BB2430 Gene Technology and Molecular Biology, theory 5.5 credits

Genteknik och molekylärbiologi, teori

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

Establishment

Course syllabus for BB2430 valid from Spring 2011

Grading scale

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

Education cycle

Second cycle

Main field of study

Biotechnology

Specific prerequisites

At least 150 credits from grades 1, 2 and 3 of which at least 100 credits from years 1 and 2, and bachelor's work must be completed. The 150 credits should include a minimum of 20 credits within the fields of Mathematics, Numerical Analysis and Computer Sciences, 5 of these must be within the fields of Numerical Analysis and Computer Sciences, 20 credits of Chemistry, possibly including courses in Chemical Measuring Techniques and 20 credits of Biotechnology or Molecular Biology.

Language of instruction

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

Intended learning outcomes

Breakthroughs in molecular biology and biotechnology have the last decades paved the way for completely new strategies that hold promise to solve real-world problems; some are related to the diagnosis and treatment of disease, others to the use of genetically modified organisms for detoxification of the environment or production of biofuels, while still others deal with the engineering of proteins to adapt them for specific applications.

The course's main goal is to provide a good insight into the principles and methods on which modern (molecular) biotechnology is based as well as an understanding of their inherent possibilities and limitations to address and solve modern day problems.

After passing the course, the student should be able to:

- describe the function of commonly used enzymes within the field of molecular biotechnology
- from a given problem, design a suitable PCR-setup/strategy; for example, how to clone a certain gene, and explain the function of all necessary components
- explain the principle behind different DNA-sequencing methods and discuss their possible strengths and weaknesses
- give examples of different physical and genetic strategies for modification/manipulation of gene expression and describe which consequences this will have at a cellular level
- describe different mutagenesis, screening, and selection methods that are used within protein engineering and suggest strategies for how these techniques can be applied in order to solve/address a given issue
- from a given issue or problem, choose an appropriate combination of host-vector system and describe its specific advantages and disadvantages in relation to other conceivable combinations. The student should also be able to describe/explain the function of the different vector component/elements
- describe the principles behind modern gene technology-based therapeutics such as modern vaccines and gene therapy, and give examples on some of the advantages/disadvantages and possible limitations compared with traditional treatments
- give examples of methods for transcriptome and proteome analysis and explain the underlying principles

Course contents

The course focuses on the most important gene technology principles/methods and thereto-relevant concepts in molecular biology will be reviewed. An in-depth look at prokaryotic and eukaryotic gene expression and recombinant protein production and optimization will

be central. In addition, several important applications of molecular biotechnology will be presented and discussed. Some of the topics covered:

- transcription/translation regulation
- recombinant DNA (enzymes, vectors and host cells)
- PCR techniques
- DNA sequencing
- mutagenesis, gene libraries
- screening and selection methods
- design of recombinant processes (promoters, vectors, host cells, gene fusions etc)
- therapeutic strategies (vaccine technology, gene therapy etc)
- DNA diagnostics
- transgenic organisms
- functional genomics

Course literature

Biotechnology: Applying the genetic revolution (2009) David P. Clark & Nanette J. Pazdernik, 1st ed., Elsevier Academic Press, ISBN 978-0-12-175552-2

Examination

- TEN1 - Examination, 5.5 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.

If the course is discontinued, students may request to be examined during the following two academic years.

TEN1 - Examination, 5,5 credits, grade scale: A, B, C, D, E, FX, F

Other requirements for final grade

Written examination (TEN1; 5,5 credits, grading scale A-F)

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.