Programme-specific Section of the Curriculum for the MSc Programme in Molecular Biomedicine at the Faculty of Science, University of Copenhagen 2009 (Rev. 2022)

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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 Molecular Biomedicine leads to a Master of Science (MSc) in Molecular Biomedicine with the Danish title: Cand.scient. (candidatus/candidata scientiarum) i molekylær biomedicin.

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 Biology (biologi).
- In addition, examiners from other corps can be brought in for subject elements not covered by the primary corps.

1.4 Language
The language of this MSc Programme is English.

2 Academic profile
2.1 Purpose
The programme is taught in English and the objective is to produce graduates with extensive, internationally competitive knowledge of a particular area of experimental molecular biomedicine, who have carried out a significant independent experimental project within this academic field. In addition, the programme aims to provide graduates with an extensive knowledge of the molecular mechanisms of disease and knowledge of relevant bioinformatics and statistical working methods.

2.2 General programme profile
The programme is composed of an experimental Master’s thesis project and compulsory courses in human molecular pathology, statistics and bioinformatics of high throughput analyses. Elective courses provide the opportunity to individualize the MSc programme.

Molecular insight into the function of the human body in health and disease is the key subject area of the programme.

2.3 General structure of the programme
The MSc Programme is set at 120 ECTS.

There are no defined specialisations in this programme.

2.4 Career opportunities
The MSc Programme in Molecular Biomedicine qualifies students to become professionals within business functions and/or areas such as:
- A PhD programme
- Membership of research groups in the biomedical industry, providing independent contributions to experimental work and internal debates.
• Teamwork in method development and quality control in the biomedical industry, hospitals and the healthcare sector in general.

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
Graduates holding an MSc in Molecular Biomedicine have acquired the following:

Knowledge about:
• A large part of recent original literature within their chosen thesis field as well as some original literature within several other fields in molecular biomedicine.
• Human molecular pathology.
• Relevant statistical theories and methods.
• Relevant bioinformatics tools and methods.
• Locate, evaluate and summarise up-to-date knowledge within a given area of molecular biomedicine.
• Critically evaluate other researchers’ results within the field of molecular biomedicine based upon a broad knowledge of the methodology and critical analysis within the field.
• Discuss relevant molecular biomedical challenges and solutions in the context of health and disease as well as sustainability.

Skills in/to:
• Communicate research-based knowledge and discuss professional and biomedical problem areas with both fellow specialists and non-specialists.
• Document knowledge and experimental work in a manner that meets the requirements set out by international scientific publications.
• Understand and reflect, scientifically, on the current knowledge of molecular biomedicine and identify molecular biomedical problems that can be solved experimentally.
• Evaluate and choose from within their thesis area’s scientific theories, methods, tools and techniques in order to construct a problem-solving strategy for a hitherto unsolved molecular biomedical problem.

Competences in/to:
• Formulate, structure and carry out an independent molecular biomedical research project.
• Manage complex work and development situations that they are not familiar with in advance and which require new problem-solving models.
• Independently take responsibility for their own academic development and specialisation.
• Independently initiate and carry out collaborations both within their field and across scientific fields and take on professional responsibility.
• Assess the importance and involvement of molecular biomedical research and development in public health and sustainability.
4 Admission requirements
With a Bachelor’s degree in Molecular Biomedicine from the University of Copenhagen the student is granted reserved access and guaranteed a place on the MSc Programme in Molecular Biomedicine if the student applies in time to begin the MSc programme within three years of the completion of the Bachelor’s degree.

4.1 Applicants with a Bachelor’s degree in Molecular Biomedicine or Molecular Medicine
Applicants with a Bachelor’s degree in Molecular Biomedicine from the University of Copenhagen or a Bachelor’s degree in Molecular Medicine from Aarhus University are directly academically qualified for admission to the MSc Programme in Molecular Biomedicine.

4.2 Applicants with a Bachelor’s degree in Biochemistry
Applicants with a Bachelor’s degree in Biochemistry from the University of Copenhagen may also be admitted if their programme includes the following:
- A minimum of 22.5 ECTS from courses in cell biology.
- A minimum of 15 ECTS from courses in human physiology.

4.3 Applicants with a related Bachelor’s degree
Applicants with a related Bachelor’s degree from the University of Copenhagen or other Danish or international universities may also be admitted if their programme includes the following:
- A minimum of 60 ECTS of formal classes in the fields of protein chemistry, cell biology, molecular biology and human physiology of which a minimum of 30 ECTS must be from courses in molecular biology.
- Relevant laboratory experience equivalent to a minimum of 30 ECTS from courses, projects etc. (must be documented).

4.4 Other applicants
The Faculty may also admit applicants who, after an individual academic assessment, are assessed to possess educational qualifications equivalent to those required in Subclause 4.1-5.

4.5 Language requirements
Applicants must as a minimum document English language qualifications comparable to a Danish upper secondary school English B level or English proficiency corresponding to the tests and scores required. Accepted tests and required minimum scores are published online at science.ku.dk.

4.7 Supplementary subject elements
The qualifications of an applicant to the MSc programme are assessed exclusively on the basis of the qualifying bachelor’s degree. Supplementary subject elements passed between the completion of the bachelor’s programme and the admission to the MSc programme cannot be included in the overall assessment.

However, subject elements passed before the completion of the bachelor’s programme may be included in the overall assessment. This includes subject elements completed as continuing education as well as subject elements completed as part of a former higher education programme. A maximum of 30 ECTS supplementary subject elements can be included in the overall assessment.
Subject elements passed before completing the BSc programme which are to form part of the MSc programme to which the student has a legal right of admission (§12-courses) cannot be included in the overall assessment.

5 Prioritisation of applicants
If the number of qualified applicants to the programme exceeds the number of places available, applicants will be prioritised as follows:

1) Applicants with a Bachelor’s degree in Molecular Biomedicine from the University of Copenhagen with reserved access to the programme.
2) Other applicants.

If the number of qualified applicants within a category exceeds the number of places available, applicants will be prioritised according to the following criteria (listed below in prioritized order):

- Obtained ECTS in individual subjects. Each of the following subjects will be assessed individually until all applicants have been prioritised:
  1) Human/mammalian molecular biology.
  2) Human/mammalian cellular biology.
  3) Human physiology.
  4) Protein chemistry.
  5) Finally, the extent of the applicant’s documented experience of relevant laboratory work will be assessed.

6 Structure of the programme
The compulsory subject elements, restricted elective subject elements and the thesis constitute the central parts of the programme (Section 30 of the Ministerial Order on Bachelor and Master’s Programmes (Candidatus) at Universities).

6.1. Programme components
The programme is set at 120 ECTS and consists of the following:

- Compulsory subject elements, 30 ECTS.
- Restricted elective subject elements, 15 ECTS.
- Elective subject elements, 15 ECTS.
- Thesis, 60 ECTS.

6.1.1 Compulsory subject elements
All of the following subject elements are to be covered (30 ECTS):

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Block</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMOK15001U</td>
<td>Molecular Pathology</td>
<td>Block 1+2</td>
<td>15 ECTS</td>
</tr>
<tr>
<td>NBIA08011U</td>
<td>Statistics for Molecular Biomedicine</td>
<td>Block 3</td>
<td>7.5 ECTS</td>
</tr>
<tr>
<td>NBIA07023U</td>
<td>Bioinformatics of High Throughput Analyses</td>
<td>Block 4</td>
<td>7.5 ECTS</td>
</tr>
</tbody>
</table>

6.1.2 Restricted elective subject elements
15 ECTS are to be covered as subject elements from the following list:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Block</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBIK15016U</td>
<td>The Human Microbiome</td>
<td>Block 1</td>
<td>7.5 ECTS</td>
</tr>
<tr>
<td>NBIK10015U</td>
<td>Cell Cycle Control and Cancer</td>
<td>Block 1</td>
<td>7.5 ECTS</td>
</tr>
</tbody>
</table>
6.1.3 Elective subject elements

15 ECTS are to be covered as elective subject elements.

- All subject elements at MSc level may be included as elective subject elements in the MSc Programme.
- BSc subject elements corresponding to 15 ECTS may be included in the MSc Programme.
- Projects. See 6.1.4 Projects.

6.1.4 Projects

Projects outside the course scope, projects in practice and thesis preparation projects may not exceed 30 ECTS of the programme.
• Projects outside the course scope may be included in the elective section of the programme with 7.5 ECTS. The main supervisor must be employed at either the Faculty of Science or the Faculty of Health and Medical Sciences at the University of Copenhagen. The regulations are described in Appendix 5 to the shared section of the curriculum.

• Projects in practice may be included in the elective and/or restricted elective section of the programme with 15 ECTS. Projects in practice may be written as a combination of the restricted elective and elective section of the programme. Projects in practice may not exceed 15 ECTS in total of the programme. The regulations are described in Appendix 4 to the shared section of the curriculum.

• Thesis preparation projects may be included in the elective section of the programme with 7.5 ECTS. The regulations are described in Appendix 6 to the shared section of the curriculum.

6.1.5 Thesis
The MSc Programme in Molecular Biomedicine includes a thesis corresponding to 60 ECTS, as described in Appendix 2 to the shared curriculum. The thesis must be written within the academic scope of the programme.

The main supervisor must be employed at either the Faculty of Science or the Faculty of Health and Medical Sciences at the University of Copenhagen.

6.1.6 Academic mobility
The curriculum makes it possible to follow subject elements outside the Faculty of Science.

The academic mobility for the MSc Programme in Molecular Biomedicine is placed in block 1+2 or block 3+4 of the 1st year.

Academic mobility requires that the student follows the rules and regulations regarding pre-approval and credit transfer.

In addition, the student has the possibility to arrange similar academic mobility in other parts of the programme.

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 The recommended academic progression
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 September (summer):

Table – MSc Programme in Molecular Biomedicine

<table>
<thead>
<tr>
<th></th>
<th>Block 1</th>
<th>Block 2</th>
<th>Block 3</th>
<th>Block 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>Molecular Pathology</td>
<td>Statistics for</td>
<td>Bioinformatics of High Throughput Analyses</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Molecular Biomedicine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>Restricted elective</td>
<td>Elective</td>
<td>Restricted elective</td>
<td></td>
</tr>
<tr>
<td>2nd year</td>
<td></td>
<td></td>
<td>Thesis</td>
<td></td>
</tr>
</tbody>
</table>

Table for students admitted to the programme in February (winter):

Table – MSc Programme in Molecular Biomedicine*:

<table>
<thead>
<tr>
<th></th>
<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>Statistics for</td>
<td>Bioinformatics of</td>
<td>Molecular Pathology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Molecular Biomedicine</td>
<td>High Throughput</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analyses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>Restricted elective</td>
<td>Elective</td>
<td>Restricted elective</td>
<td></td>
</tr>
<tr>
<td>2nd year</td>
<td></td>
<td></td>
<td>Thesis</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.

The interim arrangements below only consist of parts where the current curriculum differs from the rules and regulations that were previously valid. Therefore, if information about relevant rules and regulations are missing, it can be found in the curriculum above.

1 General changes for students admitted in the academic year 2021/22

Students admitted to the MSc Programme in the academic year 2021/22 must finish the programme as listed in the curriculum above with the following exceptions.

Restricted elective subject elements

15 ECTS are to be covered as subject elements from the following list:

<table>
<thead>
<tr>
<th>Subject Element</th>
<th>Description</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDAK15007U</td>
<td>Machine Learning</td>
<td>7.5</td>
</tr>
<tr>
<td>NBIK20006U</td>
<td>Advanced Topics in Physiology</td>
<td>7.5</td>
</tr>
<tr>
<td>SBK10182U</td>
<td>From Gene to Function in Pathogenic Bacteria</td>
<td>7.5</td>
</tr>
</tbody>
</table>

*See discontinued courses below.

2 General changes for students admitted in the academic year 2020/21

Students admitted to the MSc Programme in the academic year 2020/21 must finish the programme as listed in the curriculum above with the following exceptions.

Programme components

The programme is set at 120 ECTS and consists of the following:

- Compulsory subject elements, 30 ECTS.
- Restricted elective subject elements, 15 ECTS.
- Elective subject elements, 15 ECTS.
- Thesis, 60 ECTS.

Table – MSc Programme in Molecular Biomedicine (summer)*

<table>
<thead>
<tr>
<th>1st year</th>
<th>2nd year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
</tr>
<tr>
<td>Molecular Pathology</td>
<td>Statistics for Molecular Biomedicine</td>
</tr>
<tr>
<td>Restricted elective</td>
<td>Elective</td>
</tr>
<tr>
<td>Thesis</td>
<td>Thesis</td>
</tr>
</tbody>
</table>

*This table only applies to students who starts the thesis before 20 August 2021.

If you are admitted to the programme in September you must start your thesis at block 2, 1st year and submit your thesis report May 31st, 2nd year.

Table – MSc Programme in Molecular Biomedicine (winter)*/**:

<table>
<thead>
<tr>
<th>1st year</th>
<th>2nd year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 3</td>
<td>Block 4</td>
</tr>
<tr>
<td>Statistics for Molecular Biomedicine</td>
<td>Bioinformatics of High Throughput Analyses</td>
</tr>
</tbody>
</table>
Restricted elective subject elements
15 ECTS are to be covered as subject elements from the following list:

<table>
<thead>
<tr>
<th>Subject Elements</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDAK15007U Machine Learning</td>
<td>7.5 ECTS</td>
</tr>
<tr>
<td>NBIK20006U Advanced Topics in Physiology</td>
<td>7.5 ECTS</td>
</tr>
<tr>
<td>SBIK10182U From Gene to Function in Pathogenic Bacteria</td>
<td>7.5 ECTS</td>
</tr>
</tbody>
</table>

*See discontinued courses below.

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

3 General changes for students admitted in the academic year 2019/20
Students admitted to the MSc Programme in the academic year 2019/20 must finish the programme as listed in the curriculum above with the following exceptions.

Programme components
The programme is set at 120 ECTS and consists of the following:

- Compulsory subject elements, 30 ECTS.
- Restricted elective subject elements, 15 ECTS.
- Elective subject elements, 15 ECTS.
- Thesis, 60 ECTS.

Table – MSc Programme in Molecular Biomedicine (summer)*

<table>
<thead>
<tr>
<th>Block 1</th>
<th>Block 2</th>
<th>Block 3</th>
<th>Block 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular Pathology</td>
<td>Statistics for</td>
<td>Bioinformatics of High Throughput</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Molecular Biomedicine</td>
<td>Analyses</td>
<td></td>
</tr>
<tr>
<td>Restricted elective</td>
<td>Thesis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd year</td>
<td>Elective</td>
<td>Elective</td>
<td>Restricted elective</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*This table only applies to students who starts the thesis before 20 August 2021.

If you are admitted to the programme in September you must start your thesis at block 2, 1st year and submit your thesis report May 31st, 2nd year.
Table – MSc Programme in Molecular Biomedicine (winter)*/**:

<table>
<thead>
<tr>
<th></th>
<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>Statistics for Molecular Biomedicine</td>
<td>Bioinformatics of High Throughput Analyses</td>
<td>Molecular Pathology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Restricted elective</td>
<td></td>
<td>Thesis</td>
<td></td>
</tr>
<tr>
<td>2nd year</td>
<td>Elective</td>
<td>Restricted elective</td>
<td>Elective</td>
<td>Thesis</td>
</tr>
</tbody>
</table>

*This table is only relevant for students who begin the MSc Programme in February (block 3)
**This table only applies to students who starts the thesis before 20 August 2021.

If you are admitted to the programme in February you must start your thesis at block 4, 1st year and submit you thesis report October 31st, 2nd year.

**Restricted elective subject elements**

15 ECTS are to be covered as subject elements from the following list:

| Restricted elective subject elements offered as part of the curriculum (see above) |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| SMOK17001U                      | Development and Clinical Implementation of Innovative Treatment Modalities: From Initial Idea to Clinical Application | Discontinued*                  | 7.5 ECTS                        |
| NBIK18002U                      | Principal Subject in Molecular Cell Biology and Immunology 1 | Discontinued*                  | 7.5 ECTS                        |
| NDAK15007U                      | Machine Learning               | Discontinued*                  | 7.5 ECTS                        |
| NBIK20006U                      | Advanced Topics in Physiology  | Discontinued*                  | 7.5 ECTS                        |
| SBIK10182U                      | From Gene to Function in Pathogenic Bacteria | Discontinued*                  | 7.5 ECTS                        |

*See discontinued courses below.

**Elective subject elements**

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

**4 Discontinued courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>ECTS</th>
<th>Interim arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBIK20006U</td>
<td>Advanced Topics in Physiology</td>
<td>7.5</td>
<td>The course was restricted elective in the academic year 2020/21 and earlier. Offered for the last time: 2020/21</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The course is identical to Advanced Topics in Physiology - Lifestyle Related Diseases (NBIK22000U), 7.5 ECTS</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
<td>Notes</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>---------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| SBIA10210U        | Applied Programming for Biosciences                                         | 7.5     | The course was restricted elective in the academic year 2020/21 and earlier. Offered for the last time: 2020/21
|                   |                                                                               |         | The course is identical to Applied Python Programming for Bio-Medical-sciences (SBIA21001U), 7.5 ECTS.                                                                                                                                                                                                                                                                                                    |
| SMOK17001U        | Development and Clinical Implementation of Innovative Treatment Modalities: From Initial Idea to Clinical Application | 7.5     | The course was restricted elective in the academic year 2018/19 and 2019/20. Offered for the last time: 2019/20
|                   |                                                                               |         | Last exam if applicable (cf. SCIENCE’s Teaching and exam rules): 2020/21.                                                                                                                                                                                                                                                                                                                                                                                       |
| SBIK10182U        | From Gene to Function in Pathogenic Bacteria                                | 7.5     | The course was restricted elective in the academic year 2021/22, 2020/21 and 2019/20. Offered for the last time: 2021/22
|                   |                                                                               |         | The course is identical to Experimental Medical Microbiology: From Gene to Function in Pathogenic Bacteria (SBIK22001U), 7.5 ECTS                                                                                                                                                                                                                                                                               |
| NDAK15007U        | Machine Learning                                                            | 7.5     | The course was restricted elective in the academic year 2021/22 and earlier. Offered for the last time: 2021/22
|                   |                                                                               |         | The course is identical to Machine Learning A (NDAK22000U), 7.5 ECTS                                                                                                                                                                                                                                                                                                                               |
| NBIK18002U        | Principal Subject in Molecular Cell Biology and Immunology 1                | 7.5     | The course was restricted elective in the academic year 2019/20 or earlier. Offered for the last time: 2019/20
|                   |                                                                               |         | Last exam if applicable (cf. SCIENCE’s Teaching and exam rules): 2020/21                                                                                                                                                                                                                                                                                                                                                                                       |
Appendix 3 Description of objectives for the thesis

After completing the thesis, the student should have:

Knowledge about:
- The latest original literature within their chosen thesis field.
- Knowledge about present methods in molecular biomedicine, their individual strengths and weaknesses.
- Statistical theories and methods relevant for the experimental thesis work.
- Bioinformatics tools and methods relevant for the experimental thesis work.

Skills in/to:
- Use an extended array of experimental methods and the associated equipment to analyze a problem in biomedical sciences.
- Maintain a professional level laboratory notebook, detailing all of the student’s experimental work.
- Independently initiate and carry out collaborations both within their field and across scientific fields and take on professional responsibility.
- Communicate research-based knowledge and discuss professional and biomedical problem areas with both fellow specialists and non-specialists.

Competences in/to:
- Formulate, structure and carry out an independent experimental molecular biomedical research project.
- Document their knowledge and experimental work at a level that meets the requirements set out by international scientific publications.
- Discuss their work and its connection to the field in general at a level that meets the requirements set out by international scientific publications.
- Evaluate and choose from within their thesis area’s scientific theories, methods, tools and techniques in order to construct a problem-solving strategy for a hitherto unsolved molecular biomedical problem.
- Identify molecular biomedical problem areas that can be solved experimentally.
- Identify, evaluate and summarize the newest knowledge within a given area of molecular biomedicine.