Programme-specific Section of the Curriculum for the MSc Programme in Biotechnology with a minor subject at the Faculty of Science, University of Copenhagen 2020

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1 Title, affiliation and language
A shared section that applies to all BSc and MSc Programmes at the Faculty of Science is linked to this programme-specific curriculum.

1.1 Title
The MSc Programme in Biotechnology with a minor subject leads to a Master of Science (MSc) in Biotechnology and minor in [the minor subject] with the Danish title: Cand.scient. (candidatus/candidata scientiarum) i bioteknologi med sidefag i [the minor subject].

It will appear from the diploma that the study programme has been completed as a MSc in two subjects and, provided that the requirements pertaining to the Upper Secondary School course packages (gymnasiefagpakkerne) have been met, that academic qualifications (faglig kompetence) for teaching at the Danish Upper Secondary School in the subjects have been achieved.

1.2 Affiliation
The programme is affiliated with the Study Board for the Biological Area and the students can both elect, and be elected, to this study board.

1.3 Corps of external examiners
The following corps of external examiners is used for the central parts of the MSc Programme:
- Corps of External Examiners for Agricultural Science (jordbrugsvidenskab).

1.4 Language
The language of this MSc Programme is English.

2 Academic profile
2.1 Purpose
The objective of the program is to offer students a coherent profession-oriented education within the field of biotechnology. On completion of the program, students will be able to perform research at all levels and analyse and solve questions and problems within the broad field of biotechnology.

The MSc programme is primarily within the field of natural sciences, supplied with aspects of innovation and business. The biotechnology programme is an international degree and will be conducted in English.

2.2 General programme profile
The aim of the programme is to give students:
- Both theoretical knowledge and method-oriented practical skills in applied biotechnology and biochemistry within the fields of domestic animals and livestock, plants, human and/or microorganisms.
- The knowledge required to analyse complex biotechnology problems of importance for the biotechnological industry, governmental agencies or educational programmes.
- The ability to communicate knowledge at all levels, and a general understanding of the interactions between biotechnology, industry, society and the environment.

Biotechnology is the key subject area of the programme.

2.3 General structure of the programme
The MSc Programme is set at 120 when the minor subject is within the field of sciences.
Exercise and Sport Sciences is in this regard considered as being outside the field of science.

The MSc Programme in Biotechnology with a minor subject consists of the following elements:

- Specialisation, 120 ECTS including the thesis.

The student must choose one of the following specialisations:
- Biotechnology with a minor subject in Biology
- Biotechnology with a minor subject in Chemistry

2.4 Career opportunities
The MSc Programme in Biotechnology with a minor subject qualifies students to become professionals within business functions and/or areas such as:
- Upper secondary school teacher in Biotechnology and the minor subject.
- Researcher/quality manager in biotechnological industry
- Scientist at research institutions
- Advisor and consultant in governmental agencies
- Product specialist in biotech sales organisations
- A PhD programme
- Educational establishments

3 Description of competence profiles
Students following the MSc Programme acquire the knowledge, skills and competences listed below. Students will also acquire other qualifications through elective subject elements and other study activities.

3.1 Competence profile
On completion of the programme, an MSc in Biotechnology with a minor subject has acquired the following:

Knowledge about:
- Didactic literature, concepts and methods.
- The biological complexities with the field of cell and organism biology and molecular biology at an advanced level including the principles of cell functions and genetic control of these processes.
- Critically reflect on the theory behind biotechnological methods.
- Model systems to obtain and integrate fundamental knowledge about organisms and to understand complex biological processes.
- The usefulness of different organisms as expression hosts in research and as production units.
- Integrated approaches to address biotechnological questions using genetics, physiology, biochemistry and bioinformatics in order to relate phenotypes to genotype and as platforms for modelling organism metabolism at the molecular level.

Skills in/to:
- Using methods and analysing data in analytical chemistry
- Apply didactic terminology correct, and use it to be able to argue with these terms for the content and progression of the student activities in relation to teaching.
- Use basic knowledge from other disciplines in an integrated manner when analysing and solving current problems in biology-biotechnology.
Discuss and choose techniques in molecular biology, design of laboratory protocols and safety procedures in relation to handling and use of organisms in biotechnology.

Transfer techniques and principles to new hypotheses based on biotechnological/biochemical, and/or mathematical/statistical descriptions, which can be statistically and experimentally tested.

Use digitalisation such as scripting to handle and analyse large and complex data sets within biotechnology.

Use advanced methods and solutions in molecular biology in the context of a project.

Set up preparations for a research plan, including critical discussion of literature and identification of problems, develop hypotheses and concrete research questions, determine data requirements and select appropriate methods.

Read, discuss and present original scientific articles within the field.

Read and interpret patents within bioscience

Communicate effectively to specialist and non-specialist audience at a variety of levels, using modern and appropriate information and communication tools.

Competences in/to:

- Analyse the justifications and description of goals in the official guidelines for teaching.
- Analyse and evaluate concrete teaching situations in relation to their learning potential.
- Transfer theories and principles from advanced state-of-the-art molecular biology to solve new questions posed by the research community, the industry and the society.
- Find innovative solutions based on sustainability perspectives and climate neutral development.
- Work effectively in teams as well as independently, apply project management in cross-disciplinary environments.
- Use lifelong learning as a principle to independently evaluate and structure learning processes and assume responsibility for continuous professional development.

4 Admission requirements

With a Bachelor’s degree in Biotechnology from University of Copenhagen the student is granted reserved access and guaranteed a place on the MSc Programme in Biotechnology with a minor subject if the student applies in time to begin the MSc Programme within three years of the completion of the Bachelor's degree.

The admission requirements for the MSc Programme in Biotechnology with a minor subject is the same as the admission requirements listed in paragraph 4 in “Programme-specific Section of the Curriculum for the MSc Programme in Biotechnology” supplemented with the following:

- At least 105 ECTS from the Upper Secondary School course package (gymnasiefagpakken) are included in the BSc programme.
- At least 45 ECTS from the minor subject is included in the BSc programme.
  - If the minor subject is Biology 45 ECTS must be contained in the minor subject Upper Secondary School course package (den reducerede gymnasiefagpakke) in Biology.
  - If the minor subject is Chemistry 45 ECTS must be contained in the minor subject Upper Secondary School course package (den reducerede gymnasiefagpakke) in Chemistry.
5 Prioritisation of applicants
If the number of qualified applicants to the programme exceeds the number of places available the applicants will be prioritised according to paragraph 5 in “Programme-specific Section of the Curriculum for the MSc Programme in Biotechnology”.

6 Structure of the programme
The compulsory subject elements, restricted elective subject elements and the thesis constitute the central parts of the programme (Section 21 of the Ministerial Order on Bachelor and Master’s Programmes (Candidatus) at Universities).

Before the beginning of the MSc Programme the student must choose a specialisation.

6.1 Programme components with a minor subject in Biology
The programme is set at 120 ECTS and consists of the following:
- Compulsory subject elements (major subject), 7.5 ECTS
- Compulsory subject elements (minor subject), 22.5 ECTS
- Restricted elective subject elements (major subject), 30 ECTS.
- Elective subject elements, 30 ECTS
- Thesis, 30 ECTS.

6.1.1 Compulsory subject elements within the major subject
All of the following subject elements are to be covered (7.5 ECTS):

<table>
<thead>
<tr>
<th>Subject Element</th>
<th>Title</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPLK19000U</td>
<td>Big Data in Biotechnology</td>
<td>Block 1</td>
</tr>
</tbody>
</table>

6.1.2 Compulsory subject elements within the minor subject
All of the following subject elements are to be covered (22.5 ECTS):

<table>
<thead>
<tr>
<th>Subject Element</th>
<th>Title</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBIA04026U</td>
<td>Populationsbiologi</td>
<td>Block 2</td>
</tr>
<tr>
<td>NBIA04035U</td>
<td>Menneskets fysiologi</td>
<td>Block 2</td>
</tr>
<tr>
<td>NBIA08033U</td>
<td>Feltbiologi I, II og III</td>
<td>Block 4</td>
</tr>
</tbody>
</table>

6.1.3 Restricted elective subject elements within the major subject
30 ECTS are to be covered as subject elements from the following lists:

<table>
<thead>
<tr>
<th>Subject Element</th>
<th>Title</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBK10135U</td>
<td>Genome and Cell Biology</td>
<td>Block 1</td>
</tr>
<tr>
<td>LBK10214U</td>
<td>Frontiers in Plant Science</td>
<td>Block 1</td>
</tr>
<tr>
<td>NPLK17001U</td>
<td>Advanced Microbial Biotechnology</td>
<td>Block 1</td>
</tr>
<tr>
<td>LBK10180U</td>
<td>Applied Microbiology</td>
<td>Block 2</td>
</tr>
<tr>
<td>LBK10136U</td>
<td>Heterologous Expression</td>
<td>Block 3</td>
</tr>
<tr>
<td>LBK10207U</td>
<td>Synthetic Biology</td>
<td>Block 3</td>
</tr>
<tr>
<td>NPLB14027U</td>
<td>Analytical Chemistry</td>
<td>Block 3</td>
</tr>
</tbody>
</table>

6.1.4 Elective subject elements
The elective subjects are generally covered by the subject elements which the student follows on the minor subject.

It is, however, possible to release elective subject elements if the academic minimum requirements for the minor subjects have been met – this will, e.g., be the case if one or both of the following two conditions are present:
- A subject element forms part of both the major and minor Upper Secondary School course packages (gymnasiefagpakker). The subject elements should only be passed once, and the student has full freedom of choice in terms of the remaining ECTS.
- If less than 45 ECTS within the minor subject are missing when entering the MSc Programme.

In this specialisation, 30 ECTS are to be covered as elective subject elements due to overlap in academic content between major and minor subject.

BSc subject elements corresponding to 7.5 ECTS may be included in the MSc Programme as elective subject elements without the approval of the study board.

Projects outside the course scope may be included in the elective section of the programme by up to 15 ECTS. The regulations are described in Appendix 5 to the shared section of the curriculum.

Projects in practice may be included in the elective section of the programme by up to 15 ECTS. The regulations are described in Appendix 5 to the shared section of the curriculum.

Thesis preparation projects may not be included in the elective section of the programme.

6.1.5 Thesis
The MSc Programme in Biotechnology includes a thesis corresponding to 30 ECTS, as described in Appendix 2 to the shared curriculum. The thesis must be written within the academic scope of the programme.

6.1.6 Academic Mobility
The academic mobility is generally covered by the subject elements which the student follows on the minor subject.

The student has the possibility to arrange academic mobility during the programme according to the rules and regulations regarding pre-approvals and credit.

6.2 Programme components with a minor subject in Chemistry
The programme is set at 120 ECTS and consists of the following:
- Compulsory subject elements (major subject), 7.5 ECTS
- Compulsory subject elements (minor subject), 52.5 ECTS
- Restricted elective subject elements, 30 ECTS.
- Thesis, 30 ECTS.

6.2.1 Compulsory subject elements within the major subject
All of the following subject elements are to be covered (7.5 ECTS):

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
<th>Block</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPLK19000U</td>
<td>Big Data in Biotechnology</td>
<td>Block 1</td>
<td>7.5 ECTS</td>
</tr>
</tbody>
</table>

6.2.2 Compulsory subject elements within the minor subject
All of the following subject elements are to be covered (52.5 ECTS):

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
<th>Block</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NKEB10003U</td>
<td>Uorganisk kemisk syntese (UorgSyn)</td>
<td>Block 1</td>
<td>7.5 ECTS</td>
</tr>
<tr>
<td>NKEB13004U</td>
<td>Anvendt matematik for kemikere (AnvMatKem)</td>
<td>Block 3</td>
<td>7.5 ECTS</td>
</tr>
<tr>
<td>NKEA60002U</td>
<td>Kemiske undervisningsforsøg</td>
<td>Block 3</td>
<td>7.5 ECTS</td>
</tr>
<tr>
<td>NKEA04034U</td>
<td>Kemisk binding (KemiBin)</td>
<td>Block 4</td>
<td>7.5 ECTS</td>
</tr>
<tr>
<td>NKEB13006U</td>
<td>Anvendt spektroskopi (AnvSpek)</td>
<td>Block 4</td>
<td>7.5 ECTS</td>
</tr>
<tr>
<td>NKEB19001U</td>
<td>Termodynamik og kinetic (TermoKin)</td>
<td>Block 1</td>
<td>7.5 ECTS</td>
</tr>
</tbody>
</table>
6.2.3 Restricted elective subject elements within the major subject

30 ECTS are to be covered as subject elements from the following lists:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Block</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NKEB14006U</td>
<td>Eksperimentel fysisk kemi (FysKem2)</td>
<td>Block 2</td>
<td>7.5 ECTS</td>
</tr>
</tbody>
</table>

6.2.4 Elective subject elements

The elective subjects are generally covered by the subject elements which the student follows on the minor subject.

It is, however, possible to release elective subject elements if the academic minimum requirements for the minor subjects have been met – this will, e.g., be the case if one or both of the following two conditions are present:

- A subject element forms part of both the major and minor Upper Secondary School course packages (*gymnasiefagpakker*). The subject elements should only be passed once, and the student has full freedom of choice in terms of the remaining ECTS.
- If less than 45 ECTS within the minor subject are missing when entering the MSc Programme.

This specialisation does not include elective subject elements.

6.2.5 Thesis

The MSc Programme in Biotechnology includes a thesis corresponding to 30 ECTS, as described in Appendix 2 to the shared curriculum. The thesis must be written within the academic scope of the programme.

6.2.6 Academic Mobility

The academic mobility is generally covered by the subject elements which the student follows on the minor subject.

The student has the possibility to arrange academic mobility during the programme according to the rules and regulations regarding pre-approvals and credit.

7 Exemptions

In exceptional circumstances, the study board may grant exemptions from the rules in the curriculum specified solely by the Faculty of Science.

8 Commencement etc.

8.1 Validity

This subject specific section of the curriculum applies to all students enrolled in the programme – see however Appendix 2.
8.2 Transfer
Students enrolled on previous curricula may be transferred to the new one as per the applicable transfer regulations or according to an individual credit transfer by the study board.

8.3 Amendment
The curriculum may be amended once a year so that any changes come into effect at the beginning of the academic year. Amendments must be proposed by the study board and approved by the Dean.

Notification about amendments that tighten the admission requirements for the programme will be published online at www.science.ku.dk one year before they come into effect.

If amendments are made to this curriculum, an interim arrangement may be added if necessary to allow students to complete their MSc Programme according to the amended curriculum.
**Appendix 1 Tables**

**Table for students admitted to the programme in September (summer):**

Table – MSc Programme in Biotechnology with a minor subject in Biology

<table>
<thead>
<tr>
<th>Block 1</th>
<th>Block 2</th>
<th>Block 3</th>
<th>Block 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st year</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big Data in Biotechnology</td>
<td>Populationsbiologi</td>
<td>Elective</td>
<td>Feltbiologi I, II og III</td>
</tr>
<tr>
<td>Elective</td>
<td>Menneskets fysiologi</td>
<td>Restricted elective</td>
<td>Restricted elective</td>
</tr>
<tr>
<td><strong>2nd year</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>Elective</td>
<td></td>
<td>Thesis</td>
</tr>
<tr>
<td>Restricted elective</td>
<td>Restricted elective</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

Table – MSc Programme in Biotechnology with a minor subject in Chemistry

<table>
<thead>
<tr>
<th>Block 1</th>
<th>Block 2</th>
<th>Block 3</th>
<th>Block 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st year</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big Data in Biotechnology</td>
<td>Restricted elective</td>
<td>Anvendt matematik for kemikere</td>
<td>Kemisk binding</td>
</tr>
<tr>
<td>Uorganisk kemisk syntese</td>
<td>Restricted elective</td>
<td>Kemiske undervisningsforsøg</td>
<td>Anvendt spektroskopi</td>
</tr>
<tr>
<td><strong>2nd year</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Termodynamik og kinetik</td>
<td>Eksperimentel fysisk kemi</td>
<td></td>
<td>Thesis</td>
</tr>
<tr>
<td>Restricted elective</td>
<td>Restricted elective</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.
Table for students admitted to the programme in February (winter):

### Table – MSc Programme in Biotechnology with a minor subject in Biology*

<table>
<thead>
<tr>
<th>Block 3</th>
<th>Block 4</th>
<th>Block 1</th>
<th>Block 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>Restricted elective</td>
<td>Big Data in Biotechnology</td>
<td>Populationsbiologi</td>
</tr>
<tr>
<td>Elective</td>
<td>Elective</td>
<td>Restricted elective</td>
<td>Menneskets fysiologi</td>
</tr>
<tr>
<td>2nd year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>Feltbiologi I, II og III</td>
<td>Thesis</td>
<td></td>
</tr>
<tr>
<td>Restricted elective</td>
<td>Restricted elective</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*This table is only relevant for students who begin the MSc Programme in February (block 3).

### Table – MSc Programme in Biotechnology with a minor subject in Chemistry*

<table>
<thead>
<tr>
<th>Block 3</th>
<th>Block 4</th>
<th>Block 1</th>
<th>Block 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anvendt matematik for kemikere</td>
<td>Kemisk binding</td>
<td>Termodynamik og kinetik</td>
<td>Restricted elective</td>
</tr>
<tr>
<td>Kemiske undervisningsforsøg</td>
<td>Anvendt spektroskopi</td>
<td>Uorganisk kemisk syntese</td>
<td>Eksperimentel fysisk kemi</td>
</tr>
<tr>
<td>2nd year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thesis</td>
<td></td>
<td>Big Data in Biotechnology</td>
<td>Restricted elective</td>
</tr>
<tr>
<td></td>
<td>Restricted elective</td>
<td>Restricted elective</td>
<td></td>
</tr>
</tbody>
</table>

*This table is only relevant for students who begin the MSc Programme in February (block 3).
Appendix 2 Interim arrangements

The Shared Section of the BSc and MSc Curricula for Study Programmes applies to all students.

There are currently no interim arrangements to this curriculum.

Appendix 3 Description of objectives for the thesis

After completing the thesis, the student should have:

Knowledge about:
- Summarising a suitable combination of methodologies/theories in biotechnology based on international research for use in his/her work with the problem formulation.
- Discussing theories/models on the basis of an organised value system and with a high degree of independence.

Skills in/to:
- Apply and critically evaluate biotechnological theories/methodologies, including their applicability and limitations.
- Draw conclusions in a clear and societal perspective academic manner in relation to the problem formulation and, more generally, considering the topic and the subject area.
- Process data through a choice of academic analysis methods and present findings objectively and in a concise manner.

Competences in/to:
- Initiate, perform academic work and find solutions in a biotechnological research context.