

Master program of the Faculty of Science Leiden University

- Descriptions
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Onderwijs en examenregeling FWN Bijlage deel 2 - Masteropleiding

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Leiden University offers five tracks of an MSc program in mathematics. Two of these correspond to research specialisations in the Leiden Mathematical Institute. The remaining three are the mathematics track of the research MSc with Science-Based Business (SBB), and the Communication and Education specializations.

The duration of each program is two years (120 ects). Students who complete the program receive the degree Master of Science in Mathematics, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Program Committee. An Admission Committee will advise on admissions.

Candidates with an BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. Individual combinations of the research programs, with research projects from different groups, are possible in principle, depending on the decision by the Exam Committee. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English. Further information is available on the website <http://www.math.leidenuniv.nl/>

The goal of each program is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

Track

Algebra, Geometry and Number theory

Description

The MSc program Algebra, Geometry and Number theory leads students to a high level of knowledge in this area. It consists of advanced courses from the field and a final research project including a master thesis and an oral presentation of it. Students with this MSc in Mathematics are admissible to a PhD program. The program is suited as preparation for an academic career, in particular via a subsequent PhD study, but also for a career as mathematical researcher outside the universities.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Mathematics or with a BSc major in Mathematics will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in optional courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

For each student a program will be tailored individually. It consists of a choice of advanced courses (at least 60 ects) from algebra, algebraic and analytic number theory and algebraic and differential geometry, a research project (at least 40 ects), and a free choice of courses from any field (maximum 20 ects); required is a total of at least 120 ects.

Track

Applied mathematics

Description

The MSc program Applied Mathematics leads students to a high level of knowledge in this area. It consists of advanced courses from the field and a final research project including a master thesis and an oral presentation of it. Students with this MSc in Mathematics are admissible to a PhD program. The program is particularly suited as preparation for a career as mathematical researcher in industry, government and other institutions, but also for an academic career, in particular via a subsequent PhD-study.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Mathematics or with a BSc major in Mathematics will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in optional courses in the MSc program may be limited by the need to adapt the program to the present -knowledge of the candidate.

Program

For each student a program will be tailored individually. It consists of a choice of advanced courses (at least 60 ects) on differential equations and dynamical systems, analysis of industrial problems, probability theory, statistics, numerical analysis and operations research, a research project (at least 40 ects), and a free choice of courses from any field (maximum 20 ects); required is a total of at least 120 ects.

Track

Mathematics and Science-Based Business

Description

The MSc program Mathematics and Science-Based Business (SBB) prepares students for a career in science-related business and administration and for innovation and enterprise from a mathematical perspective. In addition to knowledge in mathematics, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with an MSc in Mathematics and Science-Based Business are also admissible to a PhD program.

In order to get an SBB Master annotation, a minimal program consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the “free choice” part of the research MSc programs “Algebra, Geometry and Number theory” and “Applied Mathematics”.

Qualifications for admission

Students from any university in The Netherlands will be admitted to the program with a BSc degree in Mathematics or with a BSc major in Mathematics.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in optional courses in the MSc program may be limited by the need to adapt the program to the present-knowledge of the candidate.

Program

Mathematics

The Mathematics component of the Science-based Business (SBB) specialization consists of a research project of 40 ects in one of the research groups of the Leiden Mathematical Institute, including a master’s thesis and an oral presentation, 20 ects of courses to be selected in correspondence with the research topic, and a mathematical project connected with the SBB training period (see below).

Science Based Business

The Business-related part of the complete SBB program consists of 40 to 60 ects of the following components.

<i>Mandatory:</i>	<i>40+ ects</i>
SBB Fundamentals	17 ects
SBB Internship	23-34 ects
<i>Optional:</i>	<i>0-20 ects</i>
Orientation on Entrepreneurship	5 or 10 ects
SBB managerial roles	3 ects
Other courses or literature study to be chosen In the context of the SBB program	0-20 ects
Extension of the research component	0-20 ects

Track

Mathematics and Communication

Description

The MSc program Mathematics and Communication concerns science communication in a broad sense. The program prepares students for a career in popularisation of science, for example, as a science writer or public relations officer. The program includes a 60-ects Mathematics program. Students with an MSc in Mathematics and Education are also admissible to a PhD program.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Mathematics or with a BSc major in Mathematics will be admitted to the program.

For other all (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc program has included the 10-ects-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Program

Mathematics (60 ects)

The Mathematics component of the Communication specialization consists of a research project of 40 ects in one of the research groups of the Leiden Mathematical Institute, including a master's thesis and an oral presentation, and 20 ects of courses to be selected in correspondence with the research topic.

Communication (60 ects)

The MSc program Mathematics and Communication consists of the following components:

A training period for one of three key specialisations, (i) science writing, (ii) multimedia, or (iii) musea	30 ects
Two courses to be chosen from a non-Mathematics program	8 ects
A project concerning education	14 ects
Optional courses related to communication and/or general knowledge of natural sciences	8 ects

Track Mathematics and Education

Description

The MSc program Mathematics and Education prepares students for a career in teaching Mathematics. The program includes a 60-ects Mathematics program. Students with an MSc in Mathematics and Education are also admissible to a PhD program.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Mathematics or with a BSc major in Mathematics will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc program has included the 10-ects-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Program

Mathematics (60 ects)

The Mathematics component of the Education specialization consists of a research project of 40 ects in one of the research groups of the Leiden Mathematical Institute, including a master's thesis and an oral presentation, and 20 ects of courses to be selected in correspondence with the research topic.

Education (60 ects)

The Education option of the MSc program Mathematics and Education is offered by the Leiden Graduate School of Education (ICLON) and consists of the following components:

Didactics	13 ects
Professional functioning	10 ects
Educational research	7 ects
School training	30 ects

This program is adequate to obtain the so-called "eerste graads lesbevoegdheid" needed for teaching at Dutch high schools.

MSc Computer Science

Crohonummer 60300

The Leiden Institute of Advanced Computer Science (LIACS) is the computer science institute of Leiden University. The LIACS curriculum includes five MSc tracks in computer science. Two of these correspond to research specialisations of LIACS, the remaining three are the computer science track of the research MSc with Science-Based Business (SBB), and the Communication and Education specializations. In addition, LIACS offers two Master programs in ICT and Business, and Mediatechnology, respectively.

The duration of each program is two years (120 ects). Students who complete the program receive the degree Master of Science in Computer Science, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Program Committee. An Admission Committee will decide on admissions.

Candidates with an BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English.

The goal of each program is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

Track

Core Computer Technologies

Description

This MSc program is intended to provide students with a thorough computer science background that will allow them to pursue careers in research or industrial environments. The strength of the program is its individual approach: for each student an individually tailored program will be designed. This program consists of courses, research and a Master's thesis project. The research directions are embedded systems, high performance computing and digital life technologies.

Qualification for admission

Students from any university in The Netherlands with a BSc degree in Computer Science or with a BSc major in Computer Science will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in optional courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program is 120 ects in extent, and consists of compulsory and optional courses (40 ects in total), an optional project (20 ects), and two research projects (60 ects in total).

<i>Components</i>	<i>Level</i>	<i>ECTS</i>
Specialisation courses	500	23
Minor subject	500	17
Option: software project or project study	500	20
Research project	600	17
Master's thesis project	600	43

Track

Computer Science Theory and Advanced Technologies

Description

The MSc program is intended to provide students with a thorough computer science background that will allow them to pursue careers in research or industrial environments. The strength of the program is its individual approach: for each student an individually tailored programme will be designed. This program consists of courses, research and a Master's thesis project. The research directions are theoretical computer science, algorithms and program methodology, software engineering and information systems.

Qualification for admission

Students from any university in The Netherlands with a BSc degree in Computer Science or with a BSc major in Computer Science will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in optional courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program is 120 ects in extent, and consists of compulsory and optional courses (40 ects in total), an optional project (20 ects), and two research projects (60 ects in total).

<i>Components</i>	<i>Level</i>	<i>ECTS</i>
Specialization courses	500	23
Minor subject	500	17
Option: software project or project study	500	20
Research project	600	17
Master's thesis project	600	43

Track

Computer Science and Science-Based Business

Description

The MSc program Computer Science and Science Based Business prepares students for a career in science-related business and administration and for innovation and enterprise from a computer science perspective. In addition to knowledge in computer science, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with an MSc in Computer Science and Science Based Business are also admissible to a PhD program.

In order to get an SBB Master annotation, a minimal program consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the "free choice" part of the research MSc programs "Core Computer Technologies" and "Computer Science Theory and Advanced Technologies".

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Computer Science or with a BSc major in Computer Science will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training.

Program

Computer Science

The computer science component of the Science based Business (SBB) specialization consists of a research project of 40 ects in one of the research groups of LIACS, including a master's thesis and an oral presentation, and 20 ects of level-500 courses to be selected in

correspondence with the research topic. The choices for courses and research project will be made in concert with a supervisor.

Science Based Business

The Business-related part of the complete SBB program consists of 40 to 60 ects of the following components.

<i>Mandatory:</i>	<i>40+ ects</i>
SBB Fundamentals	17 ects
SBB Internship	23-34 ects
<i>Optional:</i>	<i>0-20 ects</i>
Orientation on Entrepreneurship	5 or 10 ects
SBB managerial roles	3 ects
Other courses or literature study to be chosen In the context of the SBB program	0-20 ects
Extension of the research component	0-20 ects

Track

Computer Science and Communication

Description

The MSc program Computer Science and Communication concerns science communication in a broad sense. The program prepares students for a career in popularisation of science, for example, as a science writer or public relations officer. The program includes a 60-ects Computer Science program.

Students with an MSc in Computer Science and Communication are also admissible to a PhD program.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Computer Science or with a BSc major in Computer Science will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc program has included the 10-ects-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Program

Computer Science (60 ects)

The computer science component of the Science based Business (SBB) specialization consists of a research project of 40 ects in one of the research groups of LIACS, including a master's thesis and an oral presentation, and 20 ects of level-500 courses to be selected in correspondence with the research topic. The choices for courses and research project will be made in concert with a supervisor.

Communication (60 ects)

The MSc program Computer Science and Communication consists of the following components:

A training period for one of three key specialisations,

(i) science writing, (ii) multimedia, or (iii) museums 30 ects

Two courses to be chosen from a non-Computer Science program 8 ects

A project concerning education 14 ects

Optional courses related to communication
and/or general knowledge of natural sciences 8 ects

Track

Computer Science and Education

Description

The MSc program Computer Science and Education prepares students for a career in teaching Computer Science or Mathematics. The program includes a 60-ects Computer Science program. Students with an MSc in Computer Science and Education are also admissible to a PhD program.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Computer Science or with a BSc major in Computer Science will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc program has included the 10-ects-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Program

Computer Science (60 ects)

The Computer Science part of the Education specialization consists of a research project of 40 ects in one of the research groups of LIACS, including a master's thesis and an oral presentation, and 20 ects of level-500 courses to be selected in correspondence with the research topic. The choices for courses and research project will be made in concert with a supervisor.

Education (60 ects)

The Education option of the MSc program Computer Science and Education is offered by the Leiden Graduate School of Education (ICLON) and consists of the following components:

Didactics	13 ects
Professional functioning	10 ects
Educational research	7 ects
School training	30 ects

This program is adequate to obtain the so-called "eerste graads lesbevoegdheid" needed for teaching at Dutch high schools.

MSc ICT in Business

Crohonummer 60205

The Leiden Institute of Advanced Computer Science (LIACS) is the computer science institute of Leiden University. In addition to five MSc tracks in computer science, LIACS offers a separate Master program in ICT and Business.

The duration of the program is two years (120 ects). Students who complete the program receive the degree Master of Science in ICT and Business. Details are provided below. An Admission Committee will decide on admissions.

Candidates with an BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English.

Description

This MSc program connects ICT and the science of industrial organisation. A student will obtain knowledge and insight in underlying mechanisms and ideas rather than only the ability to use techniques and tools in the field of ICT and business. Acquirement of insight is possible only when a student has practical experience with the appropriate technologies. As a consequence, the program contains many hands-on aspects.

An important topic in the program is the process of design and construction of information systems in the context of an enterprise. Especially in this area, ICT and business are connected. An "information-architect" aims at realisation of the enterprise objectives on the basis of a deep understanding of the elements of information architectures. Teamwork is an important component of the program, to motivate and learn from each other and to prepare for a career in an industrial environment.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Computer Science or with a BSc major in Computer Science will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence of their previous training to these BSc degrees. Applications are wellcome especially from students with a BSc in "Informatiekunde", a succesfully completed HIO-study or HBO-study in Computer Science or "Informatiekunde". Applications will be judged with observance of specific work- and training experience with regard to ICT in business.

Program

The program consists of four phases with a duration of six months each.

1. *Fundamentals*

In phase 1, Business fundamentals, the students obtain insight in the principles of Management & Organization, Financial Economy and Marketing.

2. *The core*

Phase 2 is the core of the program. This phase aims at learning how to find integral solutions for problems in organization. Mostly, these solutions are found by multidisciplinary teams. Correspondingly, the students work in such teams. This phase offers the following courses, among others: E-Commerce & E-Law, Supply Chain Management, E-Procurement, Expert Systems for Decision Support, Enterprise Resource Planning Systems and Entrepreneuring.

3. *Research task for or in an enterprise*

Phase 3 includes a research task for or in an enterprise *performed by a group of students*. Colloquia will be held as well as a short lecture series concerning specific subjects.

4. *Master thesis phase*

The final phase consists of the production of a Master's thesis.

As a result, the program consists of the following components:

<i>Component</i>	<i>Level</i>	ECTS
Management Game	400	1
Business Fundamentals	400	29
ICT Strategy	500	10
ICT Vision	500	10
Business Process Innovation	500	10
Software Engineering	500	10
Project management	500	5
Project	500	15
Colloquia & training in skills	500	5
Optional courses	500	10
Thesis	600	15

MSc Mediatechnology

Crohonummer 60206

The Leiden Institute of Advanced Computer Science (LIACS) is the computer science institute of Leiden University. In addition to five MSc tracks in computer science, LIACS offers a separate Master program in Mediatechnology. The duration of this program is two years (120 ects). Students who complete the program receive the degree Master of Science in Mediatechnology. Details are provided below. An Admission Committee will decide on admissions.

Candidates with an BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English.

Description

This Master program aims at innovative application of technology rather than at innovation of technology: how can innovation be realized with use of technology. As a Master program, the curriculum focuses on underlying principles of specific software and skills. The first part of the program consists of lectures and practical courses. This part is followed by projects to be realized by a small team. These projects always contain a media component: visual, auditive or else.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Computer Science or with a BSc major in Computer Science will be admitted to the program. For all other (international) candidates, the Admission Committee will judge the equivalence of their previous training to these BSc degrees. Applications are wellcome especially from students with a BSc in "Informatiekunde", a successfully completed HIO-study or HBO-study in Computer Science or "Informatiekunde". Applications will be judged with observance of specific work- and training experience with regard to Mediatechnology.

Program The program is 120 ects in extent, and consists of a series of compulsory courses (49 ects in total), an optional subject (14 ects), two workshops, three projects and a project study (all together 62 ects).

<i>Component</i>	<i>Level</i>	ECTS
Sense Interference	400	3
Project Management	400	2
Programming	400	4
HCI	500	4
Multimedia systems	500	6
Image & Sound	500	4
Language & Text	500	3
Journal	500	6
Colloquium	500	4
Webtechnology	500	4
Mediahistory	500	3
Conference / Museum	500	3
Meta Media	500	3
Optional subject	500	14
Project I	500	22
Free project	500	3
Project study	500	6
Workshop I	500	3
Workshop II	500	6
Project II	600	22

MSc Astronomy

Crohonummer 60200

Leiden Observatory, the oldest university astronomy department in the world, offers four tracks of an MSc program in astronomy. The research track focuses on two major research themes, (i) formation and evolution of galaxies, and (ii) birth and death of stars. The remaining three are the astronomy track of the research MSc with Science-Based Business (SBB), and the Communication and Education specializations.

The duration of each program is two years (120 ects). Students who complete the program receive the degree Master of Science in Astronomy, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Program Committee. An Admission Committee will decide on admissions.

Candidates with an BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English.

Aim of each program is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

Track

Research in Astronomy

Description

This 2-year program consists of advanced astronomy courses, two research projects in astronomy, and courses outside of astronomy. It prepares the student for independent research in astronomy.

Qualifications for admission

Students with a BSc in Astronomy from universities who participate in the NOVA research school will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Students with Bachelors degrees in other sciences such as mathematics, physics, or chemistry can also apply for enrollment. However, they may be required to take introductory courses in astronomy before they can be accepted.

Program

<i>year 1</i>	ECTS
first research project	30
astronomy courses	18
non-astronomy courses	12
<i>year 2</i>	
Masters research project	30, including 1 for colloquium
astronomy courses	18
non-astronomy courses	12

The astronomy courses can be chosen from the different courses offered every year. The course Stellar Evolution is compulsory for all.

The research projects will be supervised by a staff member. The two projects should be of a different nature and be supervised by a different person.

The program will be adapted for Masters students who have not followed the entire Astronomy Bachelors program. The first research project can be reduced to 15 ECTS, and the number of courses in astronomy will be increased. The students will take these additional courses in the first semester, if possible. These additional courses can be selected from the normal courses in the

Masters curriculum, and from the following courses in the Bachelors curriculum: Stars, Radiative Processes, Galaxies and Cosmology. These students may also add astronomy courses at the cost of the non-astronomy courses, after approval of the student advisor and exam committee.

Track

Astronomy and Science-Based Business

Description

The MSc program Astronomy and Science Based Business prepares students for a career in science-related business and administration and for innovation and enterprise from a physical/astronomical perspective. In addition to knowledge in astronomy and physics, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with an MSc in Astronomy and Science Based Business are also admissible to a PhD program.

In order to get an SBB Master annotation, a minimal program consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the “free choice” part of the research MSc program “Astronomy”.

Qualifications for admission

Students with a BSc in Astronomy from universities who participate in the NOVA research school or with a BSc major in Astronomy will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training.

Program

Astronomy

The astronomy component of the Science based Business (SBB) specialization consists of a research project of 30 ects in one of the research groups of the Leiden Observatory, including a master’s thesis and an oral presentation, and 30 ects of courses to be selected in correspondence with the research topic. The latter courses may include non-astronomy courses up 8-14 ects.

Science Based Business

The Business-related part of the complete SBB program consists of 40 to 60 ects of the following components.

<i>Mandatory:</i>	<i>40+ ects</i>
SBB Fundamentals	17 ects
SBB Internship	23-34 ects
<i>Optional:</i>	<i>0-20 ects</i>
Orientation on Entrepreneurship	5 or 10 ects
SBB managerial roles	3 ects
Other courses or literature study to be chosen In the context of the SBB program	0-20 ects
Extension of the research component	0-20 ects

Track

Astronomy and Communication

Description

The MSc program Astronomy and Communication concerns science communication in a broad sense. The program prepares students for a career in popularisation of science, for example, as a science writer or public relations officer. The program includes a 60-ects Astronomy program. Students with an MSc in Physics and Education are also admissible to a PhD program.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Astronomy, or Physics with an Astronomy major, will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc program has included the 10-ects-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Program

Astronomy (60 ects)

The astronomy component of the Astronomy and Communication specialization consists of a research project of 30 ects in one of the research groups of the Leiden Observatory, including a master's thesis and an oral presentation, and 30 ects of courses to be selected in correspondence with the research topic. The latter courses may include non-astronomy courses up 8-14 ects.

Communication (60 ects)

The communication option of the MSc program Astronomy and Communication consists of the following components:

A training period for one of three key specialisations, (i) science writing, (ii) multimedia, or (iii) musea	30 ects
Two courses to be chosen from a non-Astronomy program	8 ects
A project concerning education	14 ects
Optional courses related to communication and/or general knowledge of natural sciences	8 ects

Track

Astronomy and Education

Description

The MSc program Astronomy and Education prepares students for a career in teaching physics (and astronomy). The program includes a 60-ects Astronomy program.

Students with an MSc in Astronomy and Education are also admissible to a PhD program.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Astronomy, or Physics with an Astronomy major, will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc program has included the 10-ects-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Program

Astronomy (60 ects)

The astronomy component of the Astronomy and Education specialization consists of a research project of 30 ects in one of the research groups of the Leiden Observatory, including a master's thesis and an oral presentation, and 30 ects of courses to be selected in correspondence with the research topic. The latter courses may include non-astronomy courses up to 8-14 ects.

Education (60 ects)

The Education option of the MSc program Astronomy and Education is offered by the Leiden Graduate School of Education (ICLON) and consists of the following components:

Didactics	13 ects
Professional functioning	10 ects
Educational research	7 ects
School training	30 ects

This program is adequate to obtain the so-called "eerste graads lesbevoegdheid" needed for teaching at Dutch high schools.

MSc Physics

Crohonummer 60202

Leiden University offers eight tracks of an MSc program in physics. Four of these correspond to different research groups in the Leiden Institute of Physics (LION). The fifth track, NanoScience, is offered in collaboration with the Technical University Delft. The remaining three are the physics track of the research MSc with Science-Based Business (SBB), and the Communication and Education specializations.

The duration of each program is two years (120 ects). Students who complete the program receive the degree Master of Science in Physics, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Program Committee. An Admission Committee will decide on admissions.

Candidates with an BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English. Further information is available on the website <http://www.physics.leidenuniv.nl>

The goal of each program is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

Track

Quantum optics and quantum information

Description

This program concentrates on the basic knowledge and expertise in the field of modern optics in general, in particular as it relates to the emerging field of quantum information. A student will gain experience in a variety of experimental techniques and application of light sources and optical instrumentation, in situations in which quantum coherence and entanglement is created and applied. It is also possible to work on theoretical research projects. Typically, the student will participate in two ongoing projects in the field, and thereby will be trained in the basic aspects of scientific research. A participant in this program will spend 40 ects on following courses and preparing exams. The remaining 80 ects will be spent on research work in the group, the preparation of a master's thesis, and contributions to group seminars.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Physics or Astronomy, including in-depth knowledge of optics, quantum physics and electrodynamics, will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program contains two research projects (40 ects each), and compulsory and optional courses (40 ects in total).

Compulsory components

Course on Quantum Optics and Quantum Information	10 ects
Course on Quantum Theory	10 ects
Research project 1	40 ects
Research project 2	40 ects

Optional components

Additional courses	20 ects
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These additional courses can be selected, depending on the research project, from the set of courses available in the MSc Physics Program or related fields.

Track

Biological and Molecular Physics

Description

Research in the field of biological and molecular physics at the Leiden Institute of Physics (LION) is aimed at the interaction between light and matter, the photophysics of optically excited states of (bio)molecules, and the conformational dynamics of proteins. The objective of these studies is to establish at the molecular level the relationship between structure and function of biomolecules. This research involves a range of advanced methods of optical and magnetic resonance spectroscopy, and the application of state-of-the-art imaging techniques such as single-molecule fluorescence microscopy and scanning-probe imaging.

Participants in this MSc program will join the Section of Biological and Molecular Physics, and will work under close supervision on two different, consecutive research projects of 40 ects each, to broaden the scope of their education. In addition, the student will have to acquire 40 ects in various courses specified below.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Physics will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, students with a BSc degree in Chemistry or Biology are invited to apply. The choice in optional courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program contains two research projects (40 ects each), and compulsory and optional courses (40 ects in total).

Compulsory components

At least two of the following three courses:

Molecular Physics	6 ects
Biological Physics	6 ects
Two-level systems	6 ects
Research project I	40 ects
Research project II	40 ects

Optional components

Courses to be selected from:

Topics in Biophysics	4 ects
Laser Physics	6 ects
Linear and nonlinear spectroscopy	6 ects
Quantum Theory	6 ects
Scanning probe microscopy	6 ects
Single molecule optics	6 ects
Statistical and Thermal Physics	6 ects
Cell Biology	6 ects

Track

Theoretical Physics

Description

The Theoretical Physics specialization in the MSc Physics program prepares the student for scientific research towards the PhD in a broad range of topics in Theoretical Physics. The master will also be well-equipped for industrial research or other problem-solving tasks that demand strong analytical and computational skills.

A participant in this program will spend the first year following courses (60 erts), some in an interactive format, and the second year on a research project under supervision of one of the theoretical physicists at the Leiden Institute of Physics (LION), completed by writing a master's thesis and by giving an oral presentation (total 60 erts).

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in physics, with in-depth knowledge of undergraduate courses with theoretical and mathematical emphasis: quantum physics, electrodynamics, statistical physics, and complex analysis, will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The first year is devoted to compulsory courses (20 erts) and optional courses (40 erts). The second year is devoted to research (60 erts).

First year:

The *compulsory courses* are:

Quantum Theory	10 erts
Caput Theoretical Physics	10 erts

The 'Caput Theoretical Physics' has a topic that varies from year to year, and has an interactive format in the sense that weekly meetings consist of presentations by the participating students.

The *optional courses* consist of at least two Theoretical Physics master courses, to be selected from the set:

Theory of Condensed Matter	10 erts
Advanced Quantum Theory	10 erts
Quantum Field Theory	10 erts
Theory of General Relativity	10 erts
Quantum Optics and Quantum Information	10 erts
Statistical Physics	10 erts
Computational Physics	10 erts

(Some courses are not provided every year.)

Other optional courses can be taken in Mathematics or (General) Physics. A maximum of one master course can be taken anywhere at Leiden University.

Second year:

Research project	45 erts
Master's thesis	10 erts
Oral presentation	5 erts

Track Condensed Matter Physics

Description

Condensed matter physics concerns the study of the fundamental properties of solids and quantum liquids at the microscopic level, and uses the acquired understanding to develop new model systems and new materials. This often requires the development of new concepts to describe the collective behaviour of dense interacting systems. A student will gain experience in condensed matter research, which in Leiden spans a wide variety of different phenomena, different materials and different techniques. Typically a student will perform two projects (about 40 erts each) in ongoing research programmes, to be trained as an independent researcher by working in one of the groups in the Condensed Matter section (see webpage <http://www.physics.leidenuniv.nl/sections/cm/welcome.htm>), but in fact the research component has considerable flexibility. Timely planning with the study advisor and the supervisor is required.

Qualifications for admission

Students from all universities in the Netherlands with a BSc degree in Physics will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc degree with a major in a related field, such as Astronomy, Chemistry or Mathematics, and a minor in Physics will be considered. The choice in optional courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

Compulsory components

Research project 1	40 erts
Research project 2	40 erts
Course Capita Selecta Condensed Matter Physics	6 erts

Optional components

Courses to be selected according to research projects	34 erts
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Courses from which one can choose:

Quantum Theory	10 erts
Theory of Condensed Matter	10 erts
Surface physics	6 erts
Scanning probe microscopy	6 erts
Superconductivity	6 erts
Advanced Quantum Theory	10 erts

Track NanoScience

Description

Nanoscience is the study of phenomena and object (such as single molecules or atoms) on the nanoscale. Ultimately, nanotechnology aims development of fundamentally new systems with novel properties by controlling these systems on the nanoscale. Goal of this MSc program is to educate students in both technology and science on the nanometer scale, and to instil a deep understanding of this field that originates from the contributing disciplines. Beyond the principle of learning 'just a bit of everything', the NanoScience program will adapt an integrated, multidisciplinary, intellectual strategy, with contributions from physics, chemistry and (molecular)

biology. The program will produce graduates with a natural ability to be creative and inventive towards new applications and instrumentation. It opens the door to a career in industry as well as to a PhD program.

The MSc program in NanoScience enables students to take full advantage of the scientific, technological and educational expertise and facilities available at Leiden University and Delft University of Technology.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Physics will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a minor in Physics and a BSc in biochemistry, chemistry, molecular biology or materials science are encouraged to apply. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program (120 ects)

The program consists of courses (60 ects), an industrial training period (12 ects) and a Master project (48 ects).

Compulsory components

Introduction Quantum Mechanics, or Introduction in Biochemistry		6 ects
Nanotechnologies, Biophysics and/or Biophysical Structure Chemistry and/or Soft Condensed Matter	at least	6 ects
Quantum physics and chemistry and/or Mesoscopic Physics and/or Molecular Electronics	at least	6 ects
Industrial Training Period		12 ects
Master thesis research project		48 ects

Elective components 36 ects

Track

Physics and Science-Based Business

Description

The MSc program Physics and Science Based Business prepares students for a career in science-related business and administration and for innovation and enterprise from a physical perspective. In addition to knowledge in physics, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with an MSc in Physics and Science Based Business are also admissible to a PhD program.

In order to get an SBB Master annotation, a minimal program consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the “free choice” part of the research MSc programs “Core Computer Technologies” and “Condensed Matter Physics”.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Physics will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a major in Physics and a minor in a related field, such as Astronomy, Chemistry or Mathematics, will be considered.

Program

Physics

The physics component of the Science based Business (SBB) specialization consists of a research project of 40 ects in one of the research groups of the Leiden Institute of Physics (LION), including a master's thesis and an oral presentation, and 20 ects of courses to be selected in correspondence with the research topic.

Science Based Business

The Business-related part of the complete SBB program consists of 40 to 60 ects of the following components.

<i>Mandatory:</i>	<i>40+ ects</i>
SBB Fundamentals	17 ects
SBB Internship	23-34 ects
<i>Optional:</i>	<i>0-20 ects</i>
Orientation on Entrepreneurship	5 or 10 ects
SBB managerial roles	3 ects
Other courses or literature study to be chosen In the context of the SBB program	0-20 ects
Extension of the research component	0-20 ects

Track

Physics and Communication

Description

The MSc program Physics and Communication concerns science communication in a broad sense. The program prepares students for a career in popularisation of science, for example, as a science writer or public relations officer. The program includes a 60-ects Physics program. Students with an MSc in Physics and Communication are also admissible to a PhD program.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Physics will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a major in Physics and a minor in a related field, such as Astronomy, Chemistry or Mathematics, will be considered. Preferably, the BSc program has included the 10-ects-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Program

Physics (60 ects)

The physics component of the Physics and Communication specialization consists of a research project of 40 ects in one of the research groups of the Leiden Institute of Physics (LION), including a master's thesis and an oral presentation, and 20 ects of courses to be selected in correspondence with the research topic.

Communication (60 ects)

The communication part of the MSc program Physics and Communication consists of the following components:

A training period for one of three key specialisations, (i) science writing, (ii) multimedia, or (iii) musea	30 erts
Two courses to be chosen from a non-Physics program	8 erts
A project concerning education	14 erts
Optional courses related to communication and/or general knowledge of natural sciences	8 erts

Track

Physics and Education

Description

The MSc program Physics and Education prepares students for a career in teaching Physics. The program includes a 60-erts Physics program.

Students with an MSc in Physics and Education are also admissible to a PhD program.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Physics will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a major in Physics and a minor in a related field, such as Astronomy, Chemistry or Mathematics, will be considered. Preferably, the BSc program has included the 10-erts-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Program

Physics

The physics component of the Physics and Education specialization consists of a research project of 40 erts in one of the research groups of the Leiden Institute of Physics (LION), including a master's thesis and an oral presentation, and 20 erts of courses to be selected in correspondence with the research topic.

Education (60 erts)

The Education option of the MSc program Physics and Education is offered by the Leiden Graduate School of Education (ICLON) and consists of the following components:

Didactics	13 erts
Professional functioning	10 erts
Educational research	7 erts
School training	30 erts

This program is adequate to obtain the so-called "eerste graads lesbevoegdheid" needed for teaching at Dutch high schools.

MSc Chemistry

Crohonummer 66857

The Leiden Institute of Chemistry (LIC) is the basis for research and collaborations of the Leiden chemistry groups. LIC offers six tracks of an MSc program in chemistry. Three of these correspond to major research themes in LIC. The remaining three are the chemistry track of the research MSc with Science-Based Business (SBB), and the Communication and Education specializations.

The duration of each program is two years (120 ects). Students who complete the program receive the degree Master of Science in Chemistry, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Program Committee. An Admission Committee will decide on admissions.

Candidates with an BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English. Further information is available on the website <http://wwwchem.leidenuniv.nl>.

Aim of each program is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

Track

Biological Chemistry

Description

In the Master program Biological Chemistry, students are trained in understanding and application of the chemistry of biomacromolecules. After successful completion of the program, the students have extensive knowledge at the molecular level of structure and interactions of biomacromolecules, and master the skills to obtain this knowledge. Furthermore, they have insight in biochemical processes at the cellular level and at the level of the organism. They can communicate with cell biologists and biotechnologists in a multidisciplinary (and, if appropriate, industrial) team. The program is internationally oriented, and students are stimulated to take courses abroad.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Chemistry (specialization Chemistry of Life) or in Life Science and Technology will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Notably, applicants with a BSc in Chemistry (specialization Chemistry of Matter), in Sustainable Molecular Science and technology, and in Biology, as well as HBO Bachelors and foreign students with an equivalent BSc will be considered. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program contains two training periods (35 and 17 ects), including a written report and an oral presentation and compulsory and optional courses (68 ects).

Compulsory components

Biophysical Structure Chemistry	6 ects
Bioinformatics	4 ects
Cellular signalling	4 ects
Research project I	35 ects
Research project II (preferably abroad)	17 ects

Colloquium	6 icts
<i>Optional components</i>	
A selection of courses in Biological Chemistry	14 icts
A selection of courses in Physical and Theoretical Chemistry and/or Design and Synthesis	12-34 icts
Free choice	22-0 icts

Track

Physical and Theoretical Chemistry

Description

In the Master program Physical and Theoretical Chemistry, students are trained in a quantitative description of nature, with a focus on “understanding” rather than on “making”. Dependent on the subject of choice, ranging from a quantum-mechanical description of chemical reactions to “mimicking” the origin of life, the students gains extensive knowledge of experimental research, theoretical research and/or computer calculations.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Chemistry (specialization Chemistry of Matter), in Sustainable Molecular Science and Technology, or with a BSc Major in Chemistry/minor Physics or Major Physics/minor Chemistry will be admitted to the program. For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Notably, applicants with a BSc in Chemistry (specialization Chemistry of Life), in Life Science and Technology, in Biology, in Physics, as well as HBO Bachelors and foreign students with an equivalent BSc will be considered. The choice in optional courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program contains two research periods (35 and 17 icts), including a written report and an oral presentation and compulsory and optional courses (68 icts).

Compulsory components

Three of the next five courses:

1. Advanced Soft Matter	6 icts
2. Biophysical Structural Chemistry	6 icts
3. Molecular quantum mechanics and molecular modelling	4 icts
4. Quantum Chemistry	6 icts
5. Colloid and Interface Science	6 icts

Research project I	35 icts
Research project II (preferably abroad)	17 icts
Colloquium	6 icts

Optional components

A selection of courses in Physical and Theoretical Chemistry	12-16 icts
A selection of courses in Biological Chemistry and/or Design and Synthesis	12-28 icts
Free choice	22-0 icts

Track

Design and synthesis

Description

After successful completion of the Master program Design and Synthesis, students have extensive knowledge of the structure of molecules, reactivity of molecules, the course of biological processes and design and synthesis of molecules.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Chemistry (specialization Chemistry of Matter), and in Sustainable Molecular Science will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Notably, applicants with a BSc in Chemistry (specialization Chemistry of Life), in Life Science and Technology, in Biology, as well as HBO Bachelors and foreign students with an equivalent BSc will be considered. The choice in optional courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program contains two research periods (35 and 17 erts), including a written report and an oral presentation and compulsory and optional courses (68 erts).

Compulsory components

Advanced Organic Chemistry	11 erts
Bio-inorganic Chemistry	5 erts
Research project I	35 erts
Research project II	17 erts
Colloquium	6 erts

Optional components

A selection of courses in Design and Synthesis	12 erts
A selection of courses in Biological Chemistry and/or Physical and Theoretical Chemistry	12-34 erts
Free choice	22-0 erts

Track

Chemistry and Science-Based Business

Description

The MSc program Chemistry and Science Based Business prepares students for a career in science-related business and administration and for innovation and enterprise from a chemical perspective. In addition to knowledge in Biological Chemistry, Physical and Theoretical Chemistry or Design and Synthesis, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with an MSc in Chemistry and Science Based Business are also admissible to a PhD program.

In order to get an SBB Master annotation, a minimal program consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the "free choice" part of the research MSc programs "Biological Chemistry", "Physical and Theoretical Chemistry" and "Design and Synthesis".

Qualifications for admission

Students from any university in The Netherlands with a BSc in Chemistry or with a BSc Major in Chemistry will be admitted to the program.

For other (international) candidates, such as HBO Bachelors, the Admission Committee will judge the equivalence to these BSc degrees of their previous training.

Program

Chemistry

The Chemistry component of the Science based Business (SBB) specialization consists of a research project of 20 erts in one of the research groups of LIC, including a master's thesis and an oral presentation, and 54-34 erts of courses in Biological Chemistry, Physical and Theoretical Chemistry and/or Design and Synthesis, to be selected in correspondence with the research topic, and a general colloquium (6 erts). The choices for courses and research project will made in concert with an advisor.

Science Based Business

The Business-related part of the complete SBB program consists of 40 to 60 erts of the following components.

<i>Mandatory:</i>	<i>40+ erts</i>
SBB Fundamentals	17 erts
SBB Internship	23-34 erts
<i>Optional:</i>	<i>0-20 erts</i>
Orientation on Entrepreneurship	5 or 10 erts
SBB managerial roles	3 erts
Other courses or literature study to be chosen In the context of the SBB program	0-20 erts

Track

Chemistry and Communication

Description

The MSc program Chemistry and Communication concerns science communication in a broad sense. The program prepares students for a career in popularisation of science, for example, as a science writer or public relations officer. The program includes a 60-erts Chemistry program.

Students with an MSc in Chemistry and Communication are also admissible to a PhD program.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Chemistry or with a BSc Major in Chemistry will be admitted to the program.

For other (international) candidates, such as HBO Bachelors, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc program has included the 10-erts-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Program

Chemistry (60 erts)

The Chemistry component of the Communication specialization consists of a research project of 20 erts in one of the research groups of LIC, including a master's thesis and an oral presentation, and 34 erts of courses in Biological Chemistry, Physical and Theoretical Chemistry and/or Design and Synthesis, to be selected in correspondence with the research topic and a general colloquium (6 erts). The choices for courses and research project will made in concert with an advisor.

Communication (60 ects)

The communication part of the MSc program Chemistry and Communication consists of the following components:

A training period for one of three key specialisations, (i) science writing, (ii) multimedia, or (iii) musea	30 ects
Two courses to be chosen from a non-Chemistry program	8 ects
A project concerning education	14 ects
Optional courses related to communication and/or general knowledge of natural sciences	8 ects

Track **Chemistry and Education**

Description

The MSc program Chemistry and Education prepares students for a career in teaching Chemistry. The program includes a 60-ects Chemistry program.

Students with an MSc in Chemistry and Education are also admissible to a PhD program.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Chemistry or with a BSc Major in Chemistry will be admitted to the program.

For other (international) candidates, such as HBO Bachelors, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc program has included the 10-ects-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Program

Chemistry (60 ects)

The Chemistry component of the Education specialization consists of a research project of 20 ects in one of the research groups of LIC, including a master's thesis and an oral presentation, and 34 ects of courses in Biological Chemistry, Physical and Theoretical Chemistry and/or Design and Synthesis, to be selected in correspondence with the research topic and a general colloquium (6 ects). The choices for courses and research project will be made in concert with an advisor.

Education option (60 ects)

The Education option of the MSc program Chemistry and Education is offered by the Leiden Graduate School of Education (ICLON) and consists of the following components:

Didactics	13 ects
Professional functioning	10 ects
Educational research	7 ects
School training	30 ects

This program is adequate to obtain the so-called "eerste graads lesbevoegdheid" needed for teaching at Dutch high schools.

MSc Bio-Pharmaceutical Sciences Crohonummer 60207

Students in the Center for Bio-Pharmaceutical Sciences (CBPS) of Leiden University are trained for a research career in drug research and development, not for a career as a (public) pharmacist. CBPS offers eight tracks of an MSc program in Bio-Pharmaceutical Sciences (BPS). Five of these correspond to major research themes in CBPS. The remaining three are the bio-pharmaceutical track of the research MSc with Science-Based Business (SBB), and the Communication and Education specializations.

The duration of each program is two years (120 erts). Students who complete the program receive the degree Master of Science in Bio-Pharmaceutical Sciences, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Program Committee. An Admission Committee will decide on admissions.

Candidates with an BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English. Further information is available on the website www.bfw.leidenuniv.nl

Aim of each program is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

Track

Medicinal Chemistry

Description

The MSc program Medicinal Chemistry trains for junior drug researchers, and prepares students for a career in medicinal chemistry.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, or Pharmacy will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc (or equivalent) in Chemistry, Life Science and Technology, as well as HBO Bachelors in Chemistry with an equivalent BSc will be considered. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program contains two research periods (52 and 30 erts), and compulsory and optional program components (38 erts).

Compulsory components

Lecture series 1 (in BPS)	4 erts
Lecture series 2 (in BPS)	4 erts
Research project I (Medicinal chemistry; including Master's thesis and oral presentation)	52 erts
Research project II (preferably in another discipline of BPS)	30 erts
20 Lectures and Colloquia	1 erts
Literature study plus thesis	7 erts

Optional components

Additional courses or traineeships	22 erts
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Track

Analytical Bio-Sciences

Description

The MSc program Analytical Bio-Sciences (Analytical Chemistry) trains for junior drug researchers, and prepares students for a career in analytical chemistry.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, or Pharmacy will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc (or equivalent) in Chemistry, Life Science and Technology, as well as HBO Bachelors in Chemistry with an equivalent BSc will be considered. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program contains two research periods (52 and 30 erts), and compulsory and optional program components (38 erts).

Compulsory components

Lecture series 1 (in BPS)	4 erts
Lecture series 2 (in BPS)	4 erts
Research project I (Analytical Bio-Sciences; including Master's thesis and oral presentation)	52 erts
Research project II (preferably in another discipline of BPS)	30 erts
20 Lectures and Colloquia	1 erts
Literature study plus thesis	7 erts

Optional components

Additional courses or traineeships	22 erts
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Track

Pharmacology

Description

The MSc program Pharmacology trains for junior drug researchers, and prepares students for a career in pharmacology.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, or Pharmacy will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc (or equivalent) in Biology or Biomedical Sciences, as well as HBO Bachelors in Biomedical Sciences with an equivalent BSc will be considered. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program contains two research periods (52 and 30 erts), and compulsory and optional program components (38 erts).

Compulsory components

Lecture series 1 (in BPS)	4 erts
Lecture series 2 (in BPS)	4 erts

Research project I (Pharmacology, Medical Pharmacology, Clinical Pharmacology; including Master's thesis and oral presentation)	52 ects
Research project II (preferably in another discipline of BPS)	30 ects
20 Lectures and Colloquia	1 ects
Literature study plus thesis	7 ects

Optional components

Additional courses or traineeships	22 ects
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Track

Pharmaceutical Technology and Biopharmaceutics

Description

The MSc program Pharmaceutical Technology and Biopharmaceutics trains for junior drug researchers, and prepares students for a career in pharmaceutical technology and/or biopharmaceutics.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, or Pharmacy will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc (or equivalent) in Biology, Biomedical Sciences, Chemistry, Life Science and Technology, as well as HBO Bachelors in Chemistry or Biomedical Sciences with an equivalent BSc will be considered. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program contains two research periods (52 and 30 ects), and compulsory and optional program components (38 ects).

Compulsory components

Lecture series 1 (in BPS)	4 ects
Lecture series 2 (in BPS)	4 ects
Research project I (Pharmaceutical technology or Biopharmaceutics; including Master's thesis and oral presentation)	52 ects
Research project II (preferably in another discipline of BPS)	30 ects
20 Lectures and Colloquia	1 ects
Literature study plus thesis	7 ects

Optional components

Additional courses or traineeships	22 ects
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Track

Toxicology

Description

The MSc program Toxicology trains for junior drug researchers, and prepares students for a career in toxicology.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, or Pharmacy will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc (or equivalent) in Biomedical Sciences, Chemistry, Life Science and Technology, as well as HBO Bachelors in Chemistry or Biomedical Sciences with an equivalent BSc will be considered. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program contains two research periods (52 and 30 erts), and compulsory and optional program components (38 erts).

Compulsory components

Lecture series 1 (in BPS)	4 erts
Lecture series 2 (in BPS)	4 erts
Research project I (Toxicology; including Master's thesis and oral presentation)	52 erts
Research project II (preferably in another discipline of BPS)	30 erts
20 Lectures and Colloquia	1 erts
Literature study plus thesis	7 erts

Optional components

Additional courses or traineeships	22 erts
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Track

Bio-Pharmaceutical Sciences and Science-Based Business

Description

The MSc program Bio-Pharmaceutical Sciences and Science Based Business trains for junior drug researchers, who consider a career in science-related business and administration, preparing for innovation and enterprise from a bio-pharmaceutical perspective. In addition to knowledge in Bio-Pharmaceutical Sciences, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with an MSc in Bio-Pharmaceutical Sciences and Science Based Business are also admissible to a PhD program.

In order to get an SBB Master annotation, a minimal program consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the "free choice" part of the research MSc programs "Medicinal Chemistry", "Analytical Bio-Sciences", "Pharmacology", "Pharmaceutical Technology and Biopharmaceutics" and "Toxicology".

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, or Pharmacy will be admitted to the program.

For all other (international) candidates, such as HBO Bachelors, the Admission Committee will judge the equivalence to these BSc degrees of their previous training.

Program

Bio-Pharmaceutical Sciences

The Bio-Pharmaceutical component of the Science Based Business (SBB) specialization consists of a research project of 51 erts in one of the research groups of CBPS, including a master's thesis and an oral presentation, two lecture series of 4 erts each, and attendance of at least 20 colloquia or seminars (1 erts). The choices for lecture series and research project will made in concert with an advisor.

Science Based Business

The Business-related part of the complete SBB program consists of 40 to 60 erts of the following components.

<i>Mandatory:</i>	<i>40+ ects</i>
SBB Fundamentals	17 ects
SBB Internship	23-34 ects
<i>Optional:</i>	<i>0-20 ects</i>
Orientation on Entrepreneurship	5 or 10 ects
SBB managerial roles	3 ects
Other courses or literature study to be chosen In the context of the SBB program	0-20 ects
Extension of the research component	0-20 ects

Track

Bio-Pharmaceutical Sciences and Communication

Description

The MSc program Bio-Pharmaceutical Sciences and Communication concerns science communication in a broad sense. The program prepares students for a career in popularisation of science (especially bio-pharmaceutical sciences), for example, as a science writer or a public relations officer. The program includes a 61-ects Bio-Pharmaceutical Sciences program. Students with an MSc in Bio-Pharmaceutical Sciences and Communication are also admissible to a PhD program.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, or Pharmacy will be admitted to the program. For all other (international) candidates, such as HBO Bachelors, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Applicants must provide proof of proficiency in Dutch.

Program

Bio-Pharmaceutical Sciences

The Bio-Pharmaceutical component of the Communication specialization consists of a research project of 51 ects in one of the research groups of CBPS, including a master's thesis and an oral presentation, two lecture series of 4 ects each, and attendance of at least 20 colloquia or seminars (1 ects). The choices for lecture series and research project will be made in concert with an advisor.

Communication

The communication option of the MSc program Bio-Pharmaceutical Sciences and Communication consists of the following components:

A training period for one of three key specialisations, (i) science writing, (ii) multimedia, or (iii) musea	30 ects
Two courses to be chosen from a non-Bio-Pharmaceutical program	8 ects
A project concerning education	14 ects
Optional courses related to communication and/or general knowledge of natural sciences	8 ects

This program, including the additional courses, should be established in concert with the department of science-didactics of the faculty.

Track

Bio-Pharmaceutical Sciences and Education

Description

The MSc program Bio-Pharmaceutical Sciences and Education prepares students for a career in teaching Chemistry or Biology. The program includes a 53-ects Bio-Pharmaceutical Sciences program.

Students with an MSc in Bio-Pharmaceutical Sciences and Education are also admissible to a PhD program.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, Pharmacy or Chemistry will be admitted to the program.

For all other (international) candidates, such as HBO Bachelors, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc program has included the 10-ects-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Program

Bio-Pharmaceutical Sciences (60 ects)

The Bio-Pharmaceutical component of the Education specialization consists of a research project of 51 ects in one of the research groups of CBPS, including a master's thesis and an oral presentation, two lectures series of 4 ects each, and attendance of at least 20 colloquia or seminars (1 ects). The choices for lecture series and research project will be made in concert with an advisor.

Education)

The Education part of the MSc program Bio-Pharmaceutical Sciences and Education is offered by the Leiden Graduate School of Education (ICLON) and consists of the following components:

Didactics	13 ects
Professional functioning	10 ects
Educational research	7 ects
School training	30 ects

This program is adequate to obtain the so-called "eerste graads lesbevoegdheid" needed for teaching at Dutch high schools.

MSc Life Science and Technology

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The living cell is central in Life Science and Technology. Life Science & Technology offers five tracks of an MSc program, resulting from the collaboration of Leiden University and the Technical University of Delft. Each of four tracks corresponds to a research area in the field of life sciences and technology. The fifth track consists of the combination of a research program with a specialization in Science Based Business.

The duration of each program is two years (120 ECTS). Students receive the degree Master of Science in Life Science & Technology after completion of the program, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Program Committee. An Admission Committee will advise on admissions.

Candidates with an BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English. Further information is available on the website www.lst.leidenuniv.nl or www.lst.tudelft.nl

Aim of the programs is to train the student as an independent researcher and to develop the necessary skills and proficiency to advance his/her career.

Track

Cell Factory

Description

Cell factory is the most process-oriented track of the MSc program. It concerns cells operating as factories as well as in factories. The student focuses on gaining all information and skills necessary for the industrial application of (parts of) living organisms in the production of valuable components. Consequently, this educational program focuses strongly on technological aspects such as fermentation technology, as well as on purification and formulation aspects of a biotechnological product on its way to the end consumer, in addition to modern molecular biology with its basis in genomics and physiology.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Life Science & Technology will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the applications.

Applicants with a BSc or HBO degree in a related field of science will be considered. In general, the committee will compare the BSc, HBO etc. program of the candidate with the BSc-LS&T program. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program consists of a research project (45 ects), and compulsory and optional program components (75 ects). The program has two variants, one of which can be chosen.

Compulsory components

(i) Profile courses

Analysis of metabolic networks	5 ects
Metabolic reprogramming	5 ects
Bioprocess integration	5 ects

Variant "Cells in factories"

-Fermentation technology	3 ects
-Bioseparations	3 ects

-Bioconversion technology	3 ects
Variant "Cells as factories"	
- Metabolic diversity	3 ects
- Industrial genomics	3 ects
- Molecular cell biology IV	3ects
(ii) General courses	
- Ethics and technology	6 ects
- Literature study (colloquium)	4 ects
- Design project	11 ects
- Company traineeship	13 ects
(iii) Researchproject in Cell Factory	45 ects
<i>Optional courses</i>	17 ects

Track Cell Diagnostics

Description

This program focuses on development and implementation of methods, techniques and instruments in order to obtain the maximum of information about the living cell. This applies to all organizational levels, from molecule through subcellular structure to the whole cell, in vitro and in situ. In addition to acquiring new fundamental knowledge, the development of new medicines is one of the most important applications. Cell diagnostics is absolutely a bio-instrumentational track in which the definition 'Biorecognition' - the detailed specificity of binding, interaction and biocatalysis through biomolecules -is central. A well-grounded knowledge of biological systems is essential in protein chemistry and protein technology, cell biology, immunobiology, bio -organic and bio-anorganic chemistry. In addition, the student is introduced to new developments in physics, spectroscopy, electron microscopy, (micro)electronics, micro array techniques, image processing and image interpretation as well as in bio-informatics.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Life Science & Technology will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the applications. Applicants with a BSc or HBO degree in a related field of science will be considered. In general, the committee will compare the BSc, HBO etc. program of the candidate with the BSc-LS&T program. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program consists of a research project (45 ects), and compulsory and optional program components (75 ects).

Compulsory components

(i) Profile courses (24 ects from the following courses)

Biotechnology: from molecular defect to molecular therapy	3 ects
Microbiology of man, animals, food and environment	3 ects
Modern drug development technology	3 ects
Advanced bioinformatics	3 ects
Microtechnology in biomedical technology	4 ects
Biophysics	6 ects
Forensic Science	3 ects
Metals in biology and medicine	3 ects

(ii) General courses

- Ethics and technology	6 ects
- Literature study (colloquium)	4 ects
- Design project	11 ects
- Company traineeship	13 ects

(iii) Researchproject in Cell Diagnostics

45 ects

Optional courses

17 ects

Track

Functional Genomics

Description

This program is characterised by the in-depth study of molecular genetics and cell biology with emphasis on those processes which play a role in regulation of information transport in the cell. In addition, the student gains insight and skills in modern analysis (genomics, proteomics, single cell/single molecule spectroscopy) and recombinant DNA/PCR technologies. A thorough understanding of Bioinformatics is essential in view of the complexity and enormity of the data sets which are generated.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Life Science & Technology will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the applications. Applicants with a BSc or HBO degree in a related field of science will be considered. In general, the committee will compare the BSc, HBO etc. program of the candidate with the BSc-LS&T program. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program consists of a research project (46 ects), and compulsory and optional program components (74 ects).

Compulsory components

(i) Profile courses

Bioinformatics 2	4 ects
Bioinformatics 3	4 ects
Transcriptome & proteome analysis	5 ects
Biophysical structure determination	6 ects
Gene expression	5 ects

(ii) General courses

- Ethics and technology	6 ects
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- Literature study (colloquium)	4 ects
- Design project	11 ects
- Company traineeship	13 ects
(iii) Research project in Functional Genomics	45 ects
<i>Optional courses</i>	17 ects

Track Living Matter

Description

This program concerns the identification of molecular structures and mechanisms and research of the physical principles underlying cellular organisation. This is the most fundamental track, literally focused on the 'Science of Life'. Students will learn to understand living processes in terms of models, rules, laws and theories. Currently, a fundamental, theoretical description of the majority of biological processes is unknown. In order to arrive at a meaningful understanding of nature, it is important to discover regularities or laws in nature. This approach is evident in the Systems Biology where biological processes are described in model form without knowledge of the underlying theory. Graduates with the Living Matter profile will have accumulated in-depth knowledge stretching from physics and chemistry through mathematics and informatics to molecular biology. Whilst mathematical skills are important for a more quantitative description, the emphasis in these modules lies more on the application rather than the precise definition of mathematical rules. The interdisciplinary nature of the Living Matter profile means that both theoretical and experimental internship positions are possible in both Leiden University and TU Delft within a large number of research groups, in particular chemistry, biochemistry, biophysics, theoretical biology, mathematics and informatics.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Life Science & Technology will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the applications. Applicants with a BSc or HBO degree in a related field of science will be considered. In general, the committee will compare the BSc, HBO etc. program of the candidate with the BSc-LS&T program. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program

The program consists of a research project (46 ects), and compulsory and optional program components (74 ects).

Compulsory components

(i) Profile courses (*besides Systems Biology 18 ects from the other courses*)

Systems Biology	6 ects
Dynamic energy budgets	4 ects
Biological physics	6 ects
Mathematical modelling in development and evolutionary biology	4 ects
Prebiotic life	4 ects
Bioinformatics 2	4 ects
Bioinformatics 3	4 ects
Biophysical structure determination	6 ects

(ii) General courses	
- Ethics and technology	6 erts
- Literature study (colloquium)	4 erts
- Design project	11 erts
- Company traineeship	13 erts
(iii) Researchproject in Living Matter	45 erts
<i>Optional courses</i>	17 erts

Track

Life Science & Technology and Science-Based Business

Description

This MSc program prepares students for a career in science-related business and administration and for innovation and enterprise from an LS&T perspective. In addition to knowledge obtained from one of the above mentioned programs, students obtain competence with respect to organisation, people in organisations and establishment and management of processes.

Students with an MSc in Life Science & Technology and Science-Based Business are also admissible to a PhD program.

In order to get an SBB Master annotation, the minimal program consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the "free choice" part of the research MSc programs mentioned above.

Program

Life Science and Technology

Compulsory courses of the chosen profile (Cell Factory, Cell Diagnostics, Functional Genomics or Living Matter). 24 erts

Compulsory general courses

Ethics & technology	6 erts
Literature study	4 erts
Design project	11 erts

Research project in the chosen profile (Cell Factory, Cell Diagnostics, Functional Genomics or Living Matter). 35 erts

Science-based business

SBB fundamentals	17 erts
SBB internship	23 erts

Leiden University offers nine different tracks of an MSc program in Biology. Five of these concern science-based MSc programs within the Institute of Biology, Leiden (IBL). One (Sustainability and Biodiversity) is a joint MSc with the Centre of Environmental Studies (CML). The remaining three are the Biology track of the research MSc with Science-Based Business (SBB), and the Education and Communication specializations.

The duration of each program is two years (120 erts). Students who complete the program receive the degree Master of Science in Biology, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Program Committee. An Admission Committee will decide on admissions.

Candidates with an BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English.

The goal of each program is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

Track

Evolutionary and Ecological Sciences

Description:

The Master track Evolutionary and Ecological Sciences provides students with a general understanding of the research field, including the latest scientific developments. The students can analyse scientific literature and recognise relevant and interesting scientific problems on the basis of scientific and social developments and practical situations. The students can translate these problems into scientifically testable hypotheses and can design an adequate research strategy. They can formulate simple problems in the form of mathematical formulas or simulation models in such a way that they can be analysed. They are able to analyse scientific data and to formulate scientific conclusions on the basis of these data. They can deliver adequate oral and written presentations of their research projects.

With a completed Master program, the students should be well equipped to start a PhD-project in one or more of the following disciplines: evolutionary biology, (plant- and animal) ecology, behavioural biology, and theoretical biology or to function in a position in which evaluation or commission of research projects is an important element.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Biological Sciences will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc or a specific HBO degree in other natural sciences and life sciences will be considered. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program (120 erts)

The program consists of one or two research projects (56-74 erts), and compulsory and optional program components (46-64 erts). The compulsory profile course includes the following elements: statistics, genetics and topics in theoretical ecology. The MSc thesis project, either one project lasting 9-12 months or two of 6 months each, will be carried out within one of the IBL research groups on Plant Ecology, Animal Ecology, Theoretical Biology, Evolutionary Biology or Behavioural Biology

Compulsory components

Profile course Evolutionary and Ecological Sciences.....	25 ects
Seminar	4 ects
MSc thesis projects	56 - 74 ects

Optional components

Additional courses or project time 35 - 17 ects

Track

Experimental Animal Sciences

Description

This MSc track provides students with knowledge about organism-level processes in a range of animal species. Emphasis will be on developing critical skills and judgement necessary for planning and executing experiments, and for analysing data. The subject areas covered include physiology, developmental biology, including normal and abnormal development, behavioural biology, evolution and development (evo-devo), neurobiology and morphology. Students will learn scientific methods and selected lab techniques by carrying out an in-depth research project in one of the participating groups: Integrative Zoology, Behavioural Biology and Evolutionary Biology. This course will form an ideal foundation for students who want to pursue a career in zoological or biomedical research. Students will also be given the opportunity to gain a certificate in 'dierproefkunde' as part of the course (this qualification is required for the handling of experimental animals). Vertebrates, in particular fish and birds, are emphasised as main model systems.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Biological Sciences will be admitted to the program. For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc or a specific HBO degree in other natural sciences, life sciences and biomedical sciences will be considered. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program (120 ects)

The program consists of one extensive MSc research project (56-74 ects), and compulsory and optional program components (46-64 ects), which may include a second research project. The students must attend the introductory course, which includes guided self-study in the basic underlying facts and principles of experimental animal sciences. The MSc thesis project can be performed in any of the research groups of Integrative Zoology, Behavioural Biology or Evolutionary Biology.

Compulsory components

Profile course	20 ects
Seminar	4 ects
MSc thesis project	56-74 ects

Optional components

Additional courses, of which the "Experiments with Animals" course (4 ects) is strongly recommended, or additional project time 40-22 ects

Track Experimental Plant Sciences

Description:

In addition to training in general academically skills, the Masters track Experimental Plant Sciences provides students with up-to-date knowledge about general and specific molecular genetic and physiological aspects of plant growth and development as well as the responses of plants to biotic (bacteria, fungi) and abiotic stresses. The students are able to critically assess recent developments in the field. Based on this, they can discover, describe and analyse new scientific questions and design creative approaches to tackle these questions via experimentation. They are equipped with the necessary practical skills to outline, plan and execute experiments. Their training in functional genomics, proteomics and metabolomics will provide the essential knowledge and skills to be able to apply these powerful technical approaches in the broad fields of biological and medical research. The students are trained to present scientific results in oral presentations and in writing. Masters in Experimental Plant Sciences are well qualified for a position at a research institute or to successfully conduct a PhD project. As the students will be provided the option to do a project at the interface of fundamental and applied science, this will also qualify them for positions at commercial companies.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Biological Sciences will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc or a specific HBO degree in other natural sciences, life sciences and biomedical sciences will be considered. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program (120 ECTS)

The program consists of a compulsory profile course, which includes guided self-study on molecular/physiological subjects and two theoretical courses. The MSc project can be performed in any of the research groups of Developmental Genetics, Cell Physiology, Microbiology or Phytotechnology.

Compulsory components

Profile course	20 ects
Seminar	4 ects
MSc thesis project	56-74 ects

Optional components

Additional courses or project time	40-22 ects
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Track Molecular and Cellular Biology

Description:

This MSc track provides students with knowledge about all basic aspects of molecular and cellular biology of prokaryotes and eukaryotes. Attention is given to genetical, microbiological and cellular approaches to understand the functioning of uni- and multicellular organisms at the molecular level. The application of functional genomics tools and implications for the understanding of diseases of animals and plants are highlighted. Students are trained to understand and critically evaluate specialized scientific literature. They will be able to use state of the art technology in at least one of the major subdisciplines genetics, microbiology or cell biology. They are trained in skills for presentation of their results. This master track is optimally suited as a basis for starting a PhD research project in experimental molecular biological or biomedical subjects.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Biological Sciences or (Bio)chemistry will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc or a specific HBO degree in other natural sciences, life sciences, biomedical sciences and mathematics will be considered. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program (120 ects)

Compulsory components

For the theoretical aspects, students are trained to be aware of the basic textbook knowledge covering the approaches mentioned above. Mandatory are the profile course 1, a main research project, and the profile course 2. In the profile course students are trained in critical reading and writing about recent scientific literature. A major part of the training is taking part in a running research project in which they follow the scientific experimental approach, including testing scientific hypotheses, critical evaluation of their data and comparisons with literature reports. This main research project is to be completed with an MSc thesis, which can be performed within either of the research groups of Genetics, Microbiology, Cell Biology or Cell Physiology.

Profile course 1	12 ects
MSc thesis project	56-74 ects
Profile course 2	9 ects
Seminar	4 ects

Optional components

Additional courses or project time	39-21 ects
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Track

Sustainability and Biodiversity

Description

This MSc program offers knowledge of, and insight in the conservation and management of biodiversity from a local to a global scale. By using 'sustainability' as a guiding principle, the program not only takes into account ecological but also economical and social aspects of biodiversity and conservation. The program provides students with an academic attitude by stimulating reflective, independent and creative thinking. It prepares students for a PhD program and/or for research positions at universities, research institutes, government organisations and consult agencies.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Biological Sciences will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc or a specific HBO degree in other natural sciences, life sciences and biomedical sciences will be considered. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program (120 ects)

Compulsory components

Compulsory are three profile courses (Environmental processes; Mapping, monitoring and GIS; Environmental modelling), two seminars (Biodiversity and Sustainability), a training in scientific writing skills and a research project including a MSc thesis.

Profile courses (including writing skills)	22 ects
Seminars	8 ects
MSc thesis project	56-74 ects
<i>Optional components</i>	
Additional courses or project time	34-16 ects

Track

Biodiversity and Natural Products

Description:

The major aim of this MSc program is to provide the students with a broad theoretical background to multidisciplinary research in biodiversity, natural products and plant cell biotechnology, to obtain in depth knowledge about the various experimental tools, and to application of these during a research project utilizing state-of-the-art equipment. The students should be able to collect scientific information and assess this in terms of possible applications and identify and develop strategies to overcome potential scientific bottlenecks for realization of these applications. The students should be able to communicate scientific results in the oral and written form, including posters. The students should develop into independent researchers which would be able to continue for a PhD program, or take the responsibility for projects in an industrial or institutional research environment.

Qualifications for admission

The major target groups for this MSc program are students from 2nd and 3rd world countries with at least a BSc degree in biology, (bio)chemistry, pharmacy or medicine. Besides the necessary academic diplomas, important criteria will be that the applicants for the MSc program already hold positions that are connected with the field of research, or have shown to have been active in this field of research, i.e. have professional credits. Students from any university in the Netherlands with a BSc degree in Biological Sciences can also be admitted to the program. For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in elective courses in the MSc program may be limited by the need to adapt the program to the present knowledge of the candidate.

Program (120 ects)

The program has different specialisations in the research phase:

Natural products and Biodiversity which concerns different aspects of exploring and eventually sustainable exploitation of biodiversity. Methods for phytochemical screening and testing of biological activity of plant extracts will be dealt with, as well as the isolation and identification of natural products, including structure elucidation. It will provide knowledge about chemotaxonomy and the role of secondary metabolism. Basic knowledge on plant cell culture as a tool for biosynthetic studies and plant cell biotechnology is included in the programme.

Biodiversity and Systematics focusing on biodiversity issues and linked to the specialisation courses on "Systematics and Evolution" and/or "Biology and the Environment" offered in the Biology curriculum of Leiden University, and/or to the training programme of the Graduate School "Biodiversity". It provides basic knowledge on the theory, methodology and practice of systematics and taxic biodiversity studies.

Pharmacognosy dealing with aspects of the production and quality control of drugs from natural origin. The use of chromatographic methods are an important aspect of this. It will also include courses on drug discovery.

Plant Cell Biotechnology as a method for studying biosynthesis and for the production of secondary metabolites. Strategies to improve production such as metabolic engineering will be dealt with. Also plant tissue culture as method for micropropagation will be learned.

Compulsory components

The student makes a choice for a certain specialisation when he applies for the MSc program.

The program consists of two parts. The first part is a series of short courses of at least 28 ects, and a maximum of 42 ects, depending on the level of the student. The second part concerns participation in the research of the department of the specialisation chosen. The profile course for the specialisations concerning natural products consists of a general introduction to information sources in the field of Biodiversity and Natural products. Based on this, the students have to write an evaluation of these sources. Based on this evaluation the students are requested to write a chapter on a given topic for a book that could serve as course book for this topic. The research (experimental) part should last 12 months, and will be finished with a thesis. In the second part of the program, the student should participate in an international scientific meeting and present a poster on his/her research.

Additional eects can be obtained by following optional courses. Ects can also be earned with a literature review ("scriptie").

Based on the information on the educational background of the applicant, a tailor-made program will be made. The individual study program will be discussed with the student by the programcoordinator and the professor responsible for the chosen specialisation.

Track

Biology and Science-Based Business

Description

This Msc program Biology and Science Based Business prepares students for a career in science-related business and administration, and for innovation and enterprise from a biological perspective. In addition to knowledge in biology, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with an MSc in Biology and Science Based Business are also admissible to a PhD program.

In order to get an SBB Master annotation, a minimal program consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the optional part of the research MSc programs in Biology.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Biological Sciences will be admitted to the program.

For other (international) candidates, such as BSc graduates from other natural sciences, life sciences and biomedical sciences as well as specific HBO Bachelors, the Admission Committee will judge the equivalence to these BSc degrees of their previous training.

Program

Biology

The Biology component of the Science based Business (SBB) specialization consists of a research project of 40 ects in one of the research groups of the Institute of Biology, including a master's thesis and an oral presentation, and 20 ects of courses to be selected in correspondence with the research topic. The choices for courses and research project will made in concert with an advisor.

Science Based Business

The Business-related part of the complete SBB program consists of 40 to 60 ects of the following components.

<i>Mandatory:</i>	<i>40+ ects</i>
SBB Fundamentals	17 ects
SBB Internship	23-34 ects
<i>Optional:</i>	<i>0-20 ects</i>
Orientation on Entrepreneurship	5 or 10 ects

SBB managerial roles	3 icts
Other courses or literature study to be chosen In the context of the SBB program	0-20 icts
Extension of the research component	0-20 icts

Track

Biology and Communication

Description

This MSc program Biology and Communication concerns science communication in a broad sense. The program prepares students for a career in popularisation of science (especially biological sciences), such as science writing, museum- or zoo-related activities, PR, etc. The program includes a 60 icts-Biology program, combined with a communication training. Students with an MSc in Biology and Communication are also admissible to a PhD program.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Biological Sciences will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, BSc graduates from other natural sciences, life sciences and biomedical sciences and specific Dutch HBO-BSc graduates will be considered. Preferably, the BSc program has included the 10-icts-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Program

Biology (60 icts)

The Biology component in the SBB program consists of a research project of 40 icts in one of the research groups within the Institute of Biology, including a MSc thesis and an oral presentation, and 20 icts of courses to be selected in correspondence with the research topic. The choices for lecture series and research project will made in concert with an advisor.

Communication (60 icts)

The communication part of the program consists of the following components:

A training period for one of three key specializations

(1) science writing, (2) multimedia, (3) museums and zoos

30 icts

A project concerning education

14 icts

Optional courses related to communication or science

16 icts

Track

Biology and Education

Description

This MSc program prepares students for a career in teaching Biology and related disciplines. It combines a training in Biology (60 ects) with one in didactics and education (60 ects).

Students with an MSc in Biology and Education are also admissible to a PhD program.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Biological Sciences will be admitted to the program.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, BSc graduates from other natural sciences, life sciences and biomedical sciences and specific Dutch HBO-BSc graduates will be considered. Preferably, the BSc program has included the 10-ects-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Program

Biology

The Biology component in the program consists of a research project of 40 ects in one of the research groups within the Institute of Biology, including a MSc thesis and an oral presentation, and 20 ects of courses to be selected in correspondence with the research topic. The choices for lecture series and research project will be made in concert with an advisor.

Education (60 ects)

The Education part of the MSc program (60 ects) is offered by the Leiden Graduate School of Education (ICLON), and consists of the following components:

Didactics	13 ects
Professional functioning	10 ects
Educational research	7 ects
School training	30 ects

This program is adequate to obtain the so-called “eerste graads lesbevoegdheid” needed for teaching at Dutch high schools.