Programme-specific Section of the Curriculum for the MSc Programme in Molecular Biomedicine at the Faculty of Science, University of Copenhagen

2009 (Rev. 2021)

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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

On completion of the programme, an MSc in Molecular Biomedicine has 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.

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.

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 deemed 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 www.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 21 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):

• SMOK15001U	Molecular Pathology	Block 1+2	15 ECTS
• NBIA08011U	Statistics for Molecular Biomedicine	Block 3	7.5 ECTS
• NBIA07023U	Bioinformatics of High Throughput Analyses	Block 4	7.5 ECTS

6.1.2 Restricted elective subject elements

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

• NBIK15016U	The Human Microbiome	Block 1	7.5 ECTS
• NBIK10015U	Cell Cycle Control and Cancer	Block 1	7.5 ECTS
• NBIK10017U	RNA Biology	Block 1	7.5 ECTS
• NBIA05008U	Biological Sequence Analysis	Block 1	7.5 ECTS

• NBIK15003U	Advanced Bacteriology I	Block 1	7.5 ECTS
• NBIK15017U	Theoretical Molecular Genetics	Block 1	7.5 ECTS
• SBIK19001U	Basic Immunology	Block 1	7.5 ECTS
• NIFK14026U	Entrepreneurship and Innovation	Block 1	7.5 ECTS
• SBIK19002U	Current and Experimental Immunology	Block 2	7.5 ECTS
• NBIK15013U	Genome Sequence Analysis	Block 2	7.5 ECTS
• NBIK10020U	Developmental Biology	Block 2	7.5 ECTS
• NBIK15010U	Epigenetics and Cell Differentiation	Block 2	7.5 ECTS
• NBIK15005U	Advanced Bacteriology 2	Block 2	7.5 ECTS
• SBIK10182U	From Gene to Function in Pathogenic Bacteria	Block 2	7.5 ECTS
• NDAK15007U	Machine Learning	Block 2	7.5 ECTS
• NBIA05014U	Structural Bioinformatics	Block 2	7.5 ECTS
• SBIA21001U	Applied Python Programming for Bio-Medical-sciences	Block 2	7.5 ECTS
• NDAK16003U	Introduction to Data Science (IDS)	Block 3	7.5 ECTS
• SFAK20007U	Entrepreneurship in Pharmaceuticals	Block 3	7.5 ECTS
• NBIK14035U	Medical Bacteriology	Block 3	7.5 ECTS
• NBIA08004U	Evolutionary Medicine	Block 3	7.5 ECTS
• LBIK10207U	Synthetic Biology	Block 3	7.5 ECTS
• SMOK14002U	Gene Therapy	Block 3	7.5 ECTS
• SMOK14003U	Chronic Inflammation. From Basic Research to Therapy	Block 3	7.5 ECTS
• NBIK20005U	Cellular and Integrative Physiology	Block 3	7.5 ECTS
• NIFK14032U	Business Development and Innovation	Block 3	7.5 ECTS
• NBIK15014U	Human Genetics	Block 3	7.5 ECTS
• NBIK13017U	Molecular Biotechnology	Block 4	7.5 ECTS
• SFKKIL004U	Neuropharmacology	Block 4	7.5 ECTS
• NBIK20006U	Advanced Topics in Physiology	Block 4	7.5 ECTS
• NIFK14026U	Entrepreneurship and Innovation	Block 4	7.5 ECTS
• NFYK14009U	Physics of Molecular Diseases	Block 4	7.5 ECTS
• SVEK17001U	Laboratory Animal Science Function ABD	Block 1-4	7.5 ECTS
	Project in Practice	Block 1-5	15 ECTS

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 outside the course scope may be included in the elective section of the programme with up to 7.5 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 with up to 15 ECTS. The regulations are described in Appendix 4 to the shared section of the curriculum. Projects in practice may not exceed 15 ECTS in total of the programme. Projects in practice may be written as a combination of the restricted elective and elective section of the

programme. The regulations are described in Appendix 5 to the shared section of the curriculum.

Thesis preparation projects may be included in the elective section of the programme with up to 7.5 ECTS. The regulations are described in Appendix 6 to the shared section of the curriculum.
Projects outside the course scope, projects in practice and thesis preparation projects may not exceed 30 ECTS of the programme.

6.1.4 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.

6.1.5 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 Tables

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

Table – MSc Programme in Molecular Biomedicine

	Block 1	Block 2	Block 3	Block 4
1st year	Molecular Pathology		Statistics for Molecular Biomedicine	Bioinformatics of High Throughput Analyses
	Elective	Restricted elective	Elective	Restricted elective
2nd year	Thesis			

Compulsory | Restricted elective / Elective | 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 Molecular Biomedicine*:

	Block 3	Block 4	Block 1	Block 2
1st year	Statistics for Molecular Biomedicine	Bioinformatics of High Throughput Analyses	Molecular Pathology	
	Elective	Restricted elective	Elective	Restricted elective
2nd year	Thesis			

Compulsory | Restricted elective / Elective | The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

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

Compulsory | Restricted elective | Elective

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

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

	Thesis

Compulsory | Restricted elective / Elective | The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

*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)			
• SBIA10210U	Applied Programming for Biosciences	Discontinued*	7.5 ECTS

*See course specific changes below.

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

2 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)*

	Block 1	Block 2	Block 3	Block 4
1st year	Molecular Pathology		Statistics for Molecular Biomedicine	Bioinformatics of High Throughput Analyses
	Restricted elective	Thesis		
2nd year	Elective	Elective	Restricted elective	
	Thesis			

Compulsory | Restricted elective / Elective | The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

*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)*/:**

Block 3	Block 4	Block 1	Block 2

<table>
<tr><td rowspan="2">1st year</td><td>Statistics for Molecular Biomedicine</td><td>Bioinformatics of High Throughput Analyses</td><td colspan="2">Molecular Pathology</td></tr>
<tr><td>Restricted elective</td><td colspan="3">Thesis</td></tr>
<tr><td rowspan="2">2nd year</td><td>Elective</td><td>Restricted elective</td><td>Elective</td><td rowspan="2"></td></tr>
<tr><td colspan="3">Thesis</td></tr>
</table>

Compulsory | Restricted elective / Elective | The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

*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
• SBIA10210U	Applied Programming for Biosciences	Discontinued*	7.5 ECTS

*See course specific changes below.

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

3 Course specific changes

Discontinued course	Interim arrangement
Applied Programming for Biosciences (SBIA10210U), 7.5 ECTS	The course was a restricted elective course 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.
Development and Clinical Implementation of Innovative Treatment Modalities: From Initial Idea to Clinical Application (SMOK17001U), 7.5 ECTS	The course was a restricted elective course 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.
Principal Subject in Molecular Cell Biology and Immunology 1 (NBIK18002U), 7.5 ECTS	The course was a restricted elective course 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.