Studieplan 2013/2014

One-year Add-on Programme in Biotechnology

Studiepoeng: 60

Studiets varighet, omfang og nivå

Study Length and academic level

The programme is a 60 ECTS credits study programme with a full-time workload over one academic year at medium Bachelor`s level.

Innledning

Introduction

In the years to come, biotechnology will play an increasingly, important role in how society develops. Biotechnology entails the utilisation of microorganisms, animal and/or plant cells to create useful and necessary products. Biotechnology provides the means for the genetic modification of living organisms and their function.

Genetic engineering can, for instance, help in the development of new and improved vaccines. Biotechnology can be used as a tool to elucidate basic biological processes, but may also be used in diagnostics, for hygenic control, for the purification of water, raw materials, finished products, for bioproduction processes and for dealing with waste products and pollution.

Enterprises and companies in a rapidly growing biotechnological industry experience an increasing demand for qualified workers. The study programme prepares students for work in the biotechnological and pharmaceutical industries, the food processing industry, and in public and private research and development laboratories.

Læringsutbytte

Learning outcomes

Knowledge:

The candidate

- are expected to exhibit a breadth of understanding in major subjects such as biochemistry, microbiology, genetics, molecular biology, bioprocess technology and industrial biotechnology

Skills:

The candidate has

- attained the motivation, theoretical and practical skills making them well equipped for a career in biotechnology-based activities

Competence:

The candidate has

- achieved deeper understanding of the chemistry and biology in basic biotecnology and for further education in biothecnology

Målgruppe

Target group

The study programme targets people who already have a foundation in chemistry and biology, and wish to acquire theoretical knowledge and practical skills in biotechnology.

Kompetanse

Qualification attained

The study programme prepares students for work in the biotechnological and pharmaceutical industries, the food processing industry, and in public and private research and development laboratories. When combined with, or included in a Bachelor`s Degee, the one-year study programme may also provide qualifications necessary for admission to the Master`s Degree Programme in Applied and Commercial Biotechnology at Hedmark University College, and related master`s degree programmes at other universities and university colleges.

Opptakskrav fritekst

Admission requirements: In addition to standard higher education admittance requirements, the applicant must have successfully completed course exams comprising at least 60 ECTS credits in mathematics and natural sciences, including a foundation in chemistry and biology. English language requirements: All non-native English speakers must provide official documentation of English language proficiency at the level of Norwegian upper secondary school/high school. English must have been the primary foreign language in at least seven years in primary, secondary and upper secondary school, alternatively an A-level exam in English.

Undervisnings- og læringsformer

Teaching and learning methods

The instruction is based on lectures, workshops/group work, laboratory exercises and excursions. Use of the University College`s e-learning system, Fronter, will constitute an intergrated part of the instruction.

Vurderingsformer

Assessment methods

There are varied assessment methods, both regarding intermittent assessment and final assessment. These are: Written examination, oral examination, laboratory reports, project reports, hand-in assignments and portfolios. A letter grading scale is used. Grades are awarded according to a graded scale from A (highest) to F (lowest), with E as the minimum pass grade.

Internasjonalisering

Internationalisation

Exchange students from our collaborating academic institutions abroad, may, partially or completely, include the one-year study programme in their Bachelor`s Degree at their home institution.

All lectures, instructions and teaching material in the one-year study programme are in English language.

Studiets innhold, oppbygging og organisering

Content and organization

The programme comprises:

- 60 ECTS course credits or
- 40/45 course credits and a senior thesis project of respectively 20/15 credits
- Students select courses based on their background and own interests.

The senior thesis project is reserved for students who already have course exams in subjects found in the list of courses, or similar to our courses.

Four of the courses are taught in the autumn semester, and three in the spring semester.

Senior thesis project can be taken over one or two semesters.

The courses are described in greater detail below.

The following courses can be selected

Emner

Studiepoeng År 1

- **Senior Thesis Project - Biotechnology (optional)**

  20 studiepoeng Autumn Spring

- **Senior Thesis Project - Biotechnology (optional)**

  15 studiepoeng Autumn Spring

- **Industrial Biotechnology (optional)**

  5 studiepoeng Spring

- **Biochemistry and Molecular Biology lab (optional)**

  10 studiepoeng Spring

- **Microbiology (optional)**

  10 studiepoeng Spring

- **Bioprocess technology (optional)**

  15 studiepoeng Autumn

- **Biochemistry (optional)**

  10 studiepoeng Autumn

- **Molecular Biology (optional)**

  10 studiepoeng Autumn

- **Genetics (optional)**

  10 studiepoeng Autumn

Emneoversikt

2BT231 Senior Thesis Project - Biotechnology

Emnekode: 2BT231

Studiepoeng: 20

Språk

English

Forkunnskaper

Prerequisites: Recommended prerequisites: 2KJ231 Biochemistry or similar, and 2BI251 Molecular Biology or similar.

Læringsutbytte

Learning outcomes

A candidate having completed the course have the following learning outcomes:

Skills

The Candidate is

- able to work independently, and/or in groups, on a subject of considerable dimension

Competence

The Candidate is

- able to synthesise the results in a thesis that satisfies criteria for reporting scientific findings

Innhold

Content:

- during the thesis work, students accomplish an experimental investigation or a literature review relevant to the program of study
- the question in focus will be determined by the student in concert with the advisor
- the project culminates in a written thesis

Organisering og arbeidsformer

Organisation and Methods for Instruction:

Students plan and execute the investigation under supervision. The thesis work is normally carried out individually, or in groups of two students.

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam:

None

Vurderingsordning

Assessment

- individual (or in group of two) written thesis

The grading system is based on the letters from A-F, where E is the minimum passing grade

Ansvarlig avdeling

Avdeling for lærerutdanning og naturvitenskap

2BT221 Senior Thesis Project - Biotechnology

Emnekode: 2BT221

Studiepoeng: 15

Språk

English

Forkunnskaper

Prerequisites: Recommended prerequisites: 2KJ231 Biochemistry or similar, and 2BI251 Molecular Biology or similar.

Læringsutbytte

Learning outcomes

A candidate having completed the course have the following learning outcomes:

Skills

The Candidate is

- able to work independently, and/or in groups, on a subject of considerable dimension

Competence

The Candidate is

- able to synthesise the results in a thesis that satisfies criteria for reporting scientific findings

Innhold

Content:

- during the thesis work, students accomplish an experimental investigation or a literature review relevant to the program of study
- the question in focus will be determined by the student in concert with the advisor
- the project culminates in a written thesis

Organisering og arbeidsformer

Organisation and Methods of Instruction

- students plan and execute the investigation under supervision

- the thesis work is normally carried out individually, or in groups of two students

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam:

None

Vurderingsordning

Assessment:

- individual (or in groups of two) written thesis

The grading system is based on the letters from A-F, where E is the minimum passing grade

Ansvarlig avdeling

Avdeling for lærerutdanning og naturvitenskap

2BT211 Industrial Biotechnology

Emnekode: 2BT211

Studiepoeng: 5

Språk

English

Forkunnskaper

Prerequisites: None

Læringsutbytte

Learning outcomes

The candidate having completed the course should have the following learning outcomes:

Knowldge

The Candidate can

- give an overview of important products and processes employed in modern biotechnology industry

Skills

The Candidate is

- able to describe what identifies the various product sectors

Competence

The Candidate can

- provide an overview and be able to discuss details of significant processes and products in biotechnological industries and commercial biology based activities

Innhold

Content:

- industrial production systems based on microorganisms and cell cultures
- bioethanol, organic acids, antibiotics, industrial enzymes, recombinant proteins, monoclonal antibodies
- vaccine production

- enzyme technology

Organisering og arbeidsformer

Organisation and methods of Instruction:

Lectures.

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam:

None.

Vurderingsordning

Assessment:

- individual written examination, 4-hour

The grading system is based on the letters from A-F, where E is the minimum passing grade

Ansvarlig avdeling

Avdeling for lærerutdanning og naturvitenskap

2BI261 Biochemistry and Molecular Biology lab

Emnekode: 2BI261

Studiepoeng: 10

Språk

English

Forkunnskaper

Prerequisites: Recommended prerequisites: 2KJ231 Biochemistry or similar, and 2BI251 Molecular Biology or similar.

Læringsutbytte

Learning outcomes

The candidate having completed the course have the following learning outcomes:

Skills

The Candidate can

- master laboratory methods central to the fields of biochemistry and molecular biology, and use of the principles that underlie each method

Competence

The Candidate

- can work independently with the techniques and instrumentation employed in the course

Innhold

Content:

- *Biochemistry:* Quantitative measurement, spectrophotometry, isolation and characterisation of DNA and proteins, ion exchange chromatography, SDS-PAGE, enzyme kinetics, carbohydrate chemistry.
- *Molecular Biology:* Polymerase chain reaction (PCR), gel electrophoresis, cloning into plasmid vectors, preparation & transformation of competent *E. coli* , plasmid DNA isolation, restriction analysis, DNA cycle sequencing & capillary electrophoresis, bioinformatics.

Organisering og arbeidsformer

Organisation and Methods of Instruction:

- group work in the laboratory
- submission of laboratory reports of completed exercises
- student presentations
- independent study groups.

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam

Approved laboratory reports from all the exercises for which a report is required, 7 in Biochemistry and one in Molecular Biology.

Vurderingsordning

Assessment

- individual portfolio (includes two reports from the Biochemistry section, selected by the instructor and one comprehensive report from Molecular Biology section), counts 60 %
- individual written examination, 4-hour, counts 40 %

Both parts must be passed to receive a final grade.

The grading system is based on the letters from A-F, where E is the minimum passing grade.

Ansvarlig avdeling

Avdeling for lærerutdanning og naturvitenskap

2BI231 Microbiology

Emnekode: 2BI231

Studiepoeng: 10

Språk

English

Forkunnskaper

Prerequisites: None

Læringsutbytte

Learning outcomes

The candidate having completed the course have the following learning outcomes:

Skills

- understand microbial diversity, ecology, evolution, systematic and master laboratory techniques used to study microorganisms

Competence

- have acquired overview over fundamental concepts and principles in the field of microbiology

Innhold

Content:

- Microbial cell structure, function, growth, growth control, evolution, systematic and laboratory techniques.

Organisering og arbeidsformer

Organisation and Methods of Instruction:

- Lectures
- Laboratory course.

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam :

12 lab reports, detail of laboratory course will be given at the beginning of the semester.

Vurderingsordning

Assessment :

- Individual written examination, 4-hour

The grading system is based on the letters from A-F, where E is the minimum passing grade

Ansvarlig avdeling

Avdeling for lærerutdanning og naturvitenskap

2BT201 Bioprocess technology

Emnekode: 2BT201

Studiepoeng: 15

Språk

English

Forkunnskaper

Recommended prerequisites: 2KJ231 Biochemistry or similar (completed previously or taken concurrently).

Læringsutbytte

Learning outcomes

The candidate having completed the have the following learning outcomes:

Knowledge

The Candidate has

- understanding of the underlying principles of bioprocesses related to fermentation, downstream processing, and enzyme reactors, as well as analytical procedures

Skills

The Candidate is

- able to analyze data for computing process performance parameters

Competence

The Candidate has

- acquired basic competence in performing experimental procedures with fermentation, adsorption chromatography, tangential filtration and biocatalyst immobilization

Innhold

Content:

- introduction to fundamental bioengineering and biochemical aspects of fermentation and bioreactor use, and purification strategies in downstream processing
- experimental design

- fermentation: Batch, fed-batch and continuous culture, growth curve and element balances
- growth models
- reactor operation and control
- separation techniques: Membrane filtration and protein chromatography
- strategy and scale up of separation processes
- protein electrophoresis
- enzyme technology and immobilization: Immobilization of biocatalysts and the use of enzyme reactors
- simple reaction kinetics, mass transport and film theory

Organisering og arbeidsformer

Organisation and Methods of Instruction:

- lectures
- laboratory course
- self-guided colloquiums

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam :

Approved 5 lab reports.

Vurderingsordning

Assessment

- individual portfolio (includes a mid-term test (2 hours), and two lab reports selected by the instructor), counts 40 %
- Individual written examination, 4-hour, counts 60 %

Both parts must be passed to receive a final grade.

The grading system is based on the letters from A-F, where E is the minimum passing grade

Ansvarlig avdeling

Avdeling for lærerutdanning og naturvitenskap

2KJ231 Biochemistry

Emnekode: 2KJ231

Studiepoeng: 10

Språk

English

Forkunnskaper

Prerequisites: None

Læringsutbytte

Learning outcomes

A candidate having completed the course have the following learning outcomes:

Knowledge

The Candidate has

- acquired knowledge about important biological molecules
- acquired knowledge about the regulation of biomolecular processes in the cell, including the pathway from DNA to proteins

Skills

The Candidate

- is able to explain how molecule turnover occurs in the cell

Innhold

Content:
Three main topics:

- building blocks in the cell - nucleic acids, amino acids, proteins, carbohydrates, fat
- metabolism in the cell - enzymology, photosynthesis, carbohydrate-, fat-, nitrogen- and nucleic acid-metabolism
- processing of information in the cell - replication, transcription and translation

Organisering og arbeidsformer

Organisation and Methods og Instruction:

- lectures

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam

None

Vurderingsordning

Assessment

- one individual written midterm assignment that counts 30 %
- individual written examination, 4-hour, that counts 70 %

Both parts must be passed to receive a final grade.

The grading system is based on the letters from A-F, where E is the minimum passing grade.

Ansvarlig avdeling

Avdeling for lærerutdanning og naturvitenskap

2BI251 Molecular Biology

Emnekode: 2BI251

Studiepoeng: 10

Språk

English

Forkunnskaper

Prerequisites: Recommended prerequisites: 2BI131 Genetics or similar (completed previously or taken concurrently), and 2KJ231 Biochemistry or similar (completed previously or taken concurrently).

Læringsutbytte

Learning outcomes

A candidate having completed the course have the following learning outcomes:

Knowledge

The Candidate

- can understand the central concepts, principles and analytical methods employed in molecular Biology

Competence

The Candidate

- is able to integrate molecular genetic concepts with previous knowledge of classical genetics, cell biology, microbiology and biochemistry to develop a multidisciplinary understanding of molecular biology

Innhold

Content:
Introduction to the molecular biology of prokaryotic and eukaryotic cells and their viruses, including: mechanisms of DNA replication, repair and transcription; structure of genes and genomes; regulation of gene expression; chromatin structure; epigenetics; bioinformatics; modern methodology of molecular genetics.

Organisering og arbeidsformer

Organisation and Methods of Instruction:

- lectures
- self-organised colloquia
- independent study

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam:

None

Vurderingsordning

Assessment:

- one individual written assignment that counts 30 %
- individual written examination, 4-hour final, that counts 70 %

Both parts must be passed to receive a final grade.

The grading system is based on the letters from A-F, where E is the minimum passing grade.

Ansvarlig avdeling

Avdeling for lærerutdanning og naturvitenskap

2BI131 Genetics

Emnekode: 2BI131

Studiepoeng: 10

Språk

English

Forkunnskaper

Prerequisites: None

Læringsutbytte

Learning outcomes:

A candidate having completed the course have the following learning outcomes:

Knowledge

The Candidate can

- the central concepts, principles in classical, chromosomal, bacterial/viral, population, quantitative and evolutionary genetics

Skills

The Candidate can

- master analytical methods used in classical, chromosomal, bacterial/viral, population, quantitative and evolutionary genetics

Innhold

Content:

Introduction to classical, population, quantitative and evolutionary genetics, including: meiosis; Mendel's laws; probability; pedigree analysis; crosses (test-, back-, monohybrid-, dihybrid- etc.); recombination frequency and linkage analysis; gene mapping; chromosomal aberrations; transposable elements; allele frequency; Hardy-Weinberg equilibrium; natural selection; genetic drift; quantitative trait loci; heritability; marker-assisted breeding; variation and divergence; founder effect; molecular clocks.

Organisering og arbeidsformer

Organisation and Methods of Instruction:

- lectures
- discussion groups

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam

None

Vurderingsordning

Assessment:

- one individual written assignment that counts 30 %
- individual written examination, 4-hour, counts 70 %

Both parts must be passed to receive a final grade.

The grading system is based on the letters from A-F, where E is the minimum passing grade

Ansvarlig avdeling

Avdeling for lærerutdanning og naturvitenskap