

Master program of the Faculty of Science Leiden University

- Descriptions
- Qualifications for admission
- Condensed programs

Onderwijs en Examenregeling Masteropleiding Bijlage
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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 EC). 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 a 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. Admission is possible throughout the year, but we advise foreign students to start in Januari or September when new classes begin. 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 EC) from algebra, algebraic and analytic number theory and algebraic and differential geometry, a research project (at least 40 EC), and a free choice of courses from any field (maximum 20 EC); required is a total of at least 120 EC.

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 EC) on differential equations and dynamical systems, analysis of industrial problems, probability theory, statistics, numerical analysis and operations research, a research project (at least 40 EC), and a free choice of courses from any field (maximum 20 EC); required is a total of at least 120 EC.

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 EC in one of the research groups of the Leiden Mathematical Institute, including a master's thesis and an oral presentation, 20 EC 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 EC of the following components.

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

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-EC 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-EC-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 EC)

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

Communication (60 EC)

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 EC
Two courses to be chosen from a non-Mathematics program	8 EC
A project concerning education	14 EC
Optional courses related to communication and/or general knowledge of natural sciences	8 EC

Track

Mathematics and Education

Description

The MSc program Mathematics and Education prepares students for a career in teaching Mathematics. The program includes a 60-EC 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. It is strongly recommended that the BSc program has included the 10-EC-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 EC)

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

Education (60 EC)

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 EC
Professional functioning	10 EC
Educational research	7 EC
School training	30 EC

This program is sufficient 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 six 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 EC). Students who complete the program receive the degree Master of Science in Computer Science, with specification of the specialisation, 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 a BSc degree in Computer Science 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. Admission is possible throughout the year, but we advise foreign students to start in Januari or September when new classes begin. The programmes in ICT in business and in Media Technology are starting preferably in September. 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, imaging & bioinformatics, and digital life technologies. Students with an MSc in Computer Science are admissible to a PhD program.

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 determine the equivalence of their previous training to these BSc degrees. The choice of the specialisation 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 EC in extent, and consists of specialisation courses (40 EC in total), a project (software project or project study, 20 EC), and two research projects (60 EC in total).

<i>Components</i>	<i>Level</i>	<i>EC</i>
Specialisation courses	500	40
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, and software engineering and information systems. Students with an MSc in Computer Science are admissible to a PhD program.

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 determine the equivalence of their previous training to these BSc degrees. The choice of the specialisation 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 EC in extent, and consists of specialisation courses (40 EC in total), a project (software project or project study, 20 EC), and two research projects (60 EC in total).

Components	Level	EC
Specialization courses	500	40
Option: software project or project study	500	20
Research project	600	17
Master's thesis project	600	43

Track

Bioinformatics

Description

The main focus of the Bioinformatics track will be on *Data Analysis and Modeling*, which represents the unique expertise of the different research groups of Leiden University and the Delft University of Technology participating in this track. This expertise is used to address issues like data capturing, data warehousing and data mining that have become major issues for biotechnologists and biological scientists due to sudden growth in quantitative data in biology. On the other hand, bioinformatics heavily contributes to the identification of new informatics principles and the development of new informatics tools. Bioinformatics offers a new synthetic approach for formulating hypotheses and solving problems in biology and bio chemistry versus the classical reductionistic approach.

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 programme.

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 programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Program

The program is 120 EC in extent. The program is outlined below.

Core program

Data analysis / Pattern Recognition	6 EC
Databases / Data mining	6 EC
Microscopy / Modelling and Visualization	6 EC

Specialization courses 24 EC

A choice can be made out of 7 different courses of each 6 EC. More details can be found at the web-site of the institute.

Minor (Deficiency) courses 16-18 EC

A choice can be made out of courses in Life Science, Computer Science, Mathematics or of optional courses for deficiency programs. More details can be found at the web-site of the institute.

Research assignment 15-17 EC

Thesis project 45 EC

Note that sum of EC for the Minor/deficiency and Research assignment must equal 33 EC.

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 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 "specialisation" 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 determine the equivalence of their previous training to these BSc degrees.

Program

Computer Science

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

Science Based Business

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

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

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-EC 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 determine the equivalence of their previous training to these BSc degrees. Preferably, the BSc program has included the 10-EC-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 EC)

The computer science component of the Communication specialization consists of a research project of 40 EC in one of the research groups of LIACS, including a master's thesis and an oral presentation, and 20 EC of level-500 courses to be selected in correspondence with the research topic. The choices for courses and research project will be made in consultation with a supervisor.

Communication (60 EC)

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 EC

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

A project concerning education 14 EC

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

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-EC Computer Science program. Students with a 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 determine the equivalence of their previous training to these BSc degrees. It is strongly recommended that the BSc program has included the 10-EC-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 EC)

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

Education (60 EC)

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 EC
Professional functioning	10 EC
Educational research	7 EC
School training	30 EC

This program is sufficient 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 EC). 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. Acquisition 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 welcome 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 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 Entrepreneurship.

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:

Courses	Level	EC
Management Simulation	400	1
Software Engineering	500	7
Global Marketing	500	6
ICT-enabled Process Innovation	500	7
Financial Accounting	500	6
System's Development and Project Management	500	7
International Management	500	6
ICT Strategy and Planning	500	7
Corporate Finance	500	6
Electives I	500	6
Electives II	500	6
Research Seminar	500	4
Colloquia	500	4
ICT Infrastructure	500	7
Capstone Cases	500	7
MSc Thesis project	600	33
Total		120

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 EC). 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 a 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 EC in extent.

Subject	Level	EC
Sense Interference	400	2
Introduction to Programming	400	3
Multi Media Programming	400	4
Human Computer Interfaces	500	4
LabLand	500	4
Sound, Space & Interaction	500	4
Image	500	3
Language & Text	500	3
Multi Media Systems	500	7
Webtechnology	500	4
Science Practice	500	3
Technology & Philosophy	500	4
Media Philosophy	500	7
Meta Media	500	3
Free choice courses	500	12
Project	500	20
Hardware	500	3
Graduate project	600	30

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 EC). 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 a 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. Admission is possible throughout the year, but we advise foreign students to start in Januari or September when new classes begin. 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 or equivalent from universities who participate in the NOVA research school will be admitted to the program.

For all other (international) candidates, the Admission Committee will evaluate whether their degree is equivalent to the BSc in Astronomy Degree. 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>	EC
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. Each course is valued at 6 EC.

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 EC, 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 a 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 EC in one of the research groups of the Leiden Observatory, including a master’s thesis and an oral presentation, and 30 EC of courses to be selected in correspondence with the research topic. The latter courses include non-astronomy courses with 8-14 EC.

Science Based Business

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

Mandatory:

SBB Fundamentals	40+ EC
SBB Internship	17 EC
	23-34 EC

Optional:

Orientation on Entrepreneurship	0-20 EC
SBB managerial roles	5 or 10 EC
Other courses or literature study to be chosen	3 EC
In the context of the SBB program	0-20 EC
Extension of the research component	0-20 EC

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-EC Astronomy program. Students with a 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-EC-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 EC)

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

Communication (60 EC)

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 EC
Two courses to be chosen from a non-Astronomy program	8 EC
A project concerning education	14 EC
Optional courses related to communication and/or general knowledge of natural sciences	8 EC

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-EC 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. It is strongly recommended that the BSc program has included the 10-EC-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 EC)

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

Education (60 EC)

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 EC
Professional functioning	10 EC
Educational research	7 EC
School training	30 EC

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

MSc Physics

Crohonummer 60202

Leiden University offers seven 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 EC). 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 a 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. Admission is possible throughout the year, but we advise foreign students to start in Januari or September when new classes begin. 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 EC on following courses and preparing exams. The remaining 80 EC 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 EC each), and compulsory and optional courses (40 EC in total).

Compulsory components

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

Optional components

Additional courses

20 EC

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 EC each, to broaden the scope of their education. In addition, the student will have to acquire 40 EC 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 EC each), and compulsory and optional courses (40 EC in total).

Compulsory components

At least two of the following three courses:

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

Optional components

Courses to be selected from:

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

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 EC), 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 EC).

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 EC) and optional courses (40 EC). The second year is devoted to research (60 EC).

First year:

The *compulsory courses* are:

Quantum Theory	10 EC
Caput Theoretical Physics	10 EC

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 EC
Quantum Field Theory	10 EC
Advanced Quantum Field Theory	10 EC
Theory of General Relativity	10 EC
Quantum Optics and Quantum Information	10 EC
Statistical Physics	10 EC
Computational Physics	10 EC

(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 EC
Master's thesis	10 EC
Oral presentation	5 EC

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 EC 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 EC
Research project 2	40 EC
At least one of the following courses:	
Theory of Condensed Matter	10 EC
Statistical Physics	10 EC

Elective courses:

Quantum Theory	10 EC
Surface physics	6 EC
Scanning probe microscopy	6 EC
Superconductivity	6 EC

Courses can also be selected from the set of courses available in the MSc Physics Program or related fields, to be discussed with the supervisor of the research project, and subject to approval of the Exam Committee.

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 a MSc in Physics and Science Based Business are also admissible to a PhD program.

In order to get a 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 EC in one of the research groups of the Leiden Institute of Physics (LION), including a master’s thesis and an oral presentation, and 20 EC 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 EC of the following components.

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

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-EC 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-EC-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 EC)

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

Communication (60 EC)

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 EC
Two courses to be chosen from a non-Physics program	8 EC
A project concerning education	14 EC
Optional courses related to communication and/or general knowledge of natural sciences	8 EC

Track

Physics and Education

Description

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

Students with a 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. It is strongly recommended that the BSc program has included the 10-EC-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 EC in one of the research groups of the Leiden Institute of Physics (LION), including a master's thesis and an oral presentation, and 20 EC of courses to be selected in correspondence with the research topic.

Education (60 EC)

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 EC
Professional functioning	10 EC
Educational research	7 EC
School training	30 EC

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

MSc NanoScience

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Description

The ability to construct tiny objects atom-by-atom and molecule-by-molecule forms one of the exciting prospects of the emerging research field of NanoScience. This highly cross-disciplinary research area, which is expected to play a crucial role in future scientific discoveries and new technologies, combines a number of key elements from modern physics and chemistry, materials science and molecular biology.

Leiden University and Delft University of Technology have been pioneers in the field of NanoScience, and now join forces to offer students their renowned expertise in a unique, two-year MSc programme in NanoScience. The programme is especially aimed at students who are eager to transcend the traditional borders between scientific disciplines.

The aim of this programme is to educate the student in both science and technology of nanometer-scale phenomena. Students will benefit from the academic climate and infrastructure of both universities by taking courses from and participating in the research activities of the foremost experts in NanoScience.

The MSc programme in NanoScience is attractive to those students who wish to gain the skills and experience required to join the new generation of researchers in NanoScience. Being at the crossroads of a broad range of research fields, it provides students with an excellent opportunity to discover the most appealing aspects. It opens the door to a career in industry and is a stepping-stone for those graduates with the ambition and aspiration to pursue a PhD degree. The programme is starting preferably in September.

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 EC)

The program consists of course modules (60 EC), an industrial training period (12 EC) and a Master thesis research project (48 EC).

Introductory courses

Introduction Quantum Mechanics, and/or
Introduction in Biochemistry, and/or Introduction Statistical Thermodynamics 0 - 6 EC

Core courses

Nanotechnologies 6 EC
Biophysics and/or Supramolecular Chemistry 6 - 12 EC

Quantum physics and chemistry and/or
Mesoscopic Physics and/or
Molecular Electronics 6 - 18 EC

Elective courses

Electives 18 - 42 EC*

The total EC weight of the introductory-, core- and the electives courses should be 60 EC.

Practical work

Industrial Training Period 12 EC
Master thesis research project 48 EC

MSc Chemistry

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The Leiden Institute of Chemistry (LIC) is the basis for research and collaborations of the Leiden chemistry groups. LIC offers seven 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 EC). 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 and all programs will be made in consent with an advisor and must be submitted for approval to the Exam Committee before the start of the program.

Candidates with a 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. Admission is possible throughout the year, but we advise foreign students to start in Januari or September when new classes begin. The program in Industrial Ecology is starting preferably in September. 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.

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. 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. For all other (international) candidates, such as students with a degree related to Chemistry, HBO Bachelors and foreign students, the Admission Committee will judge the equivalence to these BSc degrees of their previous training.

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.

Program

The program contains two training periods (35 and 20 EC), including a written report and an oral presentation projects and compulsory and optional courses (65 EC). It is mandatory that major and minor research projects take place in different specializations. Free choice consists of a free choice of theory or an extension of the research period. Students can choose their "free choice courses"

within or outside their specialisation. Students can also choose these courses from bachelor or non-chemistry courses if allowed by the exam committee.

Compulsory components

Biophysical Structure Chemistry	6 EC
Bioinformatics	4 EC
Cellular signalling	4 EC
Research project I, including master thesis	35 EC
Research project II (preferably abroad), including report	20 EC
Colloquium	6 EC

Optional components

A selection of courses within specialization	5 EC
A selection of courses outside specialization	6 EC

Free choice or extension of research	34 EC
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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 gain extensive knowledge of experimental research, theoretical research and/or computer calculations.

Program

The program contains two research periods (35 and 20 EC), including a written report and an oral presentation and compulsory and optional courses (65 EC). It is mandatory that major and minor research projects take place in different specializations. Free choice consists of a free choice of theory or an extension of the research period. Students can choose their “free choice courses” within or outside their specialization. Students can also choose these courses from bachelor or non-chemistry courses if allowed by the exam committee.

Compulsory components

Three of the next five courses:

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

Research project I, including master thesis	35 EC
Research project II (preferably abroad), including report	20 EC
Colloquium	6 EC

Optional components

A selection of courses within specialization	6 EC
A selection of courses outside specialization	6 EC

Free choice or extension of research	31-29 EC
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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.

Program

The program contains two research periods (35 and 20 EC), including a written report and an oral presentation and compulsory and optional courses (65 EC). It is mandatory that major and minor research projects take place in different specializations. Free choice consists of a free choice of theory or an extension of the research period. Students can choose their "free choice courses" within or outside their specialization. Students can also choose these courses from bachelor or non-chemistry courses if allowed by the exam committee.

Compulsory components

Advanced Organic Chemistry	11 EC
Bio-inorganic Chemistry	5 EC
Research project I, including master thesis	35 EC
Research project II, including report	20 EC
Colloquium	6 EC

Optional components

A selection of courses within specialization	6 EC
A selection of courses outside specialization	6 EC

Free choice or extension of research 31 EC

Track

Industrial Ecology

Description

The Track Industrial Ecology is the result of a cooperation agreement between the Faculty of Mathematics and Natural Sciences of Leiden University, the Faculty of Applied Sciences of Delft University of Technology, and the Faculty of Social Sciences of Erasmus University. All three universities deliver the same amount of educational effort.

The Track Industrial Ecology starts for the first time in September 2004 as a track in the MSc Programmes Chemistry (University of Leiden, Faculty of Mathematics and Natural Sciences) and Chemical Engineering (Delft University of Technology, Faculty of Applied Sciences). The Students will receive a degree in either Chemistry or Chemical Engineering with a specialisation to Industrial Ecology. However, if the official accreditation for an independent Industrial Ecology programme is granted before August 2006, the degree received will be in Industrial Ecology.

Qualifications for admission

Students with a bachelor's degree in any of the Natural sciences, Technical sciences and Social sciences with good results from a recognised university, and with a thorough proficiency in written and spoken English, can apply for admission to the two-year programme starting in September 2004. Admission is subject to the approval of the department's selection committee.

Overview of the Programme

The MSc programme Industrial Ecology consists of the following components:

First year	Adaptation Modules	9 EC
	Core Modules	39 EC
	Elective Modules	12 EC
Second year	Interdisciplinary Project Groups	12 EC
	Specialization Modules	12 EC
	Master's Thesis Research Project	36 EC

Detailed information about the modules for the first year can be found on the website www.industrialecology.nl, or obtained from the study advisor or Programme Coordinator. The information about the second year will be announced in the course of the first year.

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".

Program

Chemistry

The Chemistry component of the Science based Business (SBB) specialization consists of a research project of 20 EC in one of the research groups of LIC, including a master's thesis and an oral presentation, and 34-54 EC 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 EC). The choices for courses and research project will be made in concert with an advisor.

Science Based Business

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

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

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 popularization of science, for example, as a science writer or public relations officer. The program includes a 60-EC Chemistry program. Students with an MSc in Chemistry and Communication are also admissible to a PhD program.

Program

Chemistry (60 EC)

The Chemistry component of the Communication specialization consists of a research project of 20 EC in one of the research groups of LIC, including a master's thesis and an oral presentation, and 34 EC 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 EC). The choices for courses and research project will be made in concert with an advisor.

Communication (60 EC)

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 EC
Two courses to be chosen from a non-Chemistry program	8 EC
A project concerning education	14 EC
Optional courses related to communication and/or general knowledge of natural sciences	8 EC

NB: For students attending the Chemistry and Communication Track, the BSc program has preferably included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or must have included an equivalent course. Applicants must provide proof of proficiency in Dutch.

Track Chemistry and Education

Description

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

Program

Chemistry (60 EC)

The Chemistry component of the Education specialization consists of a research project of 20 EC in one of the research groups of LIC, including a master's thesis and an oral presentation, and 34 EC 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 EC). The choices for courses and research project will be made in concert with an advisor.

Education option (60 EC)

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 EC
Professional functioning	10 EC
Educational research	7 EC
School training	30 EC

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

NB. For students attending the Chemistry and Education track it is strongly recommended that the BSc program has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or an equivalent course. These applicants must also provide proof of proficiency in Dutch.

MSc Life Science and Technology

Crohonummer 66286

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 EC). 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. The programmes are starting preferably in September. 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 EC), and compulsory and optional program components (75 EC). The program has two variants, one of which can be chosen.

Compulsory components

(i) Profile courses

Analysis of metabolic networks

5 EC

Metabolic reprogramming

5 EC

Bioprocess integration

5 EC

Variant "Cells in factories"	
-Fermentation technology	3 EC
-Bioseparations	3 EC
-Bioconversion technology	3 EC
Variant "Cells as factories"	
- Metabolic diversity	3 EC
- Industrial genomics	3 EC
- Molecular cell biology IV	3EC
(ii) General courses	
- Ethics and technology	6 EC
- Literature study (colloquium)	4 EC
- Design project	11 EC
- Company traineeship	13-18 EC
(iii) Researchproject in Cell Factory	45 EC
<i>Optional courses</i>	17-12 EC

Note that sum of EC for the Company traineeship and the Optional courses must equal 30 EC.

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 EC), and compulsory and optional program components (75 EC).

Compulsory components

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

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

(ii) General courses

- Ethics and technology	6 EC
- Literature study (colloquium)	4 EC
- Design project	11 EC
- Company traineeship	13-18 EC

(iii) Research project in Cell Diagnostics 45 EC

Optional courses 17 -12 EC

Note that sum of EC for the Company traineeship and the Optional courses must equal 30 EC.

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 EC), and compulsory and optional program components (74 EC).

Compulsory components

(i) Profile courses

- Bioinformatics 2	4 EC
- Bioinformatics 3	4 EC
- Transcriptome & proteome analysis	5 EC
- Biophysical structure determination	6 EC
= Gene expression	5 EC

(ii) General courses

- Ethics and technology	6 EC
- Literature study (colloquium)	4 EC
- Design project	11 EC
- Company traineeship	13-18 EC

(iii) Researchproject in Functional Genomics	45 EC
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<i>Optional courses</i>	17-12 EC
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Note that sum of EC for the Company traineeship and the Optional courses must equal 30 EC.

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 EC), and compulsory and optional program components (74 EC).

Compulsory components

(i) Profile courses)(*besides Mathematical modelling 18 EC from the other courses*)

- Systems Biology	6 EC
- Dynamic energy budgets	4 EC
- Mathematical modelling in development and evolutionary biology	6 EC
- Bioinformatics 2	4 EC
- Bioinformatics 3	4 EC
- Biophysical structure determination	6 EC

(ii) General courses

- Ethics and technology	6 EC
- Literature study (colloquium)	4 EC
- Design project	11 EC
- Company traineeship	13-18 EC

(iii) Researchproject in Living Matter 45 EC

Optional courses 17-12 EC

Note that sum of EC for the Company traineeship and the Optional courses must equal 30 EC.

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

In order to get a 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 EC

Compulsory general courses

Ethics & technology	6 EC
Literature study	4 EC
Design project	11 EC
Research project in the chosen profile (Cell Factory, Cell Diagnostics, Functional Genomics or Living Matter).	35 EC

Science-based business

SBB fundamentals	17 EC
SBB internship	23 EC

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 EC). 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 a 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. Admission is possible throughout the year, but we advise foreign students to start in Januari or September when new classes begin. 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 (drug design and molecular modelling) 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 EC), and compulsory and optional program components (38 EC).

Compulsory components

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

Optional components

Additional courses or traineeships	22 EC
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Track Analytical Bio-Sciences

Description

The MSc program Analytical Bio-Sciences (analytical chemistry focussing on hyphenated bio-analytical strategies including proteomics) 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 EC), and compulsory and optional program components (38 EC).

Compulsory components

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

Optional components

Additional courses or traineeships	22 EC
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Track Pharmacology

Description

The MSc program Pharmacology (drug transport and disposition; pharmacokinetics/pharmacodynamics; hormones in neurosciences; clinical 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 EC), and compulsory and optional program components (38 EC).

<i>Compulsory components</i>	
Lecture series 1 (in BPS)	4 EC
Lecture series 2 (in BPS)	4 EC
Research project I (Pharmacology, Medical Pharmacology, Clinical Pharmacology; including Master's thesis and oral presentation)	52 EC
Research project II (preferably in another discipline of BPS)	30 EC
20 Lectures and Colloquia	1 EC
Literature study plus thesis	7 EC

<i>Optional components</i>	
Additional courses or traineeships	22 EC

Track

Drug Delivery Technology and Biopharmaceutics

Description

The MSc program Drug Delivery Technology and Biopharmaceutics (drug delivery and formulation research; drug target finding and gene modulation in cardiovascular disease) trains for junior drug researchers, and prepares students for a career in drug delivery 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 EC), and compulsory and optional program components (38 EC).

<i>Compulsory components</i>	
Lecture series 1 (in BPS)	4 EC
Lecture series 2 (in BPS)	4 EC
Research project I (Drug Delivery Technology or Biopharmaceutics; including Master's thesis and oral presentation)	52 EC
Research project II (preferably in another discipline of BPS)	30 EC
20 Lectures and Colloquia	1 EC
Literature study plus thesis	7 EC

<i>Optional components</i>	
Additional courses or traineeships	22 EC

Track Toxicology

Description

The MSc program Toxicology (cellular and molecular mechanisms of toxicity) 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 EC), and compulsory and optional program components (38 EC).

Compulsory components

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

Optional components

Additional courses or traineeships	22 EC
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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", "Drug Delivery 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 EC in one of the research groups of CBPS, including a master's thesis and an oral presentation, two lecture series of 4 EC each, and attendance of at least 20 colloquia or seminars (1 EC). The choices for lecture series and research project will be made in concert with an advisor.

Science Based Business

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

Mandatory:

SBB Fundamentals	40+ EC
SBB Internship	17 EC

Optional:

Orientation on Entrepreneurship	23-34 EC
SBB managerial roles	0-20 EC
Other courses or literature study to be chosen	5 or 10 EC
In the context of the SBB program	3 EC
Extension of the research component	0-20 EC

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 60-EC 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 EC in one of the research groups of CBPS, including a master's thesis and an oral presentation, two lecture series of 4 EC each, and attendance of at least 20 colloquia or seminars (1 EC). 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 EC
Two courses to be chosen from a non-Bio-Pharmaceutical Sciences program	8 EC
A project concerning education	14 EC
Optional courses related to communication and/or general knowledge of natural sciences	8 EC

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 60-EC 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 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. Preferably, the BSc program has included the 10-EC-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 EC)

The Bio-Pharmaceutical component of the Education specialization consists of a research project of 51 EC in one of the research groups of CBPS, including a master's thesis and an oral presentation, two lectures series of 4 EC each, and attendance of at least 20 colloquia or seminars (1 EC). 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 EC
Professional functioning	10 EC
Educational research	7 EC
School training	30 EC

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

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 EC). 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 a 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. Admission is possible throughout the year, but we advise foreign students to start in Januari or September when new classes begin. 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 project.

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 project 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 EC)

The program consists of one or two research project (56-74 EC), and compulsory and optional program components (46-64 EC). 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 EC
Seminar 4 EC
MSc thesis project 56 - 74 EC

Optional components

Additional courses or project time 35 - 17 EC

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 'animal care' 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 EC)

The program consists of one extensive MSc research project (56-74 EC), and compulsory and optional program components (46-64 EC), 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 EC
Seminar 4 EC
MSc thesis project 56-74 EC

Optional components

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

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 aspect 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 EC)

The program consists of a compulsory profile course, which includes guided self-study on molecular/physiological subject 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 EC
Seminar	4 EC
MSc thesis project	56-74 EC

Optional components

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

Description:

This MSc track provides students with knowledge about all basic aspect 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 subject.

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 EC)

Compulsory components

For the theoretical aspect, 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 EC
MSc thesis project	56-74 EC
Profile course 2	9 EC
Seminar	4 EC

Optional components

Additional courses or project time	39-21 EC
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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 aspect 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 EC)

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 EC
Seminars	8 EC
MSc thesis project	56-74 EC

Optional components

Additional courses or project time	34-16 EC
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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 project 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 EC)

The program has different specialisations in the research phase:

Natural products and Biodiversity which concerns different aspect 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 aspect 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 EC, and a maximum of 42 EC, 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 EC's can be obtained by following optional courses. EC's 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 a 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 EC in one of the research groups of the Institute of Biology, including a master's thesis and an oral presentation, and 20 EC of courses to be selected in correspondence

with the research topic. The choices for courses and research project will be made in concert with an advisor.

Science Based Business

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

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

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 EC-Biology program, combined with a communication training. Students with a 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-EC-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 EC)

The Biology component in the SBB program consists of a research project of 40 EC in one of the research groups within the Institute of Biology, including a MSc thesis and an oral presentation, and 20 EC 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.

Communication (60 EC)

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 EC
A project concerning education	14 EC
Optional courses related to communication or science	16 EC

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 EC) with one in didactics and education (60 EC).

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. It is strongly recommended that the BSc program has included the 10-EC-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 EC in one of the research groups within the Institute of Biology, including a MSc thesis and an oral presentation, and 20 EC 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 EC)

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

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

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