

MASTER OF SCIENCE IN BIOTECHNOLOGY

Gradsnavn: Master of Science in Biotechnology
Programme code: MSBIOTECH

The 2-year biotechnology Master of Science study is interdisciplinary at several levels. First, the programme is a collaboration between the Department of Biology and the Department of Biotechnology. The courses within the programme reflect this interdisciplinary, as the development of knowledge and skills is focusing on thorough knowledge about basic biological processes, available technologies to study such processes, and knowledge-based approaches to modify or optimise processes in order to tackle major societal, environmental or sustainability problems.

Learning outcomes MSc Biotechnology, Learning Objectives

As a MSc student in Biotechnology you get bio molecular knowledge and analytical skills at an advanced level. The program emphasises advanced biochemical and biological studies. You will acquire the skills to qualify for a broad range of positions in research, industry, consultancy, education and public administration, or for further education in a doctoral program. You can in your thesis address a broad range of fields including Molecular biology, Systems biology, biopolymer chemistry, marine biochemistry, environmental biotechnology, food science, microbiology, microbial genetics, molecular biology and systems biology depending on your background and interests.

Knowledge

The MSc graduate in Biotechnology has:

- Knowledge of the leading edge in a chosen specialized area of biotechnology, based on own research experience from a master's project and international literature.
- State of art knowledge about various methodological and analytic approaches that are used within the specialization.
- In-depth knowledge in the chemical structure and function of biomolecules, metabolism in the cell, knowledge of the concepts of molecular genetics and biosynthesis of proteins, and a good theoretical and practical insight into methods used to obtain this knowledge.
- Knowledge of the relationship between structure and function at organ and/or organism level, of important cell biological communication principles and processes, and how they are regulated.

Proficiency/Skills

The MSc graduate in Biotechnology:

- Is able to independently carry out a complete scientific work process, including the understanding of theoretical background, hypothesis generation, collection and analysis of data, and interpretation and presentation of results.
- Has high competence and multidisciplinary project experience within selected topics related to biotechnology and ability to contribute in a multidisciplinary team.
- Is able to evaluate methods and results within the field of specialization critically.
- Is able to evaluate and apply relevant theory, methods and analytic approaches within the specialized field of biotechnology, including statistical methods.
- Is able to analyze relevant issues in cell and molecular biology Implement knowledge from several research fields and disciplines.

General competence

The MSc graduate in Biotechnology

- Can assess and predict the technological, ethical and social effects of their own work /disciplines and of biotechnology in general.
- Acknowledges health, safety and environment (HSE) issues in handling chemicals and biological materials; understands the environmental impacts associated with the activity; performs risk assessments and is familiar with safety instructions in his/her subject area.
- Is able to work both independently or in groups on complex projects that require collaboration across disciplines.
- Can communicate scientific results to the general public and experts by writing well-structured reports and contributions for scientific publications and posters, and by oral presentations.

Admission requirements

One of the following requirements has to be fulfilled to qualify for admission to the programme

- BSc in cell- and molecular biology,
- BSc from Norwegian university colleges within bioengineering (bioingeniørfag)
- BSc in food technology (matteknologi/næringsmiddelfag),
- An education which corresponds to 3 years of study at university level within the field of biotechnology or biochemistry.
- BSc in other related areas may be considered on an individual basis.

Study plan

There are two main components in the Master's programme:

- Master's thesis (60 ECTS credits)
- Theoretical and methodological courses, compulsory and optional courses (60 ECTS credits)

Semester	7,5 ECTS	7,5 ECTS	7,5 ECTS	7,5 ECTS
4. Spring	BI3091/ BT3091 Special Syllabus	Master thesis		
3. Autumn	BI3016 Molecular Cell Biology	Master thesis		
2. Spring	Experts in Teamwork	Optional course	Master thesis	
1. Autumn	TBT4145 Molecular Genetics	Optional course	Optional course	Optional course

Compulsory courses (30 ECTS credits):

- TBT 4145 Molecular Genetics
- Experts in Teamwork
- BI3016 Molecular Cell Biology
- BI3091/ BT3091 Special Syllabus (BI3091 Special syllabus exam (and similar special curriculum courses) can be held together with the final master exam or at an earlier stage in the master programme.)

At least two of the following courses must to be selected from the following list:

Autumn:

BI3013 Experimental Cell- and Molecular Biology

7,5 ECTS

BI3019 System biology; Resources, Standards, Tools

7,5 ECTS

TBT4135 Biopolymers	7,5 ECTS
TBT4505 Biotechnology Specialization Course	7,5 ECTS
BI3071 Advanced Ecotoxicology	7,5 ECTS
BI3072 Environmental toxicology	7,5 ECTS
BI3075 Experimental toxicology	7,5 ECTS
BI2014 Molecular Biology	7,5 ECTS
BI2015 Molecular Biology, lab.course	7,5 ECTS
BI2021 Plant Ecophysiology	7,5 ECTS
BI2022 Plant growth and Development	7,5 ECTS

Spring:

BI3018 Patentation and Commercialization of Biotech and Medtech Invention,	7,5 ECTS
TBT4125 Food Chemistry	7,5 ECTS
TBT4130 Environmental Biotechnology	7,5 ECTS
TBT4165 Systems Biology and Biological Networks	7,5 ECTS
BI3073 Genetic toxicology	7,5 ECTS
BI2012 Cell Biology	7,5 ECTS

All other courses at master level can be chosen, but are not planned according to fit in the programme (timetable and examination date)

Examples of relevant courses are listed below:

FI3107 Biotechnology and Ethics	7,5 ECTS
MOL3005 Immunology	7,5 ECTS
MOL3014 Nanomedicine I: Bioanalysis	7,5 ECTS
MOL3015 Nanomedicine II: Therapy	7,5 ECTS
MOL3019 Applied Bioinformatics	7,5 ECTS

The normal workload for a full-time student for one academic year is 60 ECTS credits.

The programme also offers the students the opportunity to study one semester abroad. We recommend that this is done in the 2nd semester (application deadline 1.st October). At least 3 of the courses taken during the master's degree have to be NTNU courses. At least 30 ECTS, in addition to the course Experts in Teamwork, should be covered by courses on a master level. Deadline for handing in the Master thesis is the 15th of May; deadline for the exam is 15th of June in the 4th semester.

Master Thesis

The Department of Biology and the Department of Biotechnology will give the student opportunities to choose between wide varieties of master thesis, covering various aspects from human health to food chemistry. In this way the programme ensures that all students, despite various educational backgrounds, are given suitable master thesis that connect to and builds directly on their previous education.

Master's thesis can be linked to on-going research in Molecular Biology, Biopolymer chemistry, Microbiology and Molecular Genetics, Systems Biology, Bioinformatics, Microarray-based and other genomics data production technologies, knowledge gathering and modelling of biological processes, Food Chemistry, and Environmental Biotechnology.

The student will be part of active research groups working with research themes that include the analysis of basic developmental processes and biochemical processes in plants; characterization of marine algae to lay the foundation for biotech applications in the fields of energy production, CO₂ capture, materials and feed; the study of fundamental processes that link quality of food and human metabolic health; the exploitation of software tools and

knowledge bases to integrate and simulate biological processes in the computer; the use of microbial communities for production of renewable energy and for water treatment; molecular genetics and biochemistry of antibiotic biosynthesis in marine bacteria and genome-based bioprospecting for new antibiotics; structure-functional characterization of bioactive molecules derived from bioprospecting studies; quality of food linked to the biochemical processes in the raw material and changes during storage and processing.

Career prospects

Graduates of the Masters programme will be internationally qualified for a wide range of positions both in industry and research related to bio- and medical technology, as well as for further doctoral studies. Other areas of employment are in the biotechnological and pharmaceutical industry, i.e. in connection with development of therapeutic products, methods of analysis and kits, along with improving products in agriculture and aquaculture.

A number of students, mainly former Bioengineers, have got leading positions in laboratories, or they are teachers in Medical technical teaching institutions. After graduating, all the students independent of their educational background, are qualified for a wide range of positions in public and government institutions, in research positions or research support in universities and private research institutes, hospitals and government institutions like Folkehelse, Veterinærinstituttet and Næringsmiddeltilsynet, and they also have competence within the area of risk assessment (REACH).

A) Information about the Master's Study

Workload and Structure

The programme requires two years of full-time study, beginning with the autumn term (medio August). The normal work load for a full-time student for one academic year is 60 ECTS credits.

The Master's study consists of two parts:

1. A written thesis of the project (Master's thesis). The extent of the assignment should correspond to a work load of 60 credits. The work on the thesis is time limited. The thesis has to be handed in within May 15th of the 2nd year.
2. An approved selection of courses, of a minimum of total of 60 credits, from what (at least) 30 credits must be courses at 3000-level (master level) (UTF§14.1).

Master's agreement

Every master student has to make a Master's agreement. This agreement comprises your syllabus and master project together with regulations for the counseling given during the master's study. The subjects, compulsory or elective, stated as syllabus in your Masters Agreement cannot be changed. If there for serious reason develops a need for change, the Masters Agreement must be revised. The supervisor, the responsible institute and the student must agree upon the revision and the new Agreement filed.

The Master's thesis

The Master thesis should be developed as your own original work (with some support from your adviser). Any quotation, use of data, information etc. from other sources (including the scientifically literature and your fellow students) should therefore be carefully listed and included in the reference list of your thesis, according to best practice within your field of study.

Submission and Examination

The student has to:

- Register for the final master's degree exam (through STUDWEB) within February the 15th of the 2nd academic year
- Apply for approval of your [individual special syllabus](#) if your Masters Agreement demands a special syllabus. It is important that this is done well in advance of the examination. A study committee will evaluate the syllabus, and if it is not accepted, you must change it. Your supervisor must approve and sign the form. The syllabus should be a minimum of 50 pages per credit.
- Hand in the thesis (within the deadline given, see below) for print through [DAIM](#). The Department will give you 5 copies of the thesis.

In addition to the judgment of thesis, the candidate will have an oral exam consisting of:

- 1) A conversation on/presentation ("defense") of the research assignment (the master's thesis)
- 2) Examination on the theoretic syllabus of the advanced subjects which has previously not been evaluated during the study (at least 7,5 credits, preferentially individual special syllabus). All exams, except the Individual Special Syllabus (if any) have to be passed before the date of the final Master's Degree exam, unless otherwise stated in your Masters Agreement.

A grade is given for every course / special syllabus that constitutes a part of the exam.

Important deadlines

- **15th of October (1st year):** Decide on a Master's project in cooperation with a supervisor.
- **1st of November (1st year)** Register your Master's Agreement in DAIM and hand in the project description.
- **15th of February (2nd year):** Deadline for the signing up of the final Master's Degree exam (through STUDWEB)
- **15th of May (2nd year).** Deadline for the submission of the master thesis. If the thesis is not submitted within this date the grade "not passed" will be awarded, unless there is an application for extension of the deadline in reasonable time before the deadline. The reasons given in the application must be in accordance with Supplementary Regulations for the Natural Sciences (UTF) § 20.3 and the Examination Regulations at NTNU, § 20. The Supplementary Regulations for the Natural Sciences (UTF) § 7 and the Examination Regulations at NTNU, § 7. See below for further information regarding §7 and §23.3.
- **15th of June (approximately, 2nd year):** The date for the final Master's Degree exam. (Individual agreement with the respective Department, approximately four weeks after the thesis is submitted).

Leave of absence from the Master Study (UTF § 7) (extract):

- a) Leave of absence from the master studies of two years of duration and from the two last year of master studies of five years of duration is normally not granted.
- b) Leaves of absence may nevertheless be granted when applied for and compelling circumstances are present. Such circumstances might be illness (yourself or among close family member) etc.

Prolongation of the study (UTF § 20.3) (extract):

The master's thesis is time limited. In case of illness, the deadline for handing in the thesis can be postponed equivalent to the time of absence due to illness. The illness must be documented by medical certificate.

If there is a valid reason for not handing in the thesis in time, one can apply for up to three months prolongation of the deadline. If the thesis is not handed in within the extended deadline, a new extension must be applied for, or else the candidate is regarded failed. Delay of deadline can only be applied for twice.

Valid reasons for postponement (in addition to illness) is teaching, organized student activity, social work and unmerited problems concerning the thesis. Written documentation or statement is required, in addition to a new plan of completion. The Faculty, or Department when given the assignment by the Faculty, determines the application. When the reason for delay is teaching, organized student activity or social work, the extended time given is according to the time spent on these activities.

The agreed delay has no influence on the evaluation of the thesis.