The Curriculum for

SDU

The Curriculum for

Study Board of Science
Programme titles:
- Bachelor i biokemi og molekylærbiologi
-

ECTS value: 180
Cities: Odense
Semesters: Autumnx

Effective date: 01-09-2021
Applicable for students enrolled as of: 01-09-2018

Version: Archive

§ 1 - Description of the Programme

§ 1.1 - Programme

Programme titles
(Bachelor of Science (BSc))

Ministerial orders

Ministerial Order on the Grading Scale and Other Forms of Assessment of Study Programmes Offered under the Ministry of Higher Education and Science (the Grading Scale Order) (BEK nr 114 af 03/02/2015)

Bekendtgørelse om ændring af bekendtgørelse om bachelor- og kandidatuddannelser ved universiteterne (uddannelsesbekendtgørelsen) (BEK nr 258 af 19/03/2019)

Bekendtgørelse om ankenævn for afgørelser om merit i universitetsuddannelser (meritankenævnsbekendtgørelsen) (BEK nr 1517 af 16/12/2013)

Bekendtgørelse om ændring af bekendtgørelse om ankenævn for afgørelser om merit i universitetsuddannelser (meritankenævnsbekendtgørelsen) (BEK nr 880 af 26/08/2019)

Bekendtgørelse om ændring af bekendtgørelse om bachelor- og kandidatuddannelser ved universiteterne (uddannelsesbekendtgørelsen) (BEK nr 876 af 26/08/2019)

Bekendtgørelse om ændring af bekendtgørelse om eksamen og censur ved universitetsuddannelser (eksamensbekendtgørelsen) (BEK nr 1080 af 28/08/2018)

Bekendtgørelse om talentinitiativer på de videregående uddannelser på Uddannelses- og Forskningsministeriets område (talentbekendtgørelsen) (BEK nr 597 af 08/03/2015)

Ministerial Order on Bachelor and Master's (Candidatus) Programmes at Universities (the University Programme Order)

Bekendtgørelse om karakterskala og anden bedømmelse (BEK nr 262 af 20/03/2007)

Bekendtgørelse om ændring af bekendtgørelse om adgang til bacheloruddannelser ved universiteterne og de videregående kunstneriske uddannelsesinstitutioner på Uddannelses- og Forskningsministeriets område (BEK nr 263 af 19/03/2019)

Ministerial Order on University Examinations and Grading (the Examination Order) (BEK nr 1062 af 30/06/2016)

Bekendtgørelse om ændring af bekendtgørelse om adgang til bacheloruddannelser ved universiteterne og de videregående kunstneriske uddannelsesinstitutioner på Uddannelses- og Forskningsministeriets område (BEK nr 256 af 19/03/2019)

Bekendtgørelse om ændring af bekendtgørelse om adgang til bacheloruddannelser ved universiteterne og de videregående kunstneriske uddannelsesinstitutioner på Uddannelses- og Forskningsministeriets område (BEK nr 861 af 26/08/2019)

Bekendtgørelse om ændring af bekendtgørelse om eksamen og censur ved universitetsuddannelser (eksamensbekendtgørelsen) (BEK nr 878 af 26/08/2019)

Ministerial Order on Admission and Enrolment on Bachelor Programmes at Universities (BEK nr 107 af 12/02/2018)

Bekendtgørelse om ændring af bekendtgørelse om talentinitiativer på de videregående uddannelser på Uddannelses- og Forskningsministeriets område (talentbekendtgørelsen) (BEK nr 892 af 26/08/201)

ECTS value
180

Academic Study Board
Study Board of Science

Language
Danish

Cities
Odense

Semesters
Autumn

Level
Bachelor

§ 1.2 - Aim of Programme, including any professional profile and specialisations

See Danish version

§ 1.3 - Didactic and pedagogical basis

See Danish version

§ 1.4 - Profiles

BSc major in Biochemistry and molecular biology - Registration 1 September 2020 and 2021

Name
BSc major in Biochemistry and molecular biology - Registration 1 September 2020 and 2021

Degree Qualifications profile
Oversættes: Kompetenceprofil for bachelorgrad inden for naturvidenskab
En dimittend med en bachelorgrad fra Det Naturvidenskabelige Fakultet kan anvende et eller flere fagområders teorier og metoder, tilegne sig ny viden på en effektiv og selvstændig måde samt anvende denne viden kritisk og reflekterende. Dimittenden kan også forstå, hvorledes naturvidenskabelig viden opnås ved et samspil mellem teori og eksperiment. Dimittenden kan desuden foretage analyser ved brug af videnskabelig metode, forholde sig kritisk til videnskabelige teorier og modeller samt træffe og begrunde fagligt relaterede beslutninger. Dimittenden kan identificere egne læringsbehov, strukturere egen læring, samt indgå i fagligt og tværfagligt samarbejde med en professionel tilgang på baggrund af erfaring med gruppebaseret projektarbejde. Dimittenden kan desuden beskrive, formulere og formidle problemstillinger og resultater i en videnskabelig sammenhæng.

A graduate with a Bachelor's degree in Biochemistry and molecular biology is familiar with theories and experimental methods in the central fields of molecular biology and biochemistry as well the general theory of science and knowledge of the physical and chemical principles the discipline is based on. The graduate knows the terminology of the field and has knowledge of the importance of relevant databases in modern molecular biology. In addition, the graduate is familiar with the safety aspects of laboratory work
The graduate can apply biochemical and molecular biological theories and methods as well as investigate specific biochemical and molecular biological problems theoretically and / or experimentally, both quantitatively and qualitatively. The graduate can also apply selected techniques in the fields of biochemistry, molecular biology, including metabolism, microbiology, and spectroscopy, and can apply bioinformatics in practice. The graduate can assess theoretical and practical problems, apply relevant analysis and solution models and can describe, formulate and communicate scientific problems and solutions to peers and non-specialists or partners and users.
With the international dimension of the program, the graduate acquires competencies to handle professional and personal relationships in non-Danish cultural contexts and to understand that the approach to the subject's central topics and methods is independent of national boundaries.

Correlation between competence profile and learning objectives
During the bachelor programme in biochemistry and molecular biology knowledge and skills are acquired which are naturally tied to the methods of the field, especially the methods used in the research at the department of biochemistry and molecular biology and the department of molecular medicine. The courses stated in parenthesis contribute to the stated objective.
1.The concrete knowledge obtained with a bachelor degree in Biochemistry and molecular biology is:
a. Knowledge of theories and experimental methods within the fields of molecular biology and biochemistry (All courses in the programme)
b. Knowledge of central topics within theory of science (BMB507, BMB508, BMB543, BMB544, BMB531, BMB536, bachelor project)
c. Knowledge of the scientific terminology used in the fields of molecular biology and biomedicine (All courses in the programme)
d. Knowledge of the importance of biological databases in modern biomedicine and molecular biology (BMB511)
e. Understanding of how scientific knowledge is obtained through interplay between theory and experiment (FF501, BMB544, KE501, BMB507, BMB508, BMB543, BMB511, BMB536, KE521, BMB540, Bachelor project)
f. Ability to perform analyses based scientific methods and critically evaluate and reflect upon scientific theories and models in the fields of biochemistry and molecular biology (FF501, BMB543, Bachelor project)
g. The ability to acquire new knowledge effectively and independently, and to use that knowledge reflectively (BMB508, BMB511, BMB543, bachelor project)
h. Knowledge of the safety aspects of working in the laboratory (BMB500, BMB544, KE501, BMB507, BMB508, BMB536, KE521, BMB540, Bachelor project)
i. The understanding that the approach to the topics of the field is independent of national borders (All courses in the programme)
2. The concrete skills obtained with a bachelor degree in Biochemistry and molecular biology is:
a. Be able to apply one or more theories and methods from the fields of biochemistry and molecular biology (All courses in the programme)
b. Be able to investigate concrete biochemical and molecular biological phenomena theoretically and or experimentally (All courses in the programme)
c. Be able to apply a number of techniques within the fields of biochemistry, molecular biology, microbiology and spectroscopy (FF501, BMB544, KE501, BMB507, BMB508, BMB509, BMB532, BMB536, bachelor project)
d. Be able to implement the use of bioinformatics (BMB511)
e. Be able to evaluate theoretical and practical scientific problems and apply relevant models for analyses and solutions (FF501, BMB543, bachelor project)
f. Be able to describe, formulate and disseminate scientific problems and results to peers and non-specialists, collaborators and users. (FF501, BMB543, BMB531, bachelor project)
3. The concrete competences obtained with a bachelor degree in Biochemistry and molecular biology is:
a. Be able to handle complex and development orientated situations in the context of studies and work. (FF501, BMB543, bachelor project)
b. Be able to enter into academic and cross disciplinary collaborations with a professional mindset on the basis of project work in groups (FF501, BMB500, BMB508, BMB509, BMB543, bachelor project)

Employment profile
With a bachelor degree in Biochemistry and molecular biology the student continue on to a master degree.

With a master degree in Biochemistry and molecular biology it is possible to continue a career in research and become a PhD student. Other possible employment opportunities include private companies or hospitals, where typical tasks include biochemical and molecular biological analyses, quality control and laboratory management, but it is also possible to work in sales and service or research and innovation in the pharmaceutical and biotech industry.

With a degree in Biochemistry and molecular biology jobs are available all over the world, as graduate will be fluent in both Danish and English.

It is also possible to become a teacher in high schools, technical schools and university colleges. Typical job titles for graduates include: cancer biologist, cell biologist, gene technologist, immunologist, micro biologist, protein chemist, pharmaceutical consultant, product specialist, key account manager.

Recommended course of study

Semester 6 30 ECTS	BABMB501: Bachelor's project in Biochemistry and Molecular Biology N200002101 (15 ects)			ST520: Applied Statistics N360002101 (5 ects)	Elective (10 ects)
Semester 5 30 ECTS	KE504: Analytical Spectroscopy N530017101 (5 ects)	BMB511: Bioinformatica I N200005101 (5 ects)	BMB512: Teoretical Immunology N200006101 (5 ects)	BMB509: Bioanalytical instrumentation N200004101 (5 ects)	Elective (10 ects)
Semester 4 30 ECTS	BMB536: Metabolic Regulation N200027101 (7.5 ects)	BMB508: Advanced Molecular Biology N200022101 (10 ects)		BMB507: Fundamental Microbiology N200021101 (5 ects)	BMB543: Biomedical Microbiology N200032101 (7.5 ects)
Semester 3 30 ECTS	BMB532: Fundamental Biochemistry N200036101 (10 ects)	BMB533: Molecular biology and protein chemistry N200039101 (10 ects)		BMB540: Physical Biochemistry N200019101 (5 ects)	KE521: Chemistry of the elements N530002101 (5 ects)
Semester 2 30 ECTS	FF501: First year project N700006101 (10 ects)	FY527: Physics A N500053101 (5 ects)	BMB531: Human Diseases N200026101 (5 ects)	BMB539: Applications of mathematics in life sciences N200028101 (5 ects)	BMB546: Cellular evolution N200037101 (5 ects)
Semester 1 30 ECTS	BMB500: Study Introduction for Biomedicine, Biochemistry and Molecular Biology N200035101 (5 ects)	BMB538: Cellular Identity N200030101 (5 ects)	MM555: Mathematics for Molecular Bioscience, Biomedicine and Chemistry N300016101 (5 ects)	KE501: Basic chemistry N530042101 (10 ects)	BMB544: Fundamental cell biology N200033101 (5 ects)

NAT500: Study start test
N700017101

= 1st year test
= Elective
= Constituent courses

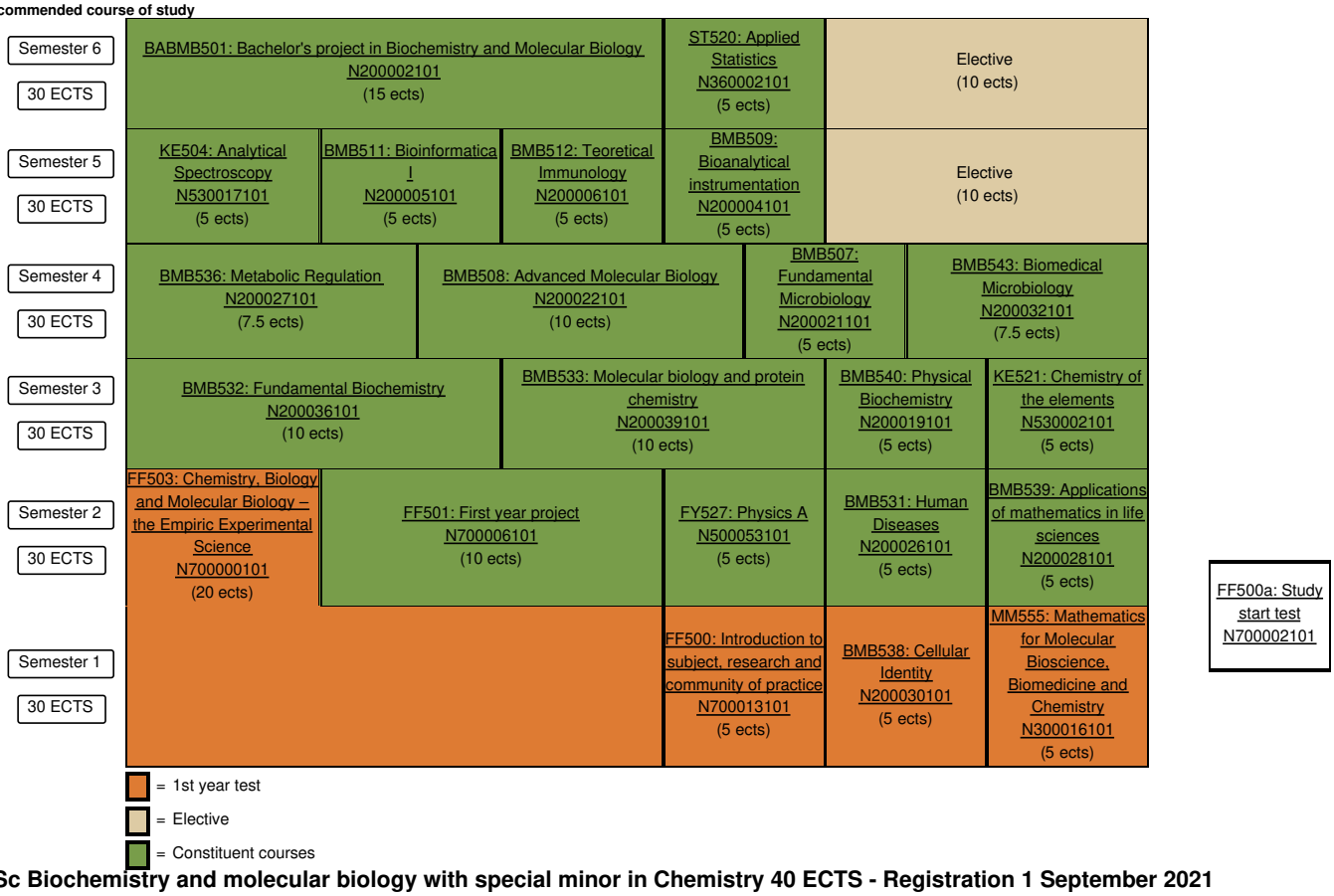
BSc major in Biochemistry and molecular biology - Registration 1 September 2018 and 2019

Name
BSc major in Biochemistry and molecular biology - Registration 1 September 2018 and 2019

Degree Qualifications profile
A graduate with a bachelor's degree in biochemistry and molecular biology has knowledge of theory and experimental methods within the biochemical and molecular biology disciplines, as well as knowledge of key topics within philosophy of science, and the physical and chemical principles the discipline is based on. The graduate also knows the scientific terminology used in the field and has knowledge of the importance of relevant databases in modern

molecular biology. In addition, the graduate knows the safety aspects of laboratory work. The graduate can apply biochemical and molecular biological theories and methods as well as investigate specific biochemical and molecular biological problems theoretically and / or experimentally, both quantitatively and qualitatively. The graduate can also apply selected techniques in the fields of biochemistry, molecular biology, including metabolism, microbiology, immunological analysis methods and spectroscopy, and can apply bioinformatics in practice. The graduate can assess theoretical and practical problems, apply relevant analysis and solution models and can describe, formulate and communicate scientific problems and solutions to peers and non-specialists or partners and users.
With the international dimension of the program, the graduate acquires competencies to handle professional and personal relationships in non-Danish cultural contexts and to understand that the approach to the subject's central topics and methods is independent of national boundaries.

Recommended course of study



BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2021

Name
BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2021

Degree Qualifications profile
Oversæt: Kompetenceprofil for bachelorgrad inden for naturvidenskab
En dimittend med en bachelorgrad fra Det Naturvidenskabelige Fakultet kan anvende et eller flere fagområders teorier og metoder, tilegne sig ny viden på en effektiv og selvstændig måde samt anvende denne viden kritisk og reflekterende. Dimittenden kan også forstå, hvorledes naturvidenskabelig viden opnås ved et samspil mellem teori og eksperiment. Dimittenden kan desuden foretage analyser ved brug af videnskabelig metode, forholde sig kritisk til videnskabelige teorier og modeller samt træffe og begrunde fagligt relaterede beslutninger. Dimittenden kan identificere egne læringsbehov, strukturere egen læring, samt indgå i fagligt og tværfagligt samarbejde med en professionel tilgang på baggrund af erfaring med gruppebaseret projektarbejde. Dimittenden kan desuden beskrive, formulere og formidle problemstillinger og resultater i en videnskabelig sammenhæng.

A graduate with a Bachelor's degree in Biochemistry and molecular biology with chemistry is familiar with theories and experimental methods in the central fields of molecular biology, biochemistry and chemistry as well the general theory of science. The graduate knows the terminology of the field and has knowledge of the importance of relevant databases in modern molecular biology. In addition, the graduate is familiar with the safety aspects of laboratory work.

The graduate can apply biochemical, molecular biological and chemical theories and methods as well as investigate specific biochemical and molecular biological problems theoretically and / or experimentally, with a special focus on the chemical aspect. The graduate can also apply selected techniques in the fields of biochemistry, molecular biology, microbiology, analytical spectroscopy, organic chemistry, inorganic chemistry and quantum chemistry, and can apply bioinformatics in practice. The graduate can assess theoretical and practical problems, apply relevant analysis and solution models and can describe, formulate and communicate scientific problems and solutions to peers and non-specialists or partners and users.
With the international dimension of the program, the graduate acquires competencies to handle professional and personal relationships in non-Danish cultural contexts and to understand that the approach to the subject's central topics and methods is independent of national boundaries.

Correlation between competence profile and learning objectives
During the bachelor programme in biochemistry and molecular biology with chemistry knowledge and skills are acquired which are naturally tied to the methods of the field, especially the methods used in the research at the department of biochemistry and molecular biology and the department of molecular medicine. The courses stated in parenthesis contribute to the stated objective.
1.The concrete knowledge obtained with a bachelor degree in Biochemistry and molecular biology with chemistry is:
a. Knowledge of theories and experimental methods within the fields of molecular biology, biochemistry and chemistry (All courses in the programme)
b. Knowledge of central topics within theory of science (BMB507, BMB508, BMB543, BMB544, KE548, BMB531, BMB536, bachelor project)
c. Knowledge of the scientific terminology used in the fields of molecular biology, biochemistry and chemistry (All courses in the programme)
d. Knowledge of the importance of biological databases in modern biomedicine and molecular biology (BMB511)
e. Understanding of how scientific knowledge is obtained through interplay between theory and experiment (BMB544, KE501, BMB508, BMB511, BMB536, KE521, BMB540, Bachelor project)
f. Ability to perform analyses based scientific methods and critically evaluate and reflect upon scientific theories and models in the fields of biochemistry and molecular biology (FF501, Bachelor project)
g. The ability to acquire new knowledge effectively and independently, and to use that knowledge reflectively (BMB508, BMB511, bachelor project)
h. Knowledge of the safety aspects of working in the laboratory (BMB500, BMB544, KE501, BMB507, BMB508, BMB536, KE521, BMB540, bachelor project)
i. The understanding that the approach to the topics of the field is independent of national borders (All courses in the programme)
2. The concrete skills obtained with a bachelor degree in Biochemistry and molecular biology with chemistry is:
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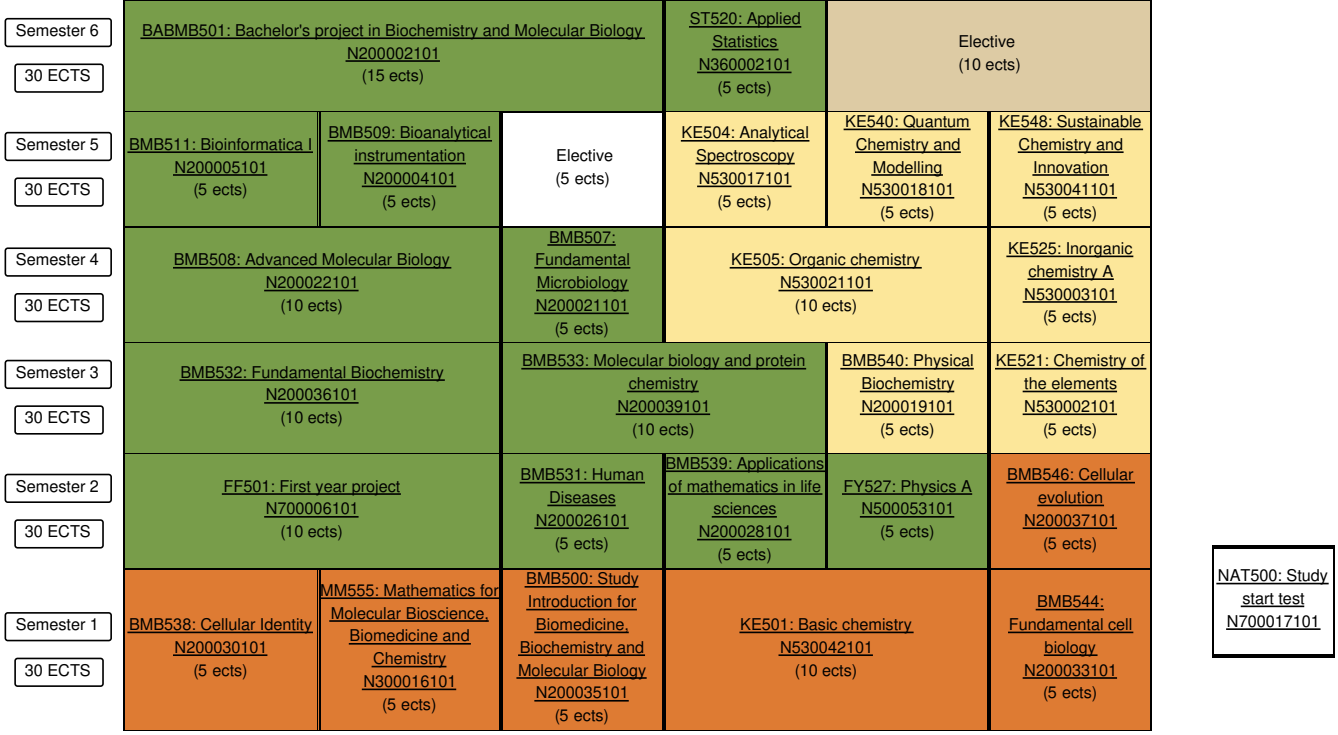
b. Be able to investigate concrete biochemical and molecular biological phenomena theoretically and or experimentally (All courses in the programme)
c. Be able to apply a number of techniques within the fields of biochemistry, molecular biology, microbiology organic synthesis and spectroscopy (FF501, BMB544, KE501, BMB507, BMB508, BMB509, BMB532, KE505, bachelor project)
d. Be able to implement the use of bioinformatics (BMB511)
e. Be able to evaluate theoretical and practical scientific problems and apply relevant models for analyses and solutions (FF501, KE548, bachelor project)
f. Be able to describe, formulate and disseminate scientific problems and results to peers and non-specialists, collaborators and users. (FF501, BMB531, bachelor project)
3. The concrete competences obtained with a bachelor degree in Biochemistry and molecular biology is:
a. Be able to handle complex and development orientated situations in the context of studies and work. (FF501, KE548, bachelor project)
b. Be able to enter into academic and cross disciplinary collaborations with a professional mindset on the basis of project work in groups (FF501, BMB500, BMB508, BMB509, KE548, bachelor project)
c. Be able to identify own learning needs and structure own learning in different learning environments (BMB500, FF501, bachelor project)

Employment profile
With a bachelor degree in Biochemistry and molecular biology with chemistry you continue on to a master degree.
With a master degree in Biochemistry and molecular biology with chemistry it is possible to continue a career in research and become a PhD student. Other possible employment opportunities include private companies or hospitals, where typical tasks include chemical, biochemical and molecular biological analyses, quality control and laboratory management, but it is also possible to work in sales and service or research and innovation in the pharmaceutical and biotech industry.
With a degree in Biochemistry and molecular biology with chemistry jobs are available all over the world, as graduate will be fluent in both Danish and English.
It is also possible to become a teacher in high schools, technical schools and university colleges. Typical job titles for graduates include: chemist, cancer biologist, cell biologist, gene technologist, immunologist, micro biologist, protein chemist, pharmaceutical consultant, product specialist, key account manager.

Recommended course of study

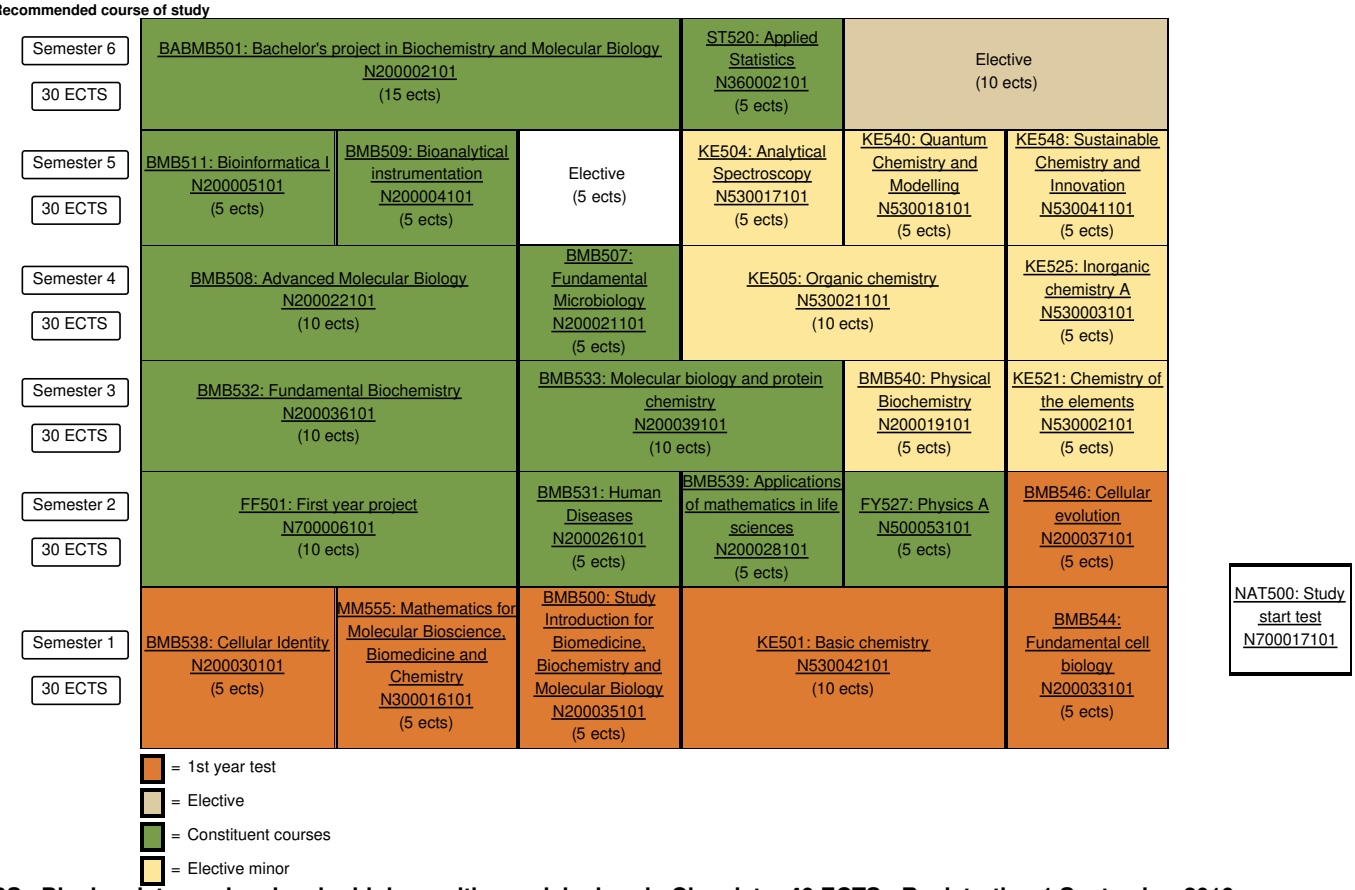
BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2020

Name



BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2020

Recommended course of study



▾ BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2019

Name
BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2019

Recommended course of study

▾ BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2018

Name
BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2018

Recommended course of study

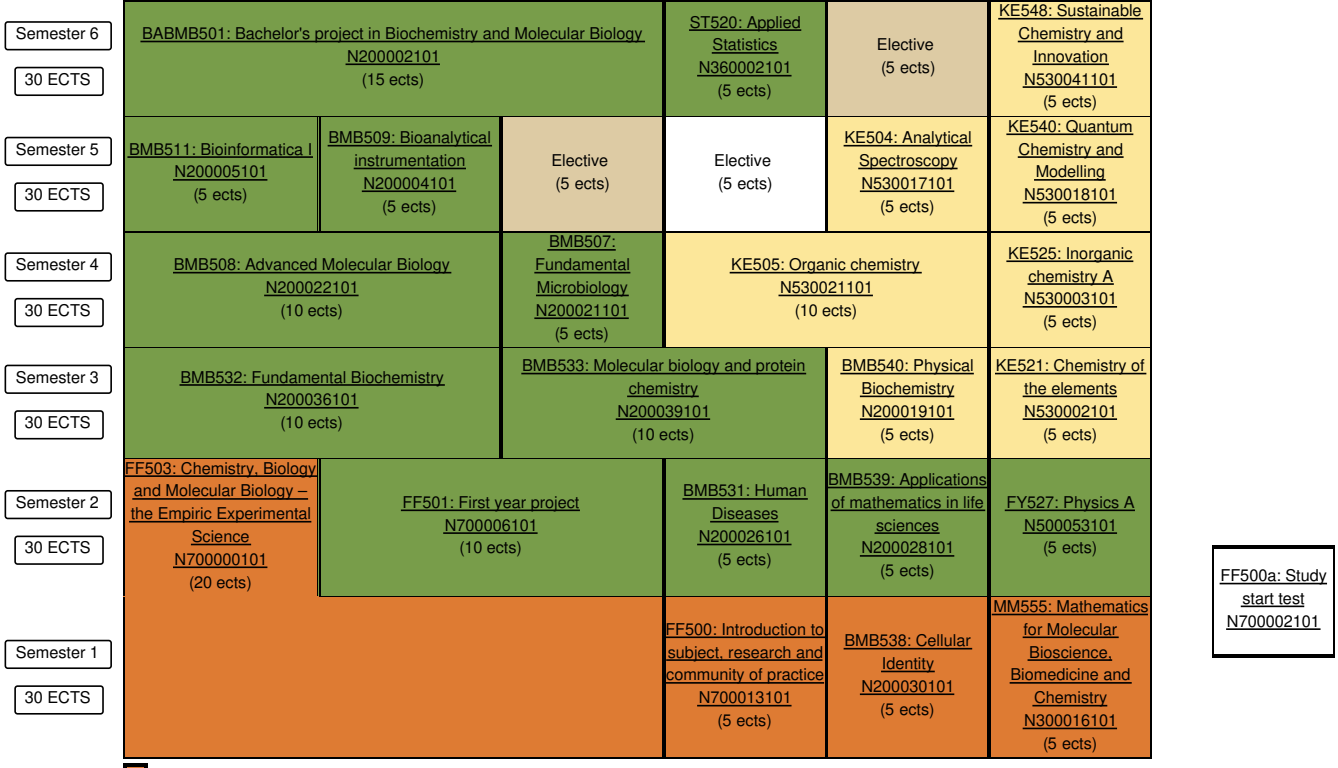
▾ No longer applicable (31 August 2019): BSc major in Biochemistry and molecular biology - Registration 1 September 2018

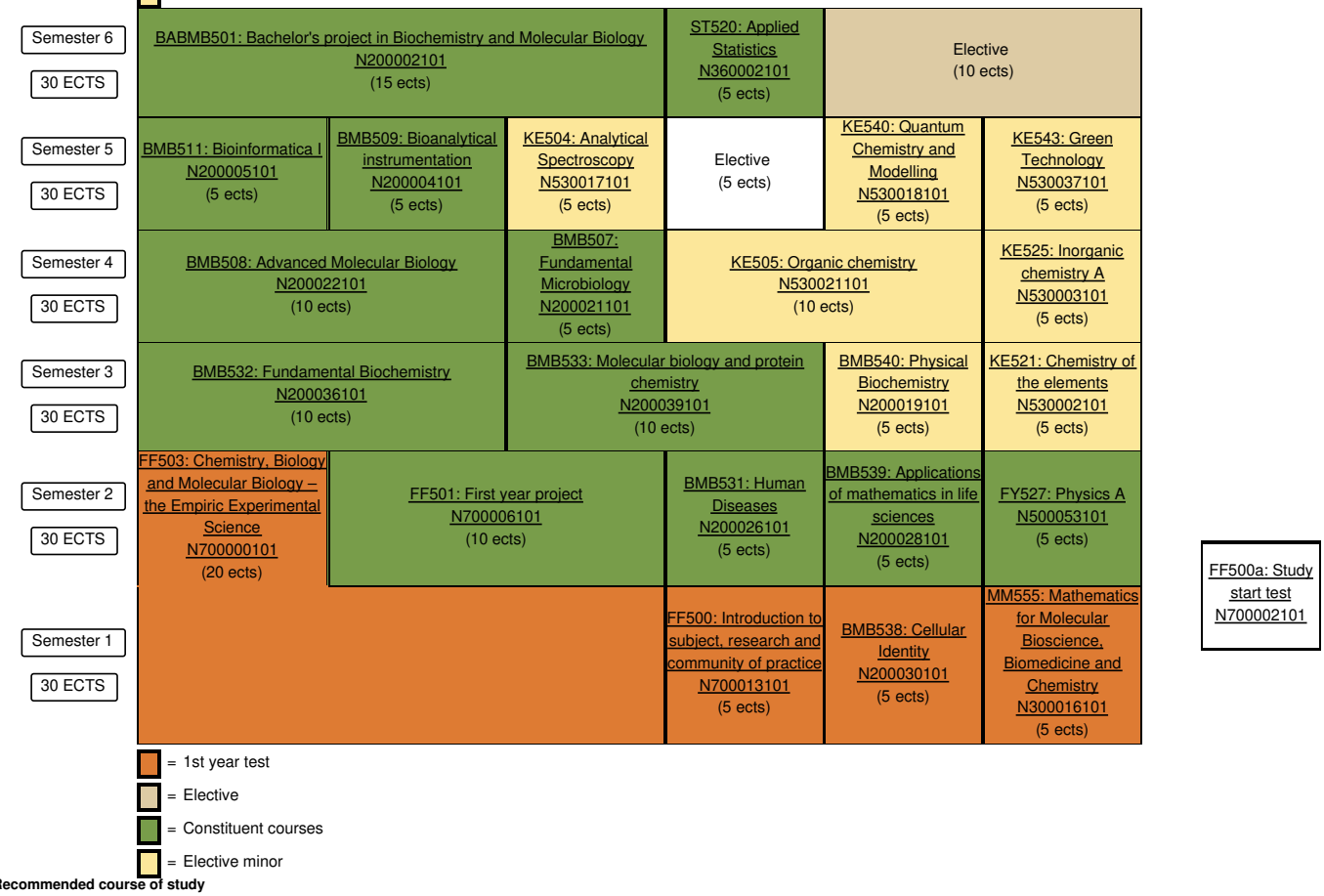
Name
No longer applicable (31 August 2019): BSc major in Biochemistry and molecular biology - Registration 1 September 2018

Recommended course of study

▾ No longer applicable (31 August 2019): BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2018

Name
No longer applicable (31 August 2019): BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2018





Recommended course of study

▾ No longer applicable (31 August 2020): BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2019

Name
No longer applicable (31 August 2020): BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2019

Recommended course of study

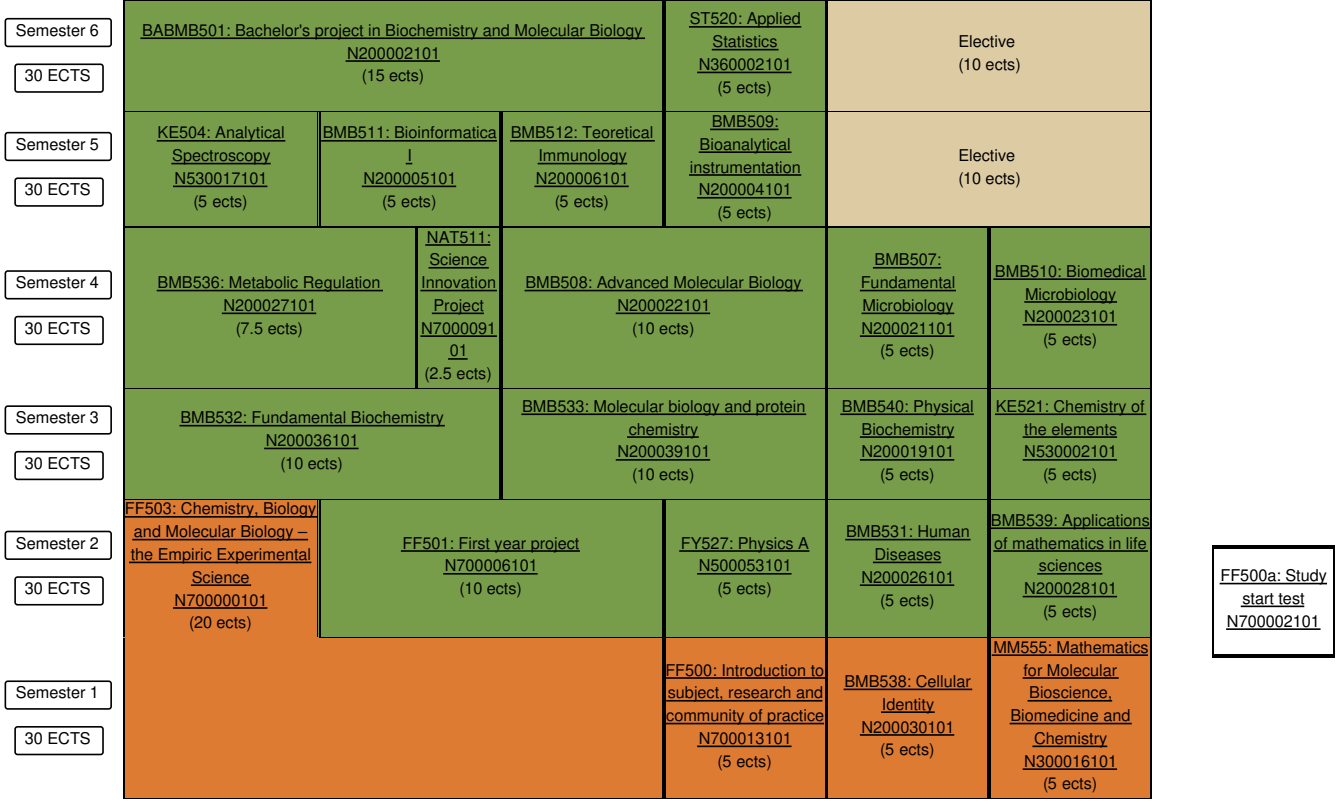
▾ § 2 - Enrollment

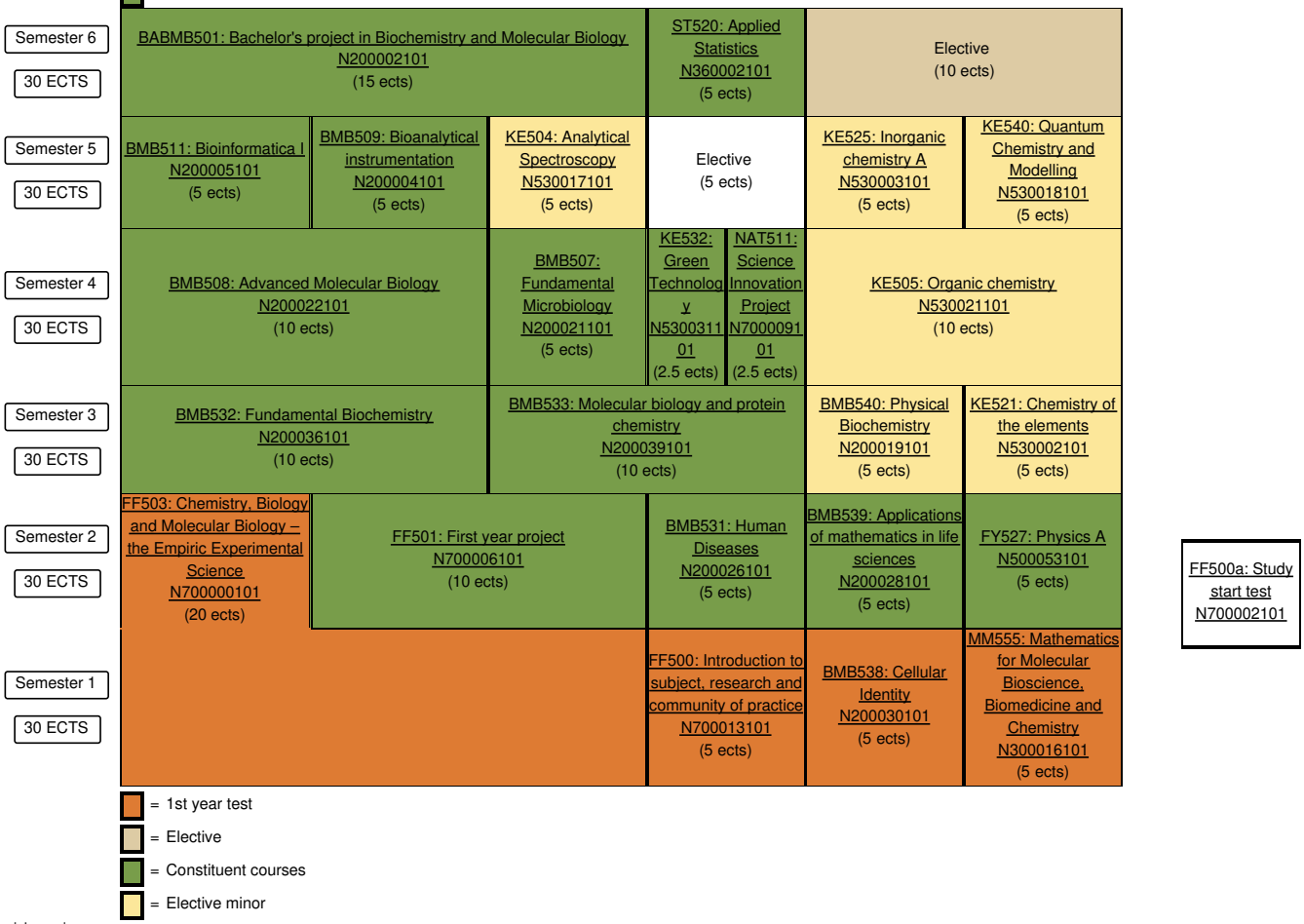
▾ § 2.1 - Tuition
See Danish version

▾ § 2.2 - Entry requirements
See Danish version

▾ § 3 - Structure and Progression

▾ § 3.1 - The structure of the programme





See Danish version

§ 4 - Course descriptions

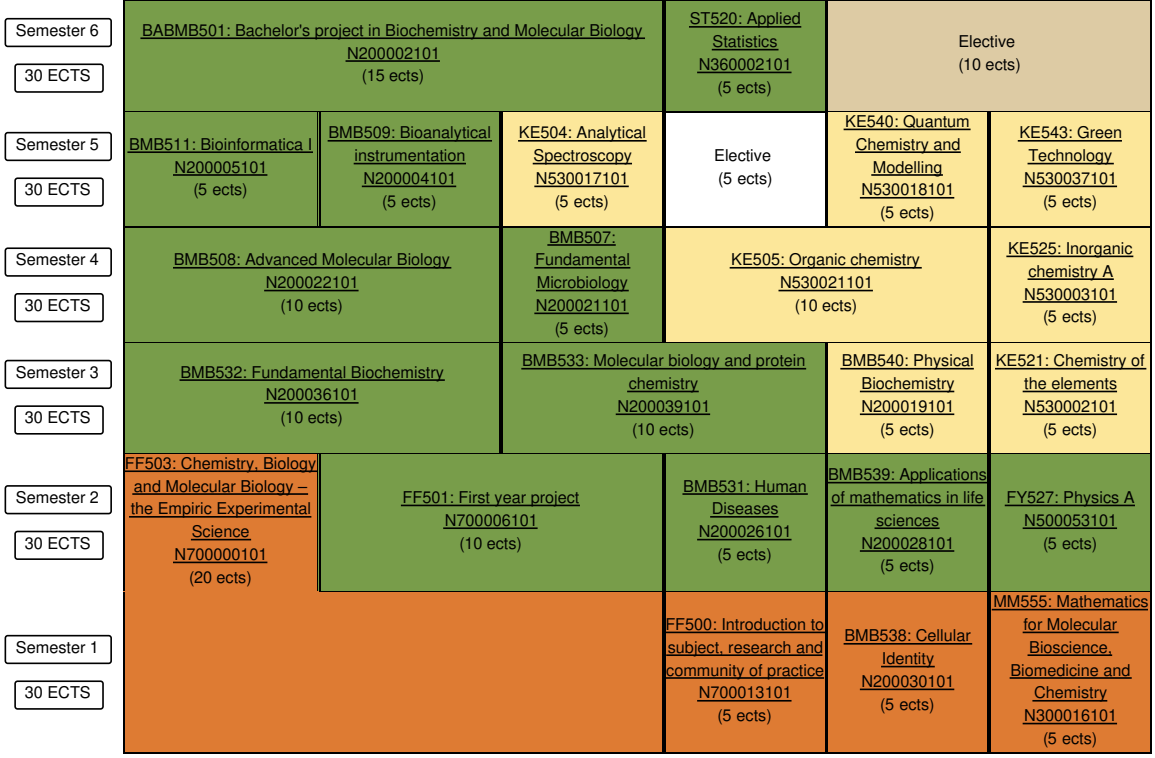
§ 4.1 - Course descriptions

BMB538: Cellulær Identitet

Expected learning outcome

The learning objectives of the course is that the student demonstrates the ability to:

- Understand the fundamental principles of cellular identity
- Understand internal and external factors having impact on cellular identity in living organisms
- Account for the central concepts; differentiation, trans-differentiation, as well as cellular plasticity
- Provide examples of shifts in cellular identity seen in development, aging, and disease
- State the most important functions of central cellular organelles
- State central epigenetic principles with known importance to cellular differentiation
- Account for the molecular mechanisms underlying writing and reading of the epigenetic code
- Account for the principles of functional genomic analysis



Profile course descriptions

BSc major in Biochemistry and molecular biology - Registration 1 September 2020 and 2021

BSc major in Biochemistry and molecular biology - Registration 1 September 2018 and 2019

BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2021

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No longer applicable (31 August 2020): BSc Biochemistry and molecular biology with special minor in Chemistry 40 ECTS - Registration 1 September 2019

Course descritions in the curriculum

Account for the principles of functional proteome analysis

- Account for the principles of luminescence-based techniques for investigation of cellular function and identity
- Account for the principles of functional, cell-based screens

MM555: Matematik for Biokemi og Molekylær Biologi, Biomedicin og Kemi

Expected learning outcome

The learning objectives of the course are that the student demonstrates the ability to:

- Argue in a logical and rigorous manner.
- Understand and work with the mathematical theories introduced in the course.
- Construct simple mathematical models describing phenomena occurring in the natural sciences.

BMB500: Studieintroduktion for Biomedicin, Biokemi og Molekylær Biologi

Expected learning outcome

Intended learning outcomes - after completing the course the student is expected to be able to:

- Applies study and learning strategies to organize hers/his own learning in relation to the intended learning outcomes, learning activities and assessment tasks.
- Establishes working relationships to his fellow students and describes his role as an active participant in the study program's social and academic learning activities
- Specifies and analyzes a problem in pre-formulated form and communicates the solving process and the result of the process.
- Identifies different science representations (textual, auditory, visual, symbolic, iconic, graphical, tabular, static or dynamic) and applies them in problem solving.

BMB544: Grundlæggende cellebiologi

Expected learning outcome

The learning objectives of the course is that the student demonstrates the ability to:

- Describe the structure of cells and he function of essential organelles
- Describe cell division and how it relates to inheritance

- Account for the basic genetic laws, and carry out simple inheritance calculations based on these
- Recognize and name functional groups in biological macromolecules and account for there chemical structure
- Outline the mechanism behind non covalent forces acting on biomolecules and explain the significance of these in determining the structure
- List central metabolic pathways and explain their importance for the energy and matter turnover of the cell
- Recognize common chemical reactions in metabolic pathways
- Account for the flow of genetic information in a cell, including regulation of gene expression
- Consider experimental design and control experiments from the theory of science perspective
- Relate theoretical knowledge to practical experiments and observations
- Work independently and safely in a laboratory, including safe handling of chemicals
- Take notes, work reproducibly and use standard curves in connection to laboratory work

KE501: Grundlæggende kemi

Expected learning outcome
See Danish version

FF503: Kemi, Biologi og Molekylær Biologi - Den empiriske eksperimentelle videnskab

Expected learning outcome
See Danish version

FF500: Introduktion til fag, forskning og fællesskab

Expected learning outcome
Intended learning outcomes - after completing the course the student is expected to be able to:

- The student applies study and learning strategies to organize hers/his own learning in relation to the intended learning outcomes, learning activities and assessment tasks.
- The student establishes working relationships to his fellow students and describes his role as an active participant in the study program's social and academic learning activities
- The student specifies and analyzes a problem in pre-formulated form and communicates the solving process and the result of the process.
- The student identifies different science representations (textual, auditory, visual, symbolic, iconic, graphical, tabular, static or dynamic) and applies them in problem solving.

FF501: Førsteårsprojekt

Expected learning outcome
At the end of the course the student is expected to:

- Plan and complete a project based on a scientific question and related design (theoretical project or experimental research)
- Handle the most common IT-tools
- Communicate, collaborate and share knowledge by itslearning og MS Teams
- Write a report and make a poster of the project
- Undertake a thorough literature search for analysis and discussion in the report, in the oral presentations and during the exam
- Communicate the project at a poster conference
- Make an oral presentation of the project at the exam
- Discuss and motivate important aspects of the project at the exam
- Demonstrate overview and skills to integrate important aspects of the project at the exam

FY527: Fysik A

Expected learning outcome
The learning objective of the course is that the student demonstrates the ability to:

- Perform simple mathematical derivations.
- Identify the most relevant components of a physical system.
- Describe a physical system with a mathematical model.
- Apply Newton's laws to predict the future behaviour of a physical system on the basis of a mathematical model.
- Compute the electric and magnetic fields from simple charge distributions and currents.
- Analyse the motion of charged particles in electric and magnetic fields.

BMB531: Sygdomme hos mennesket

Expected learning outcome
The learning objective of the course is that the student demonstrates the ability to:

- Describe specific biochemical and metabolic processes and understand how they can be disrupted in metabolic diseases.
- Recognize the basic modes of inheritance, and draw pedigrees of affected families.
- Describe the cell-cycle, its components and how this scan be disturbed in cancerous diseases.
- Describe the most prominent hallmarks of cancer.
- Searching and employing databases of scientific literature.
- To analyze gene-sequences, effects of mutations, the mutational spectrum of diseases, to identify recognition sequences for restriction enzymes and finally to identify and analyze reference sequences for human disease genes.
- Perform basic web-based bioinformatic analyses.
- To write assignments where a selected disease is problematized and the involved disease mechanisms are described at the level of molecular biology, genetics and biochemistry employing correct scientific terms and references to scientific literature.

BMB539: Anvendelser af matematik i lifescience

Expected learning outcome
The learning objective of the course is that the student demonstrates the ability to:

- Use mathematics to describe and solve typical mathematical problems in life sciences.
- Gain an overview and understanding of the basic concepts of the mathematical methods used in life sciences.

BMB546: Cellulær udvikling

Expected learning outcome
The learning objective of the course is that the student demonstrates the ability to:

- Account for the mechanism behind evolution, including micro- and macroevolution
- Account for the mechanisms of evolution on the genetic level
- Describe the physiology of mammals in a evolutionary perspective
- Explain the function of major hormones
- Account for the mammalian digestion, excretion and cardiovascular systems
- Account for the physiological function of selected organs and tissues, including the evolutionary development and variation
- Explain the function of the nervous system and account for the different types of neurons and electrical signaling
- Account for reproduction and fetal development in humans, at a basic level
- Account for the mechanisms in sensory organs at a cellular and molecular level
- Account for the motor skills in muscles at the physiological, cellular and molecular level
- Transfer knowledge of natural selection to other areas, including evolutionary computation

BMB532: Fundamental Biokemi

Expected learning outcome
The student demonstrates the ability to:

- Use methods from chemical kinetics and enzyme kinetics to determine characteristic constants such as KM and turnover number for enzyme, both in theory and in practice
- Explain how the activity of enzymes are regulated, including allosteric regulation
- Explain the structure of biological membranes and how compounds are transported through these
- Use the thermodynamic and kinetic foundations of metabolism and explain the significance of free energy and equilibrium constants for coupled reactions and the universal role of ATP in this coupling

- Describe metabolites, enzymes and coenzymes in glycolysis, gluconeogenesis, the citric acid cycle pentose-phosphate pathway, glycogen metabolism, fatty acids oxidation and biosynthesis, oxidative phosphorylation
- Describe principles behind regulation and integration of metabolic pathways in mammalian organisms
- Describe the basics of photosynthesis and CO2-fixation in plants

BMB533: Molekylær biologi og proteinkemi

Expected learning outcome

The learning objectives of the course is that the student demonstrates the ability to:

- Know how to use correctly general terminology within the fields of genetics, molecular biology and protein chemistry.
- Explain the Central Dogma of the flow of information from genes to proteins.
- Explain connection between nucleic acid structure and function in the Central Dogma information flow.
- Describe the basic steps in DNA replication and transcription, and mRNA translation to proteins.
- Describe the combinations of enzyme complexes that are involved in DNA replication and transcription, and mRNA translation to proteins.
- Understand the principles of gene regulation.
- Give detailed, specific examples of these processes.
- Distinguish the differences between the molecular processes governing these processes in prokaryotes and eukaryotes.
- Sketch the mechanisms involved in homologous and specific recombination.
- List the main causes of mutation and the consequences of these at the molecular and cellular levels and their potential effects on the whole organism.
- Demonstrate knowledge of general techniques in molecular biology and gene technology.
- Describe the chemical structures of the twenty common amino acids, and how modification of these alters protein structure and function.
- Differentiate between primary, secondary and tertiary structures of proteins and describe quaternary interactions within protein complexes.
- Use the programs VMD for visualizing macromolecular structures, and its application in discovering details of molecular interactions.
- Describe the folding, misfolding and degradation of proteins, and how deviations in these molecular pathways can lead to disease.
- Attain knowledge of modern methodology in protein chemistry, protein purification, characterization and their analysis using bioinformatics.
- Demonstrate knowledge of how proteins interaction with other biological macromolecules during the execution of physiological processes in the cell. This includes an understanding of how proteins function in receptor signalling and in sensory system.
- Independently search and find relevant information to answer questions concerning the topics covered on this course.

BMB540: Fysisk Biokemi

Expected learning outcome

The learning objective of the course is that the student demonstrates the ability to:

- calculate changes in Gibbs free energy, entropy and enthalpy in biomolecular processes
- define conditions for spontaneity of chemical reactions and derive the law of mass action
- define properties of mixtures and solutions, such as ion activity and acid-base equilibria
- describe the time evolution of spontaneous processes including chemical kinetics and transition states
- define conditions for a steady state in thermodynamically open systems and calculate steady state fluxes and concentrations
- interpret diffusion from a microscopic and macroscopic viewpoint
- explain the thermodynamic coupling in bioenergetics
- define conditions for feedback loops and oscillations in biochemical processes, as found in metabolism or gene activation
- describe and interpret biochemical binding processes
- explain the principles behind the interaction of light with biomolecules from a classical and quantum mechanical view

KE521: Grundstoffernes Kemi

Expected learning outcome

The learning objectives of the course is that the student demonstrates the ability to:

- Classify the chemical elements according to the periodic system.
- Apply this classification to predict important properties of chemical compounds, including stability, solubility, redox properties and reactivity.
- Identify a given inorganic compound based on a series of analytical reactions.
- Argue for the suggested identification.

BMB536: Metabolsk og hormonel regulering

Expected learning outcome

The learning objective of the course is that the student demonstrates the ability to:

- describe metabolites, enzymes, co-enzymes in glycogen and fatty acid metabolism and its regulation.
- explain
  the formation and function of lipoproteins like chylomicrons, VLDL, HDL
  and LDL, and describe their respective roles in triglyceride /
  cholesterol homeostasis.
- explain how the vesicular transport takes place in eukaryotic cells.
- describe how high levels of cholesterol can lead to the development of cardiovascular diseases.
- explain
  the synthesis of phospholipids and triglycerides and how the synthesis
  of phospholipids is closely associated with amino acid metabolism.
- explain how glucogenic and ketogenic amino acids are converted and how the amino groups may be disposed in the urea cycle.
- explain how amino acids are synthesized from intermediates in glycolysis and TCA cycle.
- describe how synthesis of branched chain amino acids and glutamine synthesis is regulated.
- on the basis of own experiments explain the glucose-fatty acid cycle.
- explain
  the effect of the hormones insulin, glucagon, norepinephrine and
  epinephrine on the metabolic pathways in the brain, muscles, liver and
  adipose tissue.
- describe the mechanisms underlying the hormonal effect on blood levels of glucose, fatty acids and ketone bodies.
- explain
  the metabolic adaptations that occur as a result of food intake,
  fasting and diabetes (type 1 and 2) as well as muscle work.
- describe
  the structure and function of 7TM receptors, G proteins and signaling
  pathways that lead to the formation of secondary "messengers" such as
  Ca2+, IP3 and cAMP, and explain how the activity of these signaling
  pathways and the level of these messengers can be regulated.
- describe
  the structure and function of tyrosine kinase receptors, including
  insulin receptor, and explain how the PI3 kinase signaling and MAPK
  signaling can be activated by insulin.

BMB508: Avanceret Molekylær Biologi

Expected learning outcome

The learning objective of the course is that the student demonstrates the ability to:

- Describe the general architecture of eukaryotic chromosomes and genes
- Explain how chromatin structures are regulated and how DNA and histone modifications take part in this process
- Explain how transcription factors and transcriptional processes regulate gene expression
- Explain how posttranscriptional processes, including RNA modification, processing, and alternative splicing are regulated and how they contribute to the control gene expression
- Explain the function and regulation of different types of non-coding RNA
- Explain how different classes of membrane bound receptors are activated, how signals are transduced from the membrane to the cell nucleus, and how signals are integrated to control gene expression and cell fate.
- Explain how the eukaryotic cell cycle is regulated and the role of checkpoints to maintain genome integrity and stability.
- Explain how anti-apoptotic and pro-survival signals regulate cell survival and apoptosis
- Explain how proto-oncogens, oncogenes, tumor suppressors, and DNA damage and repair factors control normal cell cycle , cell growth and development and how changes in these genes/proteins contributes to cancer development.
- Explain how virus and carcinogens might promote cancer
- Explain how cell types are specified and how early development of various eukaryotic organisms are regulated
- Explain the basic principles of methods for the analysis of gene and protein function based on knockout cells or transgenic model organisms, genome sequencing, and visualization of proteins within cells.
- Apply tools for the analysis and presentation of microscopy images
- Deduce conclusions based on the interpretation of experimental data
- Arguing over options on how to solve complex and transverse biological questions.

BMB507: Fundamental mikrobiologi

Expected learning outcome
The learning objective of the course is that the student demonstrates the ability to:

- describe the structure of bacterial cells at the molecular level.
- describe the function of antibiotics and mechanisms of antibiotic resistance.
- use basic techniques for cultivation of microorganisms.
- estimate of bacterial numbers in air and water.
- describe and understand how bacteria can cause disease and how the immune system responds to it.
- describe the structure and properties of virus.
- describe how bacterial cells convert substrates into new cell material.
- calculate growth rates, death rates, doubling times, mutation frequency etc.
- investigate bacterial population growth and how environmental factors influence bacterial growth and behavior.

BMB543: Biomedicinsk Mikrobiologi

Expected learning outcome
The learning objective of the course is that the student demonstrates the ability to:

- Give an account for the pathological importance of bacteria.
- Describe the interactions between bacteria and host-organisms.
- Describe the molecular mechanisms underlying bacterial pathogenesis.
- Give an account for the basic molecular biological methods for investigation of host-pathogen interactions.
- Plan and carry out a theoretical project based on research publications.
- Search for relevant research publications and employ this information in relation to the project.
- Show possibilities for application-oriented use of theoretical knowledge
- Describe the overall concepts of innovation processes and their relevance for scientific innovation

KE505: Organisk Kemi

Expected learning outcome
See danish version

KE525: Uorganisk Kemi A

Expected learning outcome
The learning objective is that students acquire foundation knowledge of the chemistry of all the elements in the periodic table. However the focus is on the molecular chemistry of the d-block (transition) elements, and gaining an understanding the chemical forms of these elements in natural and synthetic compounds and their common uses. Structure, reactivity, nomenclature, physical, chemical and spectroscopic properties are covered. On completion, students will be able to:

- Rationalize the electronic structure of an element on the basis of its position in the periodic table
- Predict the properties of a compound in terms of its ionic, metallic and covalent bonding
- Predict the geometry of a metal centre and consequent molecular stereochemistry
- Rationalize influence of both metal and ligand on the tendencies in redox and spectroscopic properties
- Use crystal field theory as a simplified practical model for molecular orbital theory to predict d electron configuration and thus rationalize spectroscopic, magnetic and structural properties for d-block compounds.
- Describe basic principles in the use of optical, vibrational and magnetic resonance spectroscopies, X-ray diffraction, magnetic susceptibility measurements and other selected methods for the characterization of molecular compounds containing any element of the periodic system
- Name and write the molecular formula for simple coordination compounds
- Be familiar with the important molecular inorganic compounds, including homogenous catalysts, metalloenzymes, nanoclusters, supramolecular systems, and be able to rationalize their roles in biology, and uses in materials, industry, medicine etc.
- Describe the aqueous chemistry of metal ions and therewith the consequence for bioavailability and pollution.
- Write mass and redox balanced equations
- Carry out the synthesis of a simple coordination compound
- Describe typical processes in the synthesis of coordination and organometallic compounds
- Interpret spectra

NAT511: Naturvidenskabeligt innovationsprojekt

Expected learning outcome
The learning objective of the course is that the student demonstrates the ability to:

- Identify an idea that can be commercialized
- Describe two alternative strategies for this commercialization
- Describe
  the choices of customers, technology, identity and competetition
  associated with each strategy and the complementarities between choices
- Base the above descriptions on realistic assumptions

BMB510: Biomedicinsk Mikrobiologi

Expected learning outcome
The learning objective of the course is that the student demonstrates the ability to:

- Give an account for the pathological importance of bacteria.
- Describe the interactions between bacteria and host-organisms.
- Describe the molecular mechanisms underlying bacterial pathogenesis.
- Give an account for the basic molecular biological methods for investigation of host-pathogen interactions.
- Plan and carry out a theoretical project based on research publications.
- Search for relevant research publications and employ this information in relation to the project.

KE532: Grøn teknologi

Expected learning outcome
The learning objective of the course is that the student demonstrates the ability to:

- Account for societal and technological challenges based on specific cases
- Account for the importance of innovation in relation to the solution of technological challenges
- Describe the general concepts in innovation processes and their relevance for scientific innovation
- Illustrate possibilities for applied use of theoretical knowledge

KE504: Analytisk spektroskopi

Expected learning outcome
The learning objective of the course is that the student demonstrates the ability to:

- recognize functional groups and identify which form of spectroscopy is best suited for detection of a given functional group
- interpret experimental IR, MS and NMR spectra
- combine and value larger amounts of spectroscopic data from the different techniques for the purpose of structure determination
- discuss the validity of a suggested molecular structure based on the experimental spectra
- solve more complex problems within analytical spectroscopy

BMB511: Bioinformatik I

Expected learning outcome
When the course is over, the students are expected to be able to:

- Have an overall understanding of Bioinformatics, and know the biomolecules which are typically analyzed using bioinformatics
- Find, extract and use the information from the most relevant biological databases, and understand the structure and most important characteristics of these.
- Know and use bioinformatics tools to characterize and compare nucleic acid sequences
- Know and use bioinformatics tools to investigate and compare protein sequence, structure and function.

- Understand the key concepts in analyzing and visualizing quantitative data from omics experiments
- Understand the principles behind gene ontology and its use in molecular networks
- Know the concepts of systems biology
- Critically evaluate if software and data analysis is functioning effectively (i.e. is the analysis correct and can the results be read clearly)
- Know the possibilities of using machine learning and statistical analysis to answer biological questions on the basis of large datasets
- Understand the importance of open source code and open data policies and the accompanying ethical considerations
- Analyze digital images obtained by optical spectroscopy of biological samples, and extract information about the cellular processes from the images.

BMB512: Teoretisk immunologi

Expected learning outcome

The learning objectives of the course are that the student can demonstrate the ability to:

- describe the structure and individual elements of the innate and the adaptive immune system.
- explain the recognition mechanisms of the innate immune system and the consequences of its activation
- Explain the inflammatory response and describe the function of the key cytokines
- Explain the genetic mechanisms behind the development of the repertoire of specificities in B- and T-cell systems
- describe the maturation of B lymphocytes in the bone marrow and T-lymphocytes in the thymus and explain the mechanisms that cause tolerance to self.
- Explain effector mechanisms in the adaptive immune system and describe the different types of effector cells
- recognize or describe autoimmune diseases and their consequences
- recognize or describe the four types of hypersensitivity
- identify or describe infectious diseases, wherein the microorganism avoids the immune system

BMB509: Bioanalytisk instrumentering

Expected learning outcome

The learning objectives of the course are that the student demonstrates the ability to:

- Know the principles of frequently applied separation techniques for biomolecules.
- Sketch experiments for fractionation, isolation and characterization of biomolecules.
- Interpret straightforward data sets recorded by microscopy, optical spectroscopy or mass spectrometry.
- Explain principles of relevant light-matter interaction, as radiation, absorption, reflection, refraction, diffraction or emission from molecules (i.e. fluorescence).
- Describe properties and application of fluorescence probes being used in biochemical and cellular research.
- Know the principles of fluorescence techniques for determining concentrations and properties of biomolecules.
- Know the anatomy and function of light microscopes including a description of its optical components.
- Describe the physical principles behind microscopic methods for characterization of cellular structures.
- Know how to apply such methods in modern cell biological research.
- Be familiar with basic principles of digital images and know how to basic image processing and analysis methods.

KE540: Kvantekemi og Modellering

Expected learning outcome

The learning objective of the course is that the student demonstrates the ability to:

- Explain basic quantum mechanical principles and the underlying mathematical techniques.
- Explain the solution of the Schrödinger equation for a particle in a box and tunnel effect for a square barrier model.
- Explain the quantum mechanical description of a harmonic oscillator and explain how it can be used to interpret vibration spectra.
- Identify both the electronic and total Hamilton operator for a given molecule and explain the meaning of the individual terms.
- Explain bond strength, equilibrium distances, dissociation energy in molecules based on molecular orbital theory.
- Interpret simple electronic spectra based on molecular orbital theory.
- Identify and describe modern modeling methods in chemistry.
- Evaluate the strengths and weaknesses of these modeling methods in relation to solving problems in organic chemistry.
- Select relevant modeling methods to study a given chemical problem.
- Perform computer calculations with the selected modeling methods to solve a given problem and interpret the result of the calculations.

KE548: Bæredygtig kemi og innovation

Expected learning outcome

The learning objective of the course is that the student demonstrates the ability to:

- Account for societal and technological challenges based on specific cases as well as the fundamental principles behind potential chemical solutions
- Account for the importance of innovation in relation to the solution of technological challenges
- Describe the general concepts in innovation and development processes and their relevance for scientific innovation
- Assess the societal- and business-related potential as well as drawbacks of a technological solutions.
- Illustrate possibilities for applied use of theoretical knowledge

KE543: Grøn teknologi

Expected learning outcome

The learning objective of the course is that the student demonstrates the ability to:

- Account for societal and technological challenges based on specific cases as well as the fundamental principles behind potential chemical solutions
- Account for the importance of innovation in relation to the solution of technological challenges
- Describe the general concepts in innovation and development processes and their relevance for scientific innovation
- Assess the societal- and business-related potential as well as drawbacks of a technological solutions.
- Illustrate possibilities for applied use of theoretical knowledge

FA506: Medicinalkemi A

Expected learning outcome

The learning objectives of the course is that the student demonstrates the ability to:

- Demonstrate a broad overview over medicinal compound classes
- Explain and use important terms in medicinal chemistry, including agonism and antagonism, SAR, ADME, pharmacokinetics and pharmacodynamics
- Explain the mechanism of action of representative drugs
- Provide an overview of important molecular drug targets in the body
- Draw the chemical structures of central signaling molecules and drugs
- Provide an overview of, recognize and explain types of molecular interactions between the drug and the target
- Formulate hypotheses for interactions between a given drug and a target and for how this interaction can be optimized
- Provide an overview of and explain absorption, distribution, metabolism and excretion of drugs and formulate hypotheses for how the chemical structure of a given drug can optimized with regard to these factors
- Read and understand articles in the medicinal chemistry journals and critically analyze, interpret and explain the reported results.
- Analyzed a dataset for a given compound series, form hypotheses for structure-activity relationships and formulate optimization strategies

FA505: Naturstofkemi og farmakognosi

Expected learning outcome

The learning objectives of the course is that the student demonstrates the ability to:

- Classify natural products from their chemical structure and to indicate their possible biosynthesis
- Assess the properties of bioactive natural products and their structure-activity relations, their pharmacological effects and possible mode of actions in biological systems, in particular humans and animals.
- Assess the health promoting and pharmacological effects of herbal substances and herbal extracts based on their content of bioactive natural products.
- Explain the difference between herbal remedies, traditional herbal medicines and food supplements.
- Explain the overall principles on how to isolate and characterize
  bioactive natural products from plants and microorganisms

- Communicate and relate critically to the content in scientific papers on the subject.

KE506: Syntese

Expected learning outcome
The learning objectives of the course is that the student demonstrates the ability to:
- relate theoretical knowledge of organic reactions and reaction mechanisms to carry out practical organic synthesis
- carry out synthesis
- carry out limited multi-step syntheses
- carry out synthesis under an inert atmosphere
- describe and use different purification techniques
- determine the purity of the compounds synthesized using analytical and spectroscopic methods
- conduct literature searches in Reaxys
- explain and apply safe behavior in a synthetic laboratory

BABMB501: Bachelorprojekt i biokemi og molekylær biologi

Expected learning outcome
See Danish version

ST520: Anvendt statistik

Expected learning outcome
The learning objective of the course is that the student demonstrates the ability to:

- Utilizing graphics and summary methods for descriptive data analysis.
- Describing data using key statistics such as mean, variance, and correlation.
- Constructing confidence intervals for key statistics.
- Testing simple statistical hypotheses.
- Analyzing data using simple regression models.
- Designing data collection.
- Understanding central elements in published results from statistical analyses of biological data.
- Critically evaluating the appropriateness of employed methods and inferences based on these.
- Presenting statistical results in non-technical terms.
- Use R for simple statistical analyses.

NAT500: Studiestartsprøve

Expected learning outcome
That the student can manage oneself around the university and have knowledge of the university's study rules.

FF500a: Studiestartsprøve

Expected learning outcome
That the student can manage oneself around the university and have knowledge of the university's study rules.

§ 5 - Examination provisions

§ 5.1 - Programme passing requirements
See Danish version

§ 5.2 - Start of study exam
See Danish version

§ 5.3 - First year exam
See Danish version

§ 5.4 - Spelling and writing skills
See Danish version

§ 5.5 - Evaluation of examinations and tests
See Danish version

§ 5.6 - Exam language
See Danish version

§ 5.7 - Forms of assessment
See Danish version

§ 5.8 - Ordinary exams
See Danish version

§ 5.9 - Reexams
See Danish version

§ 5.10 - Exam attempts
See Danish version

§ 5.11 - Requirements for exams
See Danish version

§ 5.12 - Digital exams and aids
See Danish version

§ 5.13 - Special examination conditions
See Danish version

§ 5.14 - Irregularities at exams
See Danish version

§ 5.15 - Group exams
See Danish version

§ 6 - Credit transfer

§ 6.1 - Transfer of credit
See Danish version

§ 6.2 - Transfer of credit
See Danish version

§ 6.3 - Credit
See Danish version

§ 6.4 - Extemptions
See Danish version

§ 7 - Provisions on the organisation of the programme

§ 7.1 - Enrolment and unenrolment from teaching and exams
See Danish version

§ 7.2 - Deadline for programme completion
See Danish version

§ 7.3 - Study activity
See Danish version

§ 7.4 - Leave
See Danish version

§ 7.5 - Limitation on the number of entries
See Danish version

§ 7.6 - Minor, elective subject and elective
See Danish version

§ 8 - Exemptions and complaints procedures

§ 8.1 - Dispensation from University regulations
See Danish version

§ 8.2 - Complaints over exams
See Danish version

§ 8.3 - Complaints over University decisions
See Danish version

§ 9 - The affiliation of the programme

§ 9.1 - Legal basis
See Danish version

§ 9.2 - Academic Study Board
Study Board of Science

§ 9.3 - External examiners
Corps of examiners for biology

§ 9.4 - Codes
Ingen STO-kode fundet

§ 9.5 - Effective date
01-09-2021

§ 9.6 - Applicable for students enrolled as of
01-09-2018

§ 9.7 - Date of Study Board Approval
24-11-2021

§ 9.8 - Date of Deans Approval