

Studieplan 2015/2016

Master`s Degree in Applied and Commercial Biotechnology

Studiepoeng: 120

Studiets varighet, omfang og nivå

Study length and academic level

The Master`s Degree Programme comprises two years of full-time study (120 ECTS credits) that may also be completed part-time, and includes modules each totalling 5 – 20 ECTS credits.

Innledning

Introduction

Biotechnology entails the utilisation of microorganisms, animal and/or plant cells to create useful and necessary products, and further provides the means for the genetic modification of living organisms and their function. In the years to come, biotechnology will play an increasingly important role in how society develops. 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 hygienic 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. Students with an cross-disciplinary approach to biotechnological problems are well suited to work in both public and private research and development laboratories.

This biotechnology master study is unique by having a two-tailed specialisation

possibility, either in Experimental Biotechnology or in Commercialisation of Biotechnology direction. Specialisation direction is based on chosen courses, optional courses and chosen specialisation in master's degree thesis. Further, this study is taught in English, giving it an international perspective and recruit possibilities.

Læringsutbytte

Learning outcomes

Knowledge:

The candidate

- has advanced cross-disciplinary approach to biotechnological problems.
- has evolved knowledge of methods in biotechnological companies as gene technology, cell biology and bioprocess engineering.
- has advanced knowledge about the commercialisation of biotechnology in order to develop marketable products based on promising research results.

Skills:

The candidate

- can meet the increasingly cross-disciplinary demands of an expanding biotechnological business sector.
- are stimulated to establish biotechnological enterprises based on their own research,.
- can analyse and prepare appropriate IPR strategies, as well as organising and developing a business plan.

Competence:

The candidate

- has theoretical knowledge and practical skills making them well equipped for a career in biotechnology-based activities.
- has acquired deeper knowledge and skills in biotechnological subjects so they conceive and complete a piece of original research.
- has acquired a solid basic for further education on a Phd-level in biotechnology.

Målgruppe

Target group

Our aim is to target students globally to this study programme, who already have a foundation in biotechnology, and who wish to acquire advanced theoretical knowledge and practical skills in biotechnology. Primarily we target students with a bachelor in biotechnology, but we also encourage applicants with other bachelor degrees as long as they fulfil the entrance requirements (see Admission requirements below).

Kompetanse

Qualification attained

The Master's Degree Programme in Applied & Commercial Biotechnology leads to a Master's Degree in biotechnology, with specialisation in either "Experimental biotechnology" or "Commercialisation of Biotechnology" fields. Expertise in biotechnology can be utilised in basic and/or applied research focusing on the economic and socially beneficial use of organisms and their products, or to help stimulate the establishment of biotechnological enterprises.

Opptakskrav

Admission requirements

For both specialisation modules of the programme, your degree from higher education must include:

The equivalent of at least 80 ECTS credits in natural sciences and mathematics, with a solid foundation in chemistry and biology with a minimum average grade of D.

For the specialisation module in Experimental Biotechnology, your degree from higher education must additionally include:

Completed coursework in Biochemistry and Molecular Biology (may be included as part of the 80 ECTS credits) with a minimum average grade of C in these courses.

Undervisnings- og læringsformer

Teaching and learning methods

The instruction is based on lectures, workshops/group work, laboratory exercises and excursions. All students working toward a Master's Degree in Applied & Commercial Biotechnology will be enrolled in obligatory courses comprising the subjects. Introductory lectures and practical learning exercises on the computer followed by a hand-in assignment that is to count as a part of the total assessment of the students.

Synopses of these assignments are presented by students in short lectures to the instructors and the remaining students. Lectures also include group discussions, individual assignments, group assignments and quizzes. See detailed description for each courses below.

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. Oral presentation of thesis is part of final remarks. A letter grading scale is used. A more detailed description is given in the course descriptions below.

Internasjonalisering

Internationalisation

The biotechnology master study programme is entirely taught in English, which allow for international applicants as well as local ones. The entire curriculum is in English. We recruit students globally, and therefore we have an international environment at Hedmark University College.

Studiets innhold, oppbygging og organisering

Content and organization

First and second semester:

The students take 30 compulsory ECTS credits common to all students in the Master's Degree Programme in Applied & Commercial Biotechnology (see below):

- IPR strategies and Biotechnology Regulation(10 ECTS credits).
- Bioinformatics/Biostatistics(15 ECTS credits).
- Bioethics(5 ECTS credits, every second year, 2013, 2015,...).

In addition the students may choose between two different specialisations in the Programme:

Specialisation 1) Experimental Biotechnology: A deeper understanding of Bioprocess Engineering, Molecular Genetics and Cell Biology, well-suited for those aiming to

continue research or teaching in the field, or for those wishing to work with biotechnological research or problems in a company dealing with applied biotechnology.

- Biotechnological Methods With lab (20 ECTS credits).

Specialisation 2) Commercialisation of Biotechnology: A deeper understanding of the legislation regulating biotechnological activities and products, systematising innovation and the various stages of commercialisation. This specialisation is well-suited for students wishing to direct their attention to business life and commercialise their knowledge.

- Biotechnological Methods Without lab (10 ECTS credits).
- Bio-entrepreneurship and business (15 ECTS credits).

Third and fourth semester:

5 or 10 ECTS credits as an optional module, and the thesis which accounts for 60 ECTS credits.

	Specialisation 1	Specialisation 2	Common compulsory courses	
	Experimental Biotechnology	Commercialisation of Biotechnology		
Semester 1	2BIO 032	2BIO 062	2BIO 042	2BIO 051
Semester 2	Biotechnological Methods With Lab 20 ECTS	Bio-entrepreneurship and business 15 ECTS	Biotech. Methods Without Lab 10 ECTS	IPR Strategies and Biotechnology Regulation 15 ECTS
Semester 3	Optional module 10 ECTS	Optional module 5 ECTS		2BIO 011 Bioinformatics /Biostatistics 15 ECTS

Semester 4	2BIO 201 Master's degree thesis 60 ECTS (Experimental)
	2BIO 202 Master's degree thesis 60 ECTS (Commercial)

Emneoversikt

Emnekode	Emnets navn	S.poeng	O/V *)	Studiepoeng pr. semester			
				S1(H)	S2(V)	S3(H)	S4(V)
2BIO 021	<u>Bioethics</u>	5	O	5			
2BIO 042	<u>Biotechnological Methods Without Lab</u>	10	O	5	5		
2BIO012	<u>Bioinformatics/Biostatistics</u>	15	O	15			
2BIO032	<u>Biotechnological Methods With Lab</u>	20	O	10	10		
2BIO 051	<u>IPR Strategies and Biotechnology Regulation</u>	10	O	5	5		
2 BIO 062	<u>Bio-Entrepreneurship and Business</u>	15	O	7,5	7,5		
2BIO201	<u>Master`s Degree thesis in experimental Biotechnology</u>	60	O		10	20	30
2BIO202	<u>Master`s Degree thesis in commercial Biotechnology</u>	60	O		10	20	30
Possible optional modules							
2BIO092	<u>Independent study</u>	10	O			10	
2BIO091	<u>Independent study</u>	5	O			5	
Sum:				30	30	30	30

*) O - Obligatorisk emne, V - Valgbare emne

Emneoversikt

2BIO 021 Bioethics

Emnekode: 2BIO 021

Studiepoeng: 5

Semester

Høst

Språk

English

Forkunnskaper

Prerequisites: None

Læringsutbytte

Learning outcomes

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

Knowledge

The Candidate has

- knowledge of basic ethics
- knowledge of consequence and risk assessment as well as ethical argumentation
- knowledge of legislation in this area and the major parties and authorities to which the researchers must relate

Skills

The Candidate has

- ability to analyse and critically reflect on problems involving animal ethics as well as environmental ethics as related to biotechnological products, and to see them in a larger scientific context

Innhold

Content

- Ethics and ethical assessments
- Risk assessment, legislation as to patenting laws in various countries
- The Biotechnology Act and acts concerning the use of animals in research.
- Ethical, environmental, legal and social aspects of modern biotechnology
- Research-based knowledge in the field
- Legislation in the field of biotechnology, and information about which relevant major parties and authorities to which researchers must relate

Organisering og arbeidsformer

Organization and Methods of Instruction

- Lectures
- Ethical discussions, individual and in groups
- Term assignments. Synopses of these assignments are presented by students in short lectures to the instructors and the remaining students

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam

Presence at 80% of scheduled classes

Vurderingsordning

Assessment

Individual oral examination.

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

2BIO 042 Biotechnological Methods Without Lab

Emnekode: 2BIO 042

Studiepoeng: 10

Semester

Høst / Vår

Språk

English

Forkunnskaper

Prerequisites: None

Læringsutbytte

Learning outcomes

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

Knowledge:

The Candidate has

- a comprehensive understanding of central and current technological methods used in "omics" (genomics, transcriptomics & proteomics) approaches cell biological techniques, and the ability to explain them, and to be familiar with various forms of applying this knowledge.
- a advanced understanding of the bioprocess technologies underlying the industrial manufacturing of products from biochemical processes and biological materials
- a profound overview how the central technology platforms are employed in both basic and applied research projects concerning bioprocess technology, and the

biological understanding of gene regulation mechanism and function, protein expression and function, at the molecular and cellular levels.

- a deeper overview of the potential application of these technologies in the biotechnology business sector, including primary industries and public agencies

Skills:

The Candidate has

- experience with critical analysis of the primary literature of the specialization subjects

Innhold

Content

The course comprises two main parts:

- A lecture-based part providing an overview of special subjects in the three central areas of biotechnology: Bioprocess technology, molecular genetic and cell biology technologies.
- A term paper where the students are to write a scientific report based on one or more technologies applicable to an existing company.

Main themes in the course are:

- Technologies and approaches employed to identify genes or gene products that directly affect, or are associated with, a biological process of commercial interest. Current technologies/approaches utilized within genomics, functional genomics, transcriptomics, proteomics and population & quantitative genetics will be covered. Examples discussed under this section include DNA markers that are associated with phenotypic traits of commercial interest in animals, e.g. milk yield in cows and disease resistance in plants. Secondly, genes that directly add novel traits to production organisms, e.g. insect resistance to plants to produce genetically modified plants, will be described.
- Application of genes or gene products to generate commercial products. This section of the course will discuss examples of the use of marker technologies and transgenic strategies in plants and animals from regional, national and international biotechnology industries. In addition, intellectual property strategies related to biotechnology commercialization will be covered.
- Biosafety control of commercial products produced by biotechnological methods. This section will cover pre-market quality control of biotechnology

products using marker technologies. In addition, national and international biosafety approval legislation and approval submission criteria for genetically modified organisms will be covered.

- Biotechnological methods in reproduction biology. This section of the course will discuss examples of biotechnological methods using antibodies and fluorochromes for study of cell biology with a focus on sperm cell physiology. In addition, the fertilization processes in the female will be covered and examples of reproduction technologies will be discussed.
- Biotechnological methods in investigating the microbiology of the gut. This section will introduce the current knowledge about the function of gut bacteria in health and disease, and methods to investigate gut bacteria.
- Production of biologicals by means of bioprocess technology. Introduction to the application of unit operations used in industrial bioprocess technology, as fermentation and cell culture, downstream processing of biologicals. Focus on production of therapeutical proteins. Overview of product markets, process development, capital and cost elements.

Organisering og arbeidsformer

Organization and Methods of Instruction

- Lectures: Introductory lectures are given to provide an overview of the main themes in the course. These lectures will be integrated as a part of a more extensive course, 2BIO 032 (Biotechnological Methods With Lab – 20 ECTS credits).
- Term paper: In semester two, the students are to write a report based on one or more technologies applicable for the company that they should write a Master's thesis for. Comments on each report will be given once by one of the teachers before the finale due date.
- Fronter: All relevant course information and scientific articles in the syllabus will be posted on Fronter. In addition, the students will hand in the term papers using Fronter.

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam

A written individual test from Lab course 1. Duration approximately two hours.

Vurderingsordning

Assessment

Written individual report of 3500-4000 words (Term paper) counts 40% and an individual oral exam 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

2BIO012 Bioinformatics/Biostatistics

Emnekode: 2BIO012

Studiepoeng: 15

Semester

Høst

Språk

English

Forkunnskaper

Prerequisites: None

Læringsutbytte

Learning outcomes

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

Knowledge:

The Candidate can

- understand the main methods for protein modelling and operate programs to visualize protein structures
- explain the principles of methods for construction of phylogenetic trees

Skills:

The Candidate can

- give the content and characteristics of the most important bioinformatics databases and perform searches in these databases using text and sequence queries, and analyze the results of these searches

- explain the principle of pairwise and multiple sequence alignments and carry out pairwise alignments using dynamic programming

Competence:

The Candidate can

- operate commonly used bioinformatics tools and understand the components of the various programmes used
- give examples of methods used to analyze genes and the expression of genes
- statistically treat biological data to enable research results to be presented and interpreted in a scientifically acceptable manner

Innhold

Content

The course comprises two main parts:

- A lecture-based part providing introduction to various web-based resources and bioinformatics tools for the analyses of DNA, RNA and protein sequences. Lectures in elementary statistics
- Computer Lab where the students will be guided through practical bioinformatics exercises on the computer

Main themes in the course are:

- Biological databases and web-based tools and resources
- Basic DNA and protein sequence analysis
- Pairwise and multiple sequence alignments
- Phylogenetic analysis
- Principles of protein structure modelling
- Gene prediction and expression
- Introduction to elemental statistical treatment of biological data

Organisering og arbeidsformer

Organization and Methods of Instruction

- Lectures: Introductory lectures are given to provide an overview of the main topics in the course.

- Computer Lab: Practical exercises throughout the whole semester where the students will conduct a series of adapted computer tools to solve bioinformatics tasks
- Compulsory Assignment: Students in groups of 3-4 are to hand in a written report of an assigned bioinformatic problem
- Fronter: All relevant course information and scientific articles in the syllabus will be posted on Fronter.

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam

Attendance to at least 80% of the Computer Lab exercises

Vurderingsordning

Assessment

Written individual report count 40% and an individual 4 hours written exam count 60% of the final grade.

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

2BIO032 Biotechnological Methods With Lab

Emnekode: 2BIO032

Studiepoeng: 20

Semester

Høst / Vår

Språk

English

Forkunnskaper

Prerequisites: None

Læringsutbytte

Learning outcomes

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

Knowledge:

The Candidate has

- a detailed overview over central and current technological methods used in "omics" (genomics, transcriptomics & proteomics) approaches and cell biological techniques, and the ability to explain them, and to be familiar with various forms of applying this knowledge.
- a comprehensive understanding of the bioprocess technologies underlying the industrial manufacturing of products from biochemical processes and biological materials. An detailed overview how the central technology platforms are

employed in both basic and applied research projects concerning bioprocess technology, and the biological understanding of gene regulation mechanism and function, protein expression and function, at the molecular and cellular levels.

- a deeper overview of the potential application of these technologies in the biotechnology business sector, including primary industries and public agencies

Skills:

The Candidate has

- advanced experience with critical analysis of the primary literature of the specialisation subjects
- a comprehensive experience in varied laboratory techniques

Innhold

Content

The course comprises two main parts:

- A lecture-based part providing an overview of special subjects in the three central areas of biotechnology: Bioprocess engineering, molecular genetic and cell biology technologies.
- A laboratory part with tasks designed to cover a selection of central techniques in molecular genetics, cell biology and bioprocess technology.

Main themes in the course are:

- Technologies and approaches employed to identify genes or gene products that directly affect, or are associated with, a biological process of commercial interest. Current technologies/approaches utilized within genomics, functional genomics, transcriptomics, proteomics and population & quantitative genetics will be covered. Examples discussed under this section include DNA markers that are associated with phenotypic traits of commercial interest in animals, e.g. milk yield in cows and disease resistance in plants. Secondly, genes that directly add novel traits to production organisms, e.g. insect resistance to plants to produce genetically modified plants, will be described.
- Application of genes or gene products to generate commercial products. This section of the course will discuss examples of the use of marker technologies and transgenic strategies in plants and animals from regional, national and international biotechnology industries. In addition, intellectual property strategies related to biotechnology commercialization will be covered.

- Biosafety control of commercial products produced by biotechnological methods. This section will cover pre-market quality control of biotechnology products using marker technologies. In addition, national and international biosafety approval legislation and approval submission criteria for genetically modified organisms will be covered.
- Biotechnological methods in reproduction biology. This section of the course will discuss examples of biotechnological methods using antibodies and fluorochromes for study of cell biology with a focus on sperm cell physiology. In addition, the fertilization processes in the female will be covered and examples of reproduction technologies will be discussed.
- Biotechnological methods in investigating the microbiology of the gut. This section will introduce the current knowledge about the function of gut bacteria in health and disease, and methods to investigate gut bacteria.
- Production of biologicals by means of bioprocess technology. Introduction to the application of unit operations used in industrial bioprocess technology, as fermentation and cell culture, downstream processing of biologicals. Focus on production of therapeutic proteins. Overview of product markets, process development, capital and cost elements.

Organisering og arbeidsformer

Organization and Methods of Instruction

- Lectures: Introductory lectures are given to provide an overview of the main themes in the course.
- Laboratory experiments: The students will conduct a series of adapted laboratory tasks. This will be done as a project-oriented assignment where several different techniques are to be used to design, optimize and carry out a biotechnological process, as well as carrying out molecular genetic analyses, cytometric analyses and microscopy analyses.
- Laboratory reports: Results from the laboratory experiments are to be described and discussed in scientific laboratory reports. Comments on each report will be given once by the responsible teacher before the finale due date.
- Fronter: All relevant course information and scientific articles in the syllabus will be posted on Fronter. In addition, the students will hand in the laboratory reports using Fronter.

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam

A written individual test from Lab course 1. Duration approximately two hours.

Vurderingsordning

Assessment

All written individual laboratory reports counts 40% and an individual oral exam 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

2BIO 051 IPR Strategies and Biotechnology Regulation

Emnekode: 2BIO 051

Studiepoeng: 10

Semester

Høst / Vår

Språk

English

Forkunnskaper

Prerequisites: None

Læringsutbytte

Learning outcomes

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

Knowledge:

The Candidate has

- knowledge about the current laws governing the research in biotechnology in Norway
- knowledge about laws protecting the research results, with an emphasis on patent procedures
- knowledge about Norwegian Biotech regulations.
- knowledge about general principles of Law, both in Norway and USA.
- general knowledge about the Democratic principles and the place of Law in the governing of national industrialized states protecting the individual IPR rights

- advanced knowledge of processes for obtaining patents in Norway and USA

Skills:

The Candidate has

- advanced skills in establishment of Intellectual Property Rights (IPR), including Patents in USA, Trademark, and Copyright and other.
- good skills in presentations of and negotiations regarding IPR in Biotechnology
- skills in planning and documenting IPR development in organized research, using modern ICT tools like MS Project, MS Visio, and Data Base Systems for IPR maintenance
- good skills in patent claim writing and analysis
- skills in development of Patent Search Strings and its use in Business Intelligence work
- skills in reading and analyzing Law texts

Competence:

The Candidate has an advanced competence in

- aspects of IPR protection that can be useful for business and research within Biotechnology, and for further study and work
- general principles of norwegian Law, differencies to Anglo-Saxon Law
- licencing of Patents, payments, patents searches, patent negotiations, and strategic deliberations
- developement of an attitude to the field of IPR protection and Law which will qualify for responsible positions in he field of IPR protections in Norway and abroad

Innhold

Content

The course will explain different types of IPR, how the patent institute is used, and which strategy should be used in various business situations.

Central topics:

- IPR protection with the appropriate laws in Norway and USA.
- The differentent strategies available for companies to protect its IPR and ensure its

“freedom to operate”

- Laws appropriate for research in Biotechnology in Norway, inclusive understanding of the underlying political processes

Sub-themes in the course:

- Reading Law texts
- Technology based Competitive Intelligence
- Comprehensive Corporate IPR Management
- Overcoming Office Actions Rejections
- Patent Examiners MPEP
- Crucial issues in Gene Patenting
- Structured group meetings for IPR problems
- Research based business development checklist
- Valuation of patents and Return on Investment (ROI) for patents and research
- Alternative to Patents in IPR Protection (Standards, Trade Secret and others)
- Licensing Negotiations
- Non disclosure agreements NDA

Organisering og arbeidsformer

Organization and Methods of Instruction

- Lectures
- Group debates in class with preparations for debating for and against
- Individual assignments with in-class presentations and Fronter delivery of text and presentations versions of results
- Group assignments with in-class presentations and Fronter delivery of text and presentations versions of results

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam

- Completion of all given assignments before given deadlines, approximately 9-12 assignments during the two semesters. The assignments must be completed at an acceptable level, new assignments may be given during the year.

- Presence at 80% of scheduled classes, including all of classes with preannounced debates. (Aproximately 4-6)

Vurderingsordning

Assessment:

Individual Oral examination in themes from the curriculum and assignments. The examination consist in short and concise student presentations on themes selected at random from a list, and questions related to this and the assignments returns.

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

2 BIO 062 Bio-Entrepreneurship and Business

Emnekode: 2 BIO 062

Studiepoeng: 15

Semester

Høst / Vår

Språk

English

Forkunnskaper

Prerequisites: None

Læringsutbytte

Learning outcomes:

A candidate having completed the course should have the following learning outcome:

- A general overview and basic knowledge and skills related to theory and topics covered in the course: Innovation, entrepreneurship, commercialization and business - in general and in a biotechnology context.
- Be familiar with the business language, and able to communicate clearly in business terms.
- Demonstrate knowledge and understanding of, and being able to apply, central tools and techniques associated with topics covered in the course.
- Be familiar with and motivated for innovation and entrepreneurial activities in general, and within the biotechnology sector in particular.
- Be able to develop and write a viable business plan for a venture of the students choosing.
- Be able to reflect on relevant issues, display critical and innovative thinking, ask

questions and perform required research.

Innhold

Content:

The course is intended to provide basic core skills needed to identify and realize business opportunities in general and create an entrepreneurial business in the biotech-sector. Topics covered in the course include, amongst other:

- General Business topics such as:
 1. Finance/Venture capital funding
 2. Market analysis, marketing & sales
 3. Management, Organization and Strategy
 4. Cultural, Legal and Ethical topics
- Topics related to Idea Development and New Venture Creation, including:
 1. Creativity,
 2. Innovation
 3. Entrepreneurship / New venture creation
- Development and presentation of a viable Business Plan

Organisering og arbeidsformer

Organization and Methods of Instruction

- Modularised classes
- Lectures
- Individual studies
- Guest lectures
- Case studies
- Class discussions
- Group work
- Individual and team assignments
- Fronter as learning platform

Obligatoriske krav som må være godkjent før man kan

avlegge eksamen

Requirements necessary to take the exam

None

Vurderingsordning

Assessment

Portfolio assessment and presentations based on a minimum of four (4) assessments during the course will account for 40% of the final grade.

A week-long final exam will account for 60 % of the final grade. This exam-paper is to be defended by an individual oral examination.

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

2BIO201 Master`s Degree thesis in experimental Biotechnology

Emnekode: 2BIO201

Studiepoeng: 60

Semester

Vår / Høst / Vår

Språk

English

Forkunnskaper

Prerequisites: Satisfactory progress according to the Study plan

Læringsutbytte

Learning outcomes

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

Knowledge

The Candidate has

- theoretical knowledge and practical skills making them well equipped for a career in biotechnology-based activities.
- acquired knowledge and skills in biotechnological subjects so they conceive and complete a piece of original research.

Competence

The Candidate has

- acquired a solid basic for further education on a Phd-level in biotechnology

Innhold

Content

Students with experimental thesis are encouraged to include Bioprocess Engineering, Molecular Genetics, or Cell Biology in the Master's thesis.

Bioprocess Engineering

The thesis will focus in depth on a specific production or product of a biotechnological nature. The experimental work may span from describing and optimising a limited unit operation to comprising the whole process. One may also couple the thesis to gene technological or cell biological research questions. Depending on the candidate's specialisation it may also be natural to include an economical analysis (sensitivity analysis) and an assessment of the commercialisation potential. One may include an internship in a relevant enterprise or use a concrete problem from industry.

The field Bioprocess Engineering comprises the theoretical description, the optimisation and the industrial use of biochemical and biological processes. Such processes include the manufacture of products involving biological/biochemical activity that require careful conservation (biomedicines, diagnostic reagents, enzymes etc). Bioprocess engineering also includes conversion processes in which the activities of enzymes or micro-organisms is essential for production (fermentation/yeasts, enzyme reactors). By utilising selective bio-processes, a number of valuable substances can be extracted from by-products of the food industry and from refined marine raw materials.

Molecular Genetics and Cell Biology

The Master's thesis in molecular genetics and cell biology will mainly consist of an experimental research project carried out in a biotechnology laboratory. The project is to be structured in consultation with an advisor, and will, with few exceptions, be linked to a larger ongoing project, or projects in relevant companies/regional research communities. Possible research topics relevant to the thesis may be molecular genetics applied to animal or plant breeding, cell biology related to animal reproduction, molecular ecology (flora and fauna, microbial diversity), molecular genetics of development, immune cell biology, gene engineering as a phase of production in a bioprocessing strategy and gene technological methods related to biobank operations. Depending on the organism studied (e.g. bears, wolves etc), a Master's thesis in molecular ecology may be completed under co-advisement from the faculty at HUC

Evenstad. The biotechnology faculty at HUC collaborates with various other research institutions, both in Norway and abroad, and students may choose a project where experiments will be performed at external facilities.

Molecular genetics and cell biology include methods and techniques used to study and analyse life at the molecular and cellular level. In these two inter-connected fields, one primarily works with cells, metabolic systems, nucleic acids, genes and genomes containing, preserving and transmitting all the information governing the constitution of molecules, cells and organisms on earth. Today molecular genetic and cell biology techniques are used in all biology-related fields. Modern pharmaceutical, biomedical and biotechnological industries all base their research on these methods which are also increasingly applied in many other areas, including reproduction biology, animal and plant breeding, immunology, and the elucidation of floral and faunal biodiversity (as part of a sub-field called molecular ecology).

Organisering og arbeidsformer

Organization and Methods of Instruction

Written thesis based on traditional scientific methods, included literature study and laboratory experiments.

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam

A compulsory home seminar attendance and 15 minute long presentation of the thesis in the beginning of the fourth semester seminar: project theme with status and so far results.

Vurderingsordning

Assessment

One grade based on the individual written thesis, a 30 minute long presentation of the

thesis and a short oral examination.

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

2BIO202 Master`s Degree thesis in commercial Biotechnology

Emnekode: 2BIO202

Studiepoeng: 60

Semester

Vår / Høst / Vår

Språk

English

Forkunnskaper

Prerequisites: Satisfactory progress according to the Study plan

Læringsutbytte

Learning outcomes

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

Knowledge

The Candidate has

- theoretical knowledge and practical skills making them well equipped for a career in biotechnology-based activities.
- acquired knowledge and skills in biotechnological subjects so they conceive and complete a piece of original research.

Competence

The Candidate has

- acquired a solid basic for further education on a Phd-level in biotechnology

Innhold

Content

The objective of a specialisation in the commercialisation of biotechnology is to produce students with an academic and technical background in biotechnology who are also well trained in evaluating the commercial potential for applying this knowledge. The study programme was designed to meet the expressed demand in industry for people with a strong background in biotechnology who also have expertise from other areas related to the commercial application of this knowledge, such as business administration, complementing R&D strategies, innovation, business plan development, legislation, regulation and IPR. Students enrolled in this specialisation will develop the skills and expertise required for the development different types of enterprises in the biotechnology sector.

The Master's thesis in the Commercialisation of Biotechnology may be based on an assessment of a selected enterprise's current status with respect to R&D and commercialisation. These may be fully established enterprises already marketing finished products, or newly started enterprises ready to design a complete strategy from development to commercialisation. The thesis will, among other things, involve the evaluation of business concepts, product ideas, IPR and marketing strategies, with the goal of establishing a new company, or expanding production in an existing one. A project of this kind usually goes through several phases from idea to profitable operation. The Master's thesis in Commercialisation of Biotechnology may therefore consist of one or more of the following elements: developing a business plan based on commercialisation of an existing product idea arising from biotechnological research, developing/examining protective IPR strategies for a certain given product, or developing novel product ideas based on biotechnological research. The thesis may be completed as part of an internship at the enterprise in question, or at a company with a profile related to the proposed business concept. The BioInn-cluster in Hamar harbours many biotechnology companies and organisations where a Master's thesis of this kind is most relevant. The faculty at HH boasts a broad network and internship in companies located elsewhere in Norway is also possible.

Organisering og arbeidsformer

Organization and Methods of Instruction

Written thesis based on traditional scientific methods, included literature study and laboratory experiments in hybrid thesis.

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam

A compulsory home seminar attendance and 15 minute long presentation of the thesis in the beginning of the fourth semester seminar: project theme with status and so far results.

Vurderingsordning

Assessment

One grade based on the individual written thesis, a 30 minute long presentation of the thesis and a short oral examination.

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

2BIO092 Independent study

Emnekode: 2BIO092

Studiepoeng: 10

Semester

Høst / Vår

Språk

English

Forkunnskaper

Prerequisites: None

Læringsutbytte

Learning outcomes:

A Candidate having completed the course have the following learning outcome

- a deeper experience and insight into some relevant field of special interest

Innhold

Content

The independent study may be based on textbooks or chapters from textbooks, chapters from reference literature, review articles and/or original research articles.

All texts included in an independent study should be at the graduate level. One ECTS credit normally corresponds to approximately 30 pages from articles or 50 pages from books.

Literature considered as supporting literature for the the candidate's master's thesis will not be accepted for an independent study.

Organisering og arbeidsformer

Organization and Methods of Instruction

Self study

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam

None

Vurderingsordning

Assessment:

Individual oral examination

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

2BIO091 Independent study

Emnekode: 2BIO091

Studiepoeng: 5

Semester

Høst / Vår

Språk

English

Forkunnskaper

Prerequisites: None

Læringsutbytte

Learning outcomes:

A Candidate having completed the course have the following learning outcome

- a deeper experience and insight into some relevant field of special interest.

Innhold

Content

The independent study may be based on textbooks or chapters from textbooks, chapters from reference literature, review articles and/or original research articles.

All texts included in an independent study should be at the graduate level. One ECTS credit normally corresponds to approximately 30 pages from articles or 50 pages from books.

Literature considered as supporting literature for the the candidate's master's thesis will

not be accepted for an independent study.

Organisering og arbeidsformer

Organization and Methods of Instruction

Self study

Obligatoriske krav som må være godkjent før man kan avlegge eksamen

Requirements necessary to take the exam

None

Vurderingsordning

Assessment:

Individual oral examination

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