Bachelor´s Programme in Experimental and Industrial Biomedicine

Kandidatprogrammet i Experimentell och industriell biomedicin
180 credits

MGMB2

Valid from: 2022 Spring semester

Determined by

Chairman of The Board for First and Second Cycle Programmes

Date determined

2017-08-29

Revised by

Revision date

2019-06-03; 2021-05-03

Registration number

LiU-2017-02621; LiU-2019-01899; LiU-2021-01653

Offered first time

Autumn semester 2018

Offered for the last time

Replaced by

Purpose

The Bachelor of Science programme in Experimental and Industrial Biomedicine leads to a general degree in biomedicine at the BSc-level, and prepare for employment or continued studies at the advanced- and research levels. Through project-driven courses from academia, healthcare and industry, students are provided with a multidisciplinary base, latest approaches in project management, and bioentrepreneurship. The purpose of the programme is to train the students to be able to identify, assess and implement biomedical ideas and understand how these concepts can be developed into products in the biomedical field.

Aim

General objectives
In the Higher Education Act (SFS 1992:1434 including updates), the following general objectives for undergraduate level education have been established:

8 § Undergraduate level education should be primarily based on knowledge students receive from national programs at high-school level or equivalent. However, the government may decide on exemptions relating to artistic education.

Education at undergraduate level will develop the students´:

- ability to make independent and critical assessments,
- ability to independently identify, formulate and solve problems,
- preparedness to meet changes in working life.

Within the specific field of education, the students will, in addition to their knowledge and skills, develop the ability to:

- seek and evaluate knowledge at scientific level,
- follow the development of the field,
- exchange knowledge also with people without specialized knowledge in the field.

Degree objectives
Intended learning outcomes for a Bachelor of Science degree according to the Higher Education Act (SFS 1993:100, appendix 2- the Degree Ordinance).

Knowledge and understanding

For a Degree of Bachelor of Science (180 credits) the student must

- demonstrate knowledge and understanding within the main field of the education, including knowledge of the area´s scientific basis, knowledge of relevant methods in the field, in-depth knowledge of specific subjects of the field as well as understanding of current research issues.

Skills and Abilities
For a Degree of Bachelor of Science (180 credits) the student must

- demonstrate the ability to find, gather, evaluate and critically interpret and discuss relevant information regarding a specific problem, events, issues and situations,
- demonstrate the ability to independently identify, formulate and solve problems as well as carry out tasks within given time frames,
- demonstrate the ability to present and discuss information, problems and solutions in dialogue with different groups, both orally and in writing, and
- demonstrate the skills required to work independently within the field of education.

Judgement ability and approach
For a Degree of Bachelor of Science (180 credits) the student must

- demonstrate the ability to make judgments within the main field of education with regard to relevant scientific, social and ethical aspects,
- demonstrate insight into the role of knowledge in society and people´s responsibility for how it is used, and
- demonstrate the ability to identify their need for further knowledge and skills development

Besides the objectives above, after completing the programme, the students will have obtained the higher institution´s local objectives as well as the local objectives of the programme.

Local objectives for the Faculty of Medicine and Health Sciences
The student will, after completing the programme:

- have the ability to critically appraise situations within academia, healthcare and industry in order to motivate and evaluate choice of actions as a professional
- demonstrate knowledge about and understanding of the factors which affect health from a local and global perspective
- have the ability to evaluate and apply knowledge in evidence-based medicine and quality improvement in healthcare

- be able to work for a sustainable and health promoting development of current and coming generations
- have obtained inter-professional skills that enables working in teams with other professions
- demonstrate knowledge and understanding of the importance of equality and equal opportunities in society

Local objectives for the Bachelor´s Programme in Experimental and Industrial Biomedicine

Knowledge and understanding
Upon completion of the programme, the student should be able to:

- Describe the medical and scientific knowledge required to explain human biological and human pathophysiological processes in a molecular and cellular perspective.
- Describe analytical and diagnostic methods in medical biology and basic strategies for medical treatment.
- Demonstrate understanding of different statistical methods and their application in bioinformatics, systems biology and biomedical research.
- Describe the information and analyses required to evaluate an idea for a new activity, within the field of biomedicine, and demonstrate the ability to collect and analyse relevant information for this purpose.

Skills and Abilities
Upon completion of the programme, the student should be able to:

- Critically review relevant information regarding a specific challenge within medical biology.
- Design and solve theoretical and laboratory challenges and correct scientific and statistical approach in new and unknown situations under supervision.
- Discuss information, ideas, problems and solutions in the field of medical biology both orally and in writing in a multidisciplinary approach.
- Apply advanced medical biological laboratory methodology required to work independently in the biomedical field.
- Actively apply project management models in projects where biomedical issues are translated into services or products.

Judgement ability and approach
Upon completion of the programme, the student should be able to:

- Reflect on scientific and ethical aspects of medical biology and the importance of biomedical knowledge for society´s development.
- Critically assess the needs and ideas within biomedicine from a social and commercial perspective.

- Use an entrepreneurial approach to the development and evaluation of biomedical science.

Local profile of the programme

The Bachelor´s Programme in Experimental and Industrial Biomedicine integrates in-depth knowledge of medical biology with the latest experimental methods in biomedical research. Throughout the programme, the students receive practical experience in project management. Students also meet industrial collaborators where they will be trained to translate biomedical knowledge into biomedical applications, in order to prepare for further work in academia, healthcare or business.

Students gain practical experience in modern research methods in cell and molecular biology, drug development, systems biology, developmental biology, pathology, bioinformatics, statistics and computational biology. To ensure that students can apply their knowledge in clinical and industrial settings, project management, leadership, bio-entrepreneurship, quality assurance, medical ethics are integrated through the recurring project courses based on research, healthcare and business issues. Students have the opportunity to spend a semester at an academic or industrial actor in Sweden or abroad.

Content

The programme comprises of 180 credits. The major subject area of the Bachelor ´s Programme in Experimental and Industrial Biomedicine is medical biology. Distribution of subject content is stated in each course syllabus respectively. The programme is given at full-time study pace.

The following courses are included in the programme:

Medical Cell Biology, 6 credits, semester 1
Medicinsk cellbiologi, 6 högskolepoäng, termin 1

General Chemistry, 6 credits, semester 1
Allmän kemi, 6 högskolepoäng, termin 1

Molecular Genetics and Epigenetics, 6 credits, semester 1
Molekylär genetik och epigenetik, 6 högskolepoäng, termin 1

Medical Physiology, 6 credits, semester 1

Medicinsk fysiologi, 6 högskolepoäng, termin 1

Project Course: Biomedical Product Development, 6 credits, semester 1
Projektkurs: Produktutveckling inom biomedicin, 6 högskolepoäng, termin 1

Biochemistry and Organic Chemistry, 6 credits, semester 2
Biokemi och organisk kemi, 6 högskolepoäng, termin 2

Developmental and Stem Cell Biology, 6 credits, semester 2
Utvecklings- och stamcellsbiologi, 6 högskolepoäng, termin 2

Cell Metabolism, Signaling and Biochemistry, 6 credits, semester 2
Cellens metabolism, signalering och biokemi, 6 högskolepoäng, termin 2

Medical Microbiology, 6 credits, semester 2
Medicinsk mikrobiologi, 6 högskolepoäng, termin 2

Project Course: Bioentrepreneurship, 6 credits, semester 2
Projektkurs: Bioentreprenörskap, 6 högskolepoäng, termin 2

Gene Technology and Transgenic Models, 6 credits, semester 3
Genteknologi och transgena modeller, 6 högskolepoäng, termin 3

Immunology, 6 credits, semester 3
Immunologi, 6 högskolepoäng, termin 3

Analytical Chemistry for Medical Applications, 6 credits, semester 3
Analytisk kemi med medicinska applikationer, 6 högskolepoäng, termin 3

Bioinformatics and Statistics, 6 credits, semester 3
Bioinformatik och statistik, 6 högskolepoäng, termin 3

Project Course: Bioinformatics of Big Data, 6 credits, semester 3
Projektkurs: Bioinformatik av stordata, 6 högskolepoäng, termin 3

Pharmacology, 6 credits, semester 4
Farmakologi, 6 högskolepoäng, termin 4

Systems Biology, 6 credits, semester 4
Systembiologi, 6 högskolepoäng, termin 4

Pharmaceutical development, 6 credits, semester 4
Läkemedelsutveckling, 6 högskolepoäng, termin 4

Medical Systems Physiology, 6 credits, semester 4
Medicinsk systemfysiologi, 6 högskolepoäng, termin 4

Project Course: Drug Development, 6 credits, semester 4
Projektkurs: Läkemedelsutveckling, 6 högskolepoäng, termin 4

Degree Project, 30 credits, semester 5
Examensarbete, 30 högskolepoäng, termin 5

Protein Structure and Function, 6 credits, semester 6
Proteinstruktur och funktion, 6 högskolepoäng, termin 6

Pathology and Disease Models, 6 credits, semester 6
Patologi och sjukdomsmodeller, 6 högskolepoäng termin 6

Molecular Imaging and Digital Pathology, 6 credits, semester 6
Molekylär bildbehandling och digital patologi, 6 högskolepoäng termin 6

Advanced Neurobiology, 6 credits, semester 6
Avancerad neurobiologi, 6 högskolepoäng, termin 6

Project Course: Clinical Trial, 6 credits, semester 6
Projektkurs: Klinisk prövning, 6 högskolepoäng, termin 6

Progression

Progression within the main subject area is shown through the learning goals in the course syllabus for each course of the programme as well as by proposed course literature in the resource lists. The programme has project-integrated courses with continuous development in project management in the medical field. During the earlier parts of the programme there is a greater focus on gaining basic theoretical and laboratory knowledge, while the latter parts of the programme increasingly focus on the students being able to use, interpret and develop knowledge in different fields. This will enable students to explain human physiological and biomedical processes, and at a deeper level, understand how biomedical knowledge can be applied to issues in healthcare, industry and academia from a commercial and social perspective.

Teaching and working methods

At the Faculty of Medicine and Health Sciences student centred and problem based learning make up the foundation of the teaching. The student takes responsibility for, studies and researches current content of the courses and study programme. The methods of the course work challenge the students to independently formulate questions for learning, to seek knowledge and in dialogue with others judge and evaluate achieved knowledge. Students work together in groups based on reality based situations to develop their own learning, contribute to co-students´ learning and to practice cooperation. The teacher´s role is to support the students in this way of learning. The programmes consist of subject integrated themes, theoretical and practical modules integrated throughout the study programme. The study programmes at the Faculty of Medicine and Health Sciences cooperate in certain integration modules where inter-professional learning takes place through the participation of students from several professions learning with, about and from each other. The course methods and integration modules stimulate and support the student´s development of professional and inter-professional competencies as well as prepare the student for cooperation in the coming profession.

The Bachelor´s Programme in Experimental and Industrial Biomedicine cooperates with the technical faculty throughout the entire programme, as well as with other actors in academia, healthcare and business through project-integrated courses. Students learn to identify a need or an idea where they can apply their basic biomedical knowledge. During the course of the programme, students can work in teams to develop medical ideas into products or services. The students are well prepared to meet the needs of customers, to implement biomedical knowledge and to manage projects with an entrepreneurial approach. The students are prepared to meet the requirements within project management and communication within their future professions in academia, healthcare and industry.

Entry requirements

General entry requirements for undergraduate studies
and
English, Chemistry, Biology and Mathematics corresponding to the level in Swedish upper secondary education (Engelska 6 or Engelska nivå 2, Kemi 2 or Kemi nivå 2, Biologi 2 or Biologi nivå 2 and Matematik 4 or Matematik fortsättning nivå 2)

Exemption from Swedish

Threshold requirements

The content of each semester is built upon previous semesters and will be conducted in order from semester 1 to 4. For admission to the course thesis work (semester 5), at least 90 credits from semester 1 to 4 are required in the Bachelor´s Programme in Experimental and Industrial Biomedicine.

Courses in semester 6 may be completed before the course exam in semester 5 for those students who have had a study break during semester 5.

Degree thesis

For awarding of a bachelor´s degree, the student must have completed an independent work (degree project) of at least 30 credits in the main field of education, medical biology.

Degree in Swedish

Efter fullbordat program om 180 högskolepoäng utfärdas på begäran av studenten ett examensbevis med benämningen Medicine Kandidatexamen i Medicinsk biologi.

Degree in English

Upon completion of the programme with 180 credits, a degree certificate will be awarded after request from the student with the title Degree of Bachelor of Science in Medical Biology (Medicine Kandidatexamen i Medicinsk biologi).

Specific information

The Bachelor´s Programme in Experimental and Industrial Biomedicine is taught in English.

During semester 5 there is an opportunity for international exchange or collaboration with industrial actors. This work may result in additional costs to the student.

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.

Transition rules

The proposed Bachelor´s Programme in Experimental and Industrial Biomedicine will enter into force on 28 August 2018 and apply to students admitted to the programme from the autumn semester 2018.

From the autumn semester of 2017, courses according to the syllabus established August 29, 2016 (dnr LIU-2015-02323) will be gradually phased out. This means that courses during semester 1 will be given for the last time in autumn semester 2017, courses during semester 2 will be given for the last time during the spring semester 2018, etc. Thus, courses in semester 6 will be given for the last time during the spring semester of 2020. For those students who are not approved in the courses for semester 6 in spring semester of 2020, will have the opportunity for re-examination on three occasions for a period of one year.

Students admitted to the programme before autumn 2018 have the right to carry out a re-examination according to the previous education plan on three occasions within / in connection with the two semesters that follow after each course is given for the last time.

The Programme Director decides on individual study plans and forms of examination for students who have passed and followed the previous education plan and who, due to the termination of studies or for other reasons, did not complete the studies by the spring semester of 2021.

Curriculum

Semester 1 (Autumn 2026)

Course code	Course name	Credits	Level	Weeks	Timetable module	ECV
8BKG18	Medical Physiology	6	G1N	v202645-202702	3	C
8BKG12	Medical Cell Biology	6.0	G1X	v202634-202644	1/3	C
8BKG13	General Chemistry	6.0	G1X	v202634-202644	2	C
8BKG16	Project Course: Biomedical Product Development	6.0*	G1X	v202634-202702	4	C
8BKG16	Project Course: Biomedical Product Development	6.0*	G1X	v202634-202702	4	C
8BKG17	Molecular Genetics and Epigenetics	6	G1X	v202645-202702	1/2	C

Semester 2 (Spring 2027)

Preliminary courses

Course code	Course name	Credits	Level	Weeks	Timetable module	ECV
8BKG25	Project Course: Bioentrepreneurship	6.0*	G2X		4	C
8BKG26	Biochemistry and Organic Chemistry	6	G1X		1/3	C
8BKG33	Gene Technology and Transgenic Models	6.0	G2X		2	C
8BKG23	Cell Metabolism, Signaling and Biochemistry	6.0	G2X		1/3	C
8BKG24	Medical Microbiology	6.0	G1X		2	C
8BKG25	Project Course: Bioentrepreneurship	6.0*	G2X		4	C

Semester 3 (Autumn 2027)

Preliminary courses

Course code	Course name	Credits	Level	Weeks	Timetable module	ECV
8BKG22	Developmental and Stem Cell Biology	6.0	G2X		3	C
8BKG34	Immunology	6.0	G2X		1/2	C
8BKG37	Bioinformatics and Statistics	6.0*	G1X		4	C
8BKG35	Analytical Chemistry for Medical Applications	6.0	G1X		4	C
8BKG36	Project Course: Bioinformatics of Big Data	6.0	G2X		1/2	C
8BKG37	Bioinformatics and Statistics	6.0*	G1X		3	C

Semester 4 (Spring 2028)

Preliminary courses

Course code	Course name	Credits	Level	Weeks	Timetable module	ECV
8BKG43	Pharmacology	6.0	G2X		1/3	C
8BKG45	Systems Biology	6.0	G2X		2	C
8BKG47	Project Course: Drug Development	6.0*	G2X		4	C
8BKG44	Pharmaceutical Development	6.0	G2X		2	C
8BKG46	Medical Systems Physiology	6.0	G2X		1/3	C
8BKG47	Project Course: Drug Development	6.0*	G2X		4	C

Semester 5 (Autumn 2028)

Preliminary courses

Course code	Course name	Credits	Level	Weeks	Timetable module	ECV
8BKG51	Degree Project	30.0	G2E		-	C

Semester 6 (Spring 2029)

Preliminary courses

Course code	Course name	Credits	Level	Weeks	Timetable module	ECV
8BKA61	Protein Structure and Function	6.0	A1X		1/3	C
8BKG68	Pathology and Disease Models	6.0	G2X		2	C
8BKG69	Project Course: Clinical Trial	6.0*	G2X		4	C
8BKG66	Molecular Imaging and Digital Pathology	6.0	G2X		1/3	C
8BKG67	Neurobiology	6.0	G2X		2	C
8BKG69	Project Course: Clinical Trial	6.0*	G2X		4	C

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