molecular biological experiments, incl. predict the possible outcomes of the individual steps and the required experimental control reactions
- Evaluate the pros and cons of different parts and chassis (organisms) in connection with a given synthetic biological design
- Describe how instrumentation and automation of the laboratory (use of robotics) can enable synthetic biology
- Designing experiments that lead to heterogeneous clones/DNA libraries
- Design feasible screening strategies for identifying clones with a desirable functionality within a library
- Design cell factories for the production of small molecules and proteins/enzymes
- Discuss the ethical implications of synthetic biology, and Perform risks assessment of projects.

Content

The course introduces Synthetic Biology and the underlying concepts and notions.

The course focuses on the design of molecular biological experiments and screening strategies (= the participant will have to actively design/device experiments on a weekly basis). After the course, the participants will be able to design all steps necessary to implement complex genetic engineering experiments, e.g. cloning strategies, necessary experimental controls, expected outcomes of the different steps, and efficient screening assays for identifying cells with the desired functionalities.

The central concepts and mindset within Synthetic Biology is introduced through textbook chapters, original literature, lectures, and case discussions. Detailed design of complex molecular biological experiments is trained via weekly theoretical assignments and plenum discussions of the different team's solutions. The ethical and commercial aspects of Synthetic Biology are treated during the case discussions and design exercises.

Course literature

Original literature in the form of peer-review articles, selected textbook chapters and cloning procedure manuals.

Last updated

16. maj, 2024