Master's Programme in Experimental and Medical Biosciences

Masterprogrammet i experimentell och medicinsk biovetenskap
120 credits

MMEM1

Valid from: 2022 Spring semester

Determined by

Chairman of The Board for First and Second Cycle Programmes

Date determined

2012-05-31

Revised by

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LiU-2012-00930; LiU-2021-01445

Offered first time

Autumn semester 2013

Offered for the last time

Replaced by

Introduction

Linköping University Master's Programme in Experimental and Medical Biosciences comprises four semesters of full time studies, in total 120 credits. Medical Biology is the main field of study of the programme. Scientific methodology, biostatistics and philosophy of science are part of the main field of study. The programme is organized in courses, and experimental and practical work are combined with theoretical knowledge to allow integration of different subjects as well as progression within the programme.

Aim

In the Higher Education Act, Chapter1, section 9 (SFS 1992:1434), the following general learning outcomes for second-cycle courses and study programmes have been established:

Second-cycle courses and study programmes shall be based fundamentally on the knowledge acquired by students during first-cycle courses and study programmes, or its equivalent.
Second-cycle courses and study programmes shall involve the acquisition of specialist knowledge, competence and skills in relation to first-cycle courses and study programmes, and in addition to the requirements for first-cycle courses and study programmes shall:

- further develop the ability of students to integrate and make autonomous use of their knowledge
- develop the students' ability to deal with complex phenomena, issues and situations, and
- develop the students' potential for professional activities that demand considerable autonomy, or for research and development work. (Ordinance 2006:173).

National learning outcomes for a Degree of Master (120 credits)
According to the Higher Education Ordinance (Ordinance 2006:1053), the Qualification Ordinance, the following general qualifications have been established:

Knowledge and understanding
For a Degree of Master (120 credits) the student shall

- demonstrate knowledge and understanding in the main field of study, including both broad knowledge of the field and a considerable degree of specialised knowledge in certain areas of the field as well as insight into current research and development work, and
- demonstrate specialised methodological knowledge in the main field of study.

Competence and skills
For a Degree of Master (120 credits) the student shall

- demonstrate the ability to critically and systematically integrate knowledge and analyze, assess and deal with complex phenomena, issues and situations even with limited information
- demonstrate the ability to identify and formulate issues critically, autonomously and creatively as well as to plan and, using appropriate methods, undertake advanced tasks within predetermined time frames and so contribute to the formation of knowledge as well as the ability to evaluate this work
- demonstrate the ability in speech and writing both nationally and internationally to report clearly and discuss his or her conclusions and the knowledge and arguments on which they are based in dialogue with different audiences, and
- demonstrate the skills required for participation in research and development work or autonomous employment in some other qualified capacity.

Judgement and approach
For a Degree of Master (120 credits) the student shall

- demonstrate the ability to make assessments in the main field of study informed by relevant disciplinary, social and ethical issues and also to demonstrate awareness of ethical aspects of research and development work
- demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and
- demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

Independent project (degree project)
A requirement for the award of a Degree of Master (120 credits) is completion by the student of an independent project (degree project) for at least 30 credits in the main field of study. The degree project may comprise less than 30 credits, however no less than 15 credits, if the student has already completed an independent project in the second cycle for at least 15 credits in the main field of study or the equivalent from a programme of study outside Sweden.

Miscellaneous
Specific requirements determined by each higher education institution itself within the parameters of the requirements laid down in this qualification descriptor shall also apply for a Degree of Master (120 credits) with a defined specialization.

Learning outcomes for the academic Degree of Master of Medical Science (120 credits) in Medical Biology at Linköping University

Knowledge and understanding
For the Degree of Master of Medical Science (120 credits) in Medical Biology at Linköping university the student shall

- display their knowledge and understanding in new or unfamiliar cases and environments within broader and multidisciplinary contexts related to

Medical Biology and life sciences in general
- master and choose modern methodology used within the field of Medical Biology, and
- create an individual profile within medical biology by in-depth theoretical and practical studies.

Skills and abilities
For the Degree of Master of Medical Science (120 credits) in Medical Biology at Linköping university the student shall

- apply problem-solving abilities in multidisciplinary contexts related to Medical Biology
- integrate knowledge and handle complexities in biosciences and related subjects even with limited information
- display originality in developing and applying ideas within Medical Biology research
- independently apply their knowledge in qualified practical investigations, including design, choice of valid techniques, planning, evaluation and time management
- independently analyse and critically evaluate results in the context of current research
- communicate and argue conclusions to specialists and non-specialists clearly and unambiguously in English (both written and oral communication)
- display the skills demanded in research and development or in independent work within other activities, e. g. highly qualified assignments within the labour market such as life science, biotechnological, pharmaceutical and food industries, development and leading of laboratory projects within health care as well as perform research and teaching activities at universities and colleges.
- use student-centered learning methodologies as pedagogical tools and apply them to define problems as well as to search for and evaluate knowledge in order to solve problems arising in future professional practice, and
- show a profound ability to initiate, participate in and undertake work aiming to improve and evaluate activities within Medical Biology.

Judgement and attitudes
For the Degree of Master of Medical Science (120 credits) in Medical Biology at Linköping university the student shall

- formulate analysis of current research in biosciences and its role in society
- reflect on ethical and social responsibilities in biomedical research and development linked to their knowledge and judgements, and
- collaborate with people in international and multidisciplinary environments.

Independent projects
For the award of the Degree of Master of Medical Science (120 credits) in Medical Biology, the student must complete two separate, individual projects; Project in Experimental and Medical Biosciences 15 credits or Project in Experimental and

Medical Biosciences 30 credits, and a Degree Project (Master Thesis) 30 credits. The two projects comprises, altogether, 45-60 credits and must be done within the main field of study, Medical Biology.

Content

The following courses are included in the programme:
Compulsory courses
Laboratory Techniques in Experimental Biosciences, 7.5 credits
After having completed the course, the student shall have acquired proper training for future laboratory work. Common techniques are used and discussed in detail. Further, the purpose is to give students a basis for practical laboratory work at advanced level and to introduce them to work in an independent way in a bioscience laboratory.

Analytical Techniques in Experimental Biosciences, 7.5 credits
During the course, the student shall obtain knowledge of theoretical aspects of study design as well as data collection, data analysis and general statistics used within the field of biosciences and of epidemiology. The student will also gain knowledge in scientific methodologies including the philosophical and scientific aim of research, and quantitative and qualitative methodologies.

Project in Experimental and Medical Biosciences, 15 credits, or Project in Experimental and Medical Biosciences, 30 credits
Within the Project in Experimental and Medical Biosciences, 15 credits, or the Project in Experimental and Medical Biosciences, 30 credits, the student shall work independently under supervision and show the ability to apply formally acquired theoretical as well as practical knowledge on biomedical problems. The project should have a clear medical relevance. Study design, experimental work and/or data collection, and analysis and interpretation of results (own and others) are included in the course.

Degree Project (independent project, Master Thesis), 30 credits
In the Degree Project, resulting in a Master Thesis, undertaken during the second year and comprising 30 credits, the student should show a clear progression of the abilities acquired in the Scientific Project course. The student shall work independently under supervision and show the ability to apply formally acquired theoretical as well as practical knowledge on biomedical problems. The problem studied should have a clear medical relevance. Study design, experimental work and/or data collection, and analysis and interpretation of results (own and others) are included in the course. The project can be performed at a university or in cooperation with companies or local authorities.

Elective courses
Included in the programme syllabus are also elective courses of 60 credits (if Project in Experimental and Medical Biosciences, 15 credits, is chosen) or 45 credits (if Project in Experimental and Medical Biosciences, 30 credits, is chosen). Each elective course (7.5 credits) is focussed on a specific area of Medical Biology. The selection of elective courses could be subject for changes and is laid down at

the latest during the preceding semester.

Academic level
The academic level is obtained after the completion of 120 credits, out of which at least 60 credits are obtained within the main field of study, Medical Biology. According to local regulations at Linköping University, at least 90 credits shall be obtained on an advanced (second-cycle) level.

Course syllabus
Each course within the programme has a course syllabus that can be found on the programme website.

Quality assurance
Evaluation of different elements in the programme is undertaken continuously, which may involve certain changes in organization and contents, see the separate course plans.
The academic level within the main field of study is attained by supervision by qualified scientists and by performing experiments and individual projects in excellent research environments.
Electronic evaluation of the courses will also take place in accordance with Linköping University regulations.

Individual study plan
An individual study plan shall be established for each student, where courses and individual projects are planned together with a mentor. The focus of the programme is on preparation for research, but the individual study plan and the flexibility in choice of courses also enables the creation of profiles to clearly enhance employability immediately after the programme is completed. In order to stimulate cross-disciplinary collaboration, networking between students with different educational backgrounds is stimulated by enabling the students work in small, cohesive groups. There are possibilities to include other courses, for instance courses in chemistry, biology, economics, entrepreneurship or quality assurance, in the individual curriculum after decision from the Programme Committee. Including courses that convey financial costs for the programme will not be approved.

Progression in the main field of study
All courses, both compulsory and elective, included in the programme syllabus shall give in-depth knowledge in the main field of study, Medical Biology. Further progression in Medical Biology, is obtained through the two independent projects included in the syllabus, and a clear progression from the Project in Experimental and Medical Biosciences to the Degree Project is required.

Examination
Examination normally takes place at the end of each course. It should provide feedback to the student and the programme about the fulfilment of learning outcomes. The result of an examination determines whether the student has acquired adequate knowledge and skills within the relevant area. Examinations of theoretical and practical knowledge are arranged individually and in groups. Different forms of examination occur, and may also take the form of in-depth studies, reports and seminars. For each course, the specific examination forms are

stated in the course plan.

Number of opportunities for examination
Re-examination for a student who has failed to pass an examination may take place on a scheduled re-examination date; this is notified at the beginning of the semester, or at the next available regular examination date.
After failing two examinations the student is entitled to support and study guidance from the educational staff, and can demand a change of examiner after failing the same examination on two occasions.

Extent of re-examination
The extent of a re-examination shall be similar to the regular examination.

Entries for examinations
Rules for entries to examination are given in the course plans. In addition, local regulations regarding examinations and examiners laid down by decision of Linköping University apply.

Study counselling
The student's development during the studies is continuously monitored. Students are offered ways to discuss problems, and possible solutions, with the Study Counsellor so that they have every chance of succeeding with their education.

In cases where it is doubtful that a student can complete a course of studies with a pass grade, the teacher or supervisor should through the Director of Studies, initiate an inquiry into the student's situation as early as possible. If this assessment results in the student being advised against continuing the course of studies, the student has the right to guidance together with the Study Counsellor regarding alternative education or choice of a vocation.

Course attendance
A student is allowed to take the same course twice.

Grades
Grades are given by the end of each course and are based on an appraisal of all expected learning outcomes listed in the appropriate course plan. The grades Pass, Pass with Distinction, or Fail are awarded if not stated otherwise. For Project in Experimental and Medical Biosciences, 15 or 30 credits, and Degree Project, 30 credits, the grades of Pass or Fail are awarded.

Teaching and working methods

Linköping University Master's Programme in Experimental and Medical Biosciences applies student-centered learning among which Problem Based Learning (PBL) is one pedagogical philosophy and method. To prepare the students for future employment, practical and experimental work in laboratory settings are important parts of the programme in courses as well as in individual projects.

Main field of study
Medical Biology (LiU 424/98-40)
The main field of study, Medical Biology, is a cross disciplinary subject combining knowledge from areas of biology, medicine and chemistry. It comprises medical issues from the molecular level to strategies for medical treatment. The subject area comprises knowledge in medicine and natural sciences on biological processes in molecular and cellular perspectives in human. Methodological competence for studies within the area is also included in the subject. At least 60 credits of the programme contents are within the main field of study.

Entry requirements

- Bachelor's degree in a major subject area with relevance for biomedical sciences, equivalent to a Swedish Kandidatexamen with a total of at least 90ECTS credits in some of the following subjects:
  -biochemistry
  -cell biology
  -molecular biology
  -genetics
  -gene technology
  -microbiology
  -physiology
  -immunology
  -histology
  -anatomy
  -pathology
- English corresponding to the level of English in Swedish upper secondary education (Engelska 6/B)
  (Exemption from Swedish)

Threshold requirements

For entrance to the third semester of the programme, the courses Laboratory Techniques in Experimental Biosciences, and Analytical Techniques in Experimental Biosciences must be completed.

Special requirements for entrance to the Degree Project
For entrance to the course Degree Project (Master Thesis), at least 60 credits including the courses Laboratory Techniques in Experimental Biosciences, Analytical Techniques in Experimental Biosciences, and Project in Experimental and Medical Bioscience, 15 or 30 credits, must be completed.

Degree in Swedish

Medicine masterexamen i Medicinsk biologi eller Medicine magisterexamen i medicinsk biologi.

Degree in English

Degree of Master of Medical Science (120 credits) in Medical Biology or Degree of Master of Medical Science (60 credits) in Medical Biology.

Common rules

Directions regarding deferment, leave from studies, returning to study, transferring of credits etc are referred to the Linkoping University regulations and to the Faculty of Medicine and Health Sciences Board regulations.

If special circumstances prevail, the vice-chancellor may in a special decision specify the preconditions for temporary deviations from this course syllabus, and delegate the right to take such decisions.

Curriculum

Semester 1 (Autumn 2022)

Course code	Course name	Credits	Level	Weeks	ECV
8MEA02	Analytical Techniques in Experimental Biosciences	7.5	A1X	v202235-202243	C
8MEA06	Laboratory Techniques in Experimental Biosciences	7.5	A1X	v202235-202243	C
8MEA15	Project in Experimental and Medical Biosciences	15	A2E	v202235-202302	E
8MEA20	Project in Experimental and Medical Biosciences	30	A2E	v202235-202302	E
8MEA01	Advanced Immunology	7.5	A1X	v202244-202302	E
8MEA05	Laboratory Animal Sciences	7.5	A1X	v202244-202302	E
8MEA12	Tumour Biology	7.5	A1X	v202244-202302	E
8MEA14	The genetics of complex traits	7.5	A1X	v202244-202302	E

Semester 2 (Spring 2023)

Course code	Course name	Credits	Level	Weeks	ECV
8MEA03	Cardiovascular Biology	7.5	A1X	v202303-202307	E
8MEA15	Project in Experimental and Medical Biosciences	15	A2E	v202303-202322	E
8MEA20	Project in Experimental and Medical Biosciences	30	A2E	v202303-202322	E
8MEA08	Molecular and Medical Pharmacology	7.5	A1X	v202308-202312	E
8MEA10	Neurobiology	7.5	A1X	v202313-202317	E
8MEA04	Infection Biology - Clinical Perspectives	7.5	A1X	v202318-202322	E

Semester 3 (Autumn 2023)

Course code	Course name	Credits	Level	Weeks	ECV
8MEA11	Stem Cells and Applied Regenerative Medicine	7.5	A1X	v202335-202343	E
8MEA13	Molecular Virology	7.5	A1X	v202335-202343	E
8MEA30	Degree Project	30	A2E	v202335-202402	E
8MEA01	Advanced Immunology	7.5	A1X	v202344-202402	E
8MEA12	Tumour Biology	7.5	A1X	v202344-202402	E
8MEA14	The genetics of complex traits	7.5	A1X	v202344-202402	E
8MEA16	Bioinformatics for the Life Sciences	7.5	A1N	v202344-202402	E

Semester 4 (Spring 2024)

Course code	Course name	Credits	Level	Weeks	ECV
8MEA03	Cardiovascular Biology	7.5	A1X	v202403-202407	E
8MEA30	Degree Project	30	A2E	v202403-202422	E
8MEA08	Molecular and Medical Pharmacology	7.5	A1X	v202408-202412	E
8MEA10	Neurobiology	7.5	A1X	v202413-202417	E
8MEA04	Infection Biology - Clinical Perspectives	7.5	A1X	v202418-202422	E

ECV = Elective / Compulsory /Voluntary
*Kursen läses över flera terminer