



Master's programmes Life Sciences
University of Groningen

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Summary

Standard 1. Intended learning outcomes

The six MSc programmes in life sciences have generally clear and well-defined aims and profiles, spanning a wide range of research fields in biology and biomedical sciences. They are closely related to the research institutes at the Faculty, providing a high-quality, research-driven educational environment. The aims of the programmes have been adequately translated into intended learning outcomes that match the Dublin descriptors, as well as the requirements of the academic and professional field. The panel established that the Advisory Committee in the MPS programme plays a meaningful role in this, and recommends considering setting up a similar Committee for other programmes. The SBP track provides an interesting and well-organized opportunity for students interested in a career as consultant in a non-academic organization.

The *MSc Ecology and Evolution* offers two separate and relevant tracks in ecology and evolutionary biology in cooperation with the GELIFES research institute. The international joint programme MEME is a prestigious asset of the programme, and is offered in a consortium of top universities in the field. The panel advises the Ecology and Evolution programme to consider offering the SBP track for students in the Ecology and Conservation track.

The *MSc Biomolecular Sciences* has a fundamental research-oriented profile in biotechnology, with a strong focus on practical research skills. The cooperation with GBB provides students with an excellent, high-quality research environment and state-of-the-art research equipment.

The *MSc Marine Biology* has a strong, internationally recognized profile focusing on marine ecosystems and their conservation. The cooperation with NIOZ as well as the proximity of the Wadden Sea ecosystem provides students with attractive opportunities for applied research. The panel challenges the programme to consider whether there are any opportunities for sustainable growth considering the interest in the programme and the relevance of the field.

The *MSc Biology* offers a unique and flexible individual curriculum for students, as well as the opportunity to specialize in quantitative research in the life sciences in the Modelling track. The panel recommends strengthening the MSc's profile, as well as the positioning of the programme with regard to the other MSc programmes in the life sciences. A more independent position within the faculty might help attract more students specifically interested in the integrative and interdisciplinary opportunities the flexible curriculum offers.

The *MSc Biomedical Sciences* offers students an attractive research environment to study the biological aspects of diseases and their cures, with several specialization areas closely related to the expertise of the associated research departments. The collaboration with UMCG provides students with the attractive opportunity to perform research at the interface of preclinical and clinical research.

The *MSc Medical Pharmaceutical Sciences* has a clear and unique profile, focusing on interdisciplinary research related to pharmaceutical sciences. It is well aligned with research at the GRIP institute, offering distinctive and relevant specialization areas, as well as practical training in using innovative techniques.

Standard 2. Teaching-learning environment

The MSc programmes in the life sciences have adequately translated their intended learning outcomes into a coherent curriculum focused on learning by doing by participating in research. To this end, the programmes have a large individual component where students develop their skills in master-apprentice relation,

working with state-of-the-art research facilities. The courses and educational methods build towards this, providing students with knowledge and skills necessary for this individual component. The programmes are characterized by a large amount of choice: students compose an individual curriculum in consultation with their mentor from a large selection of tracks and electives, which is checked for coherence by the Board of Examiners. The panel appreciates the general design of the curricula, which fits the vision and profile of the programmes. To further improve coherence, it recommends introducing a skills learning trajectory to ensure that all students receive comparable skills training within their individual curricula. All programmes are offered in English, which the panel considers an apt and well-implemented choice considering the career perspectives of graduates. The faculty-wide track SBP is well-aligned with the associated MSc programmes, and is appreciated by students as well as the panel for its relevant content and structured curriculum with a high sense of community and high success rates.

The panel appreciates the guidance and support provided to students in the programmes. It appreciates the role of the core courses in most curricula in promoting community-building. The programmes have worked hard to keep the quality of education high during the corona pandemic, and monitored the well-being of students carefully. The mentor system works well in most cases, although experiences vary. The panel recommends safeguarding that mentors have sufficient time to support students. The curricula are feasible, yet in particular the MScs E&E, Marine Biology and Biology should work on breaking the habit of tolerating delays in research projects.

The teaching staff of the programmes is well-qualified with strong connections to research, and very much valued by students. The programmes have taken adequate measures to reduce the workload of the teaching staff in response to recommendations by the previous accreditation panel. Nevertheless, growing student numbers throughout the Faculty have posed the programmes with a new challenge, resulting in a renewed rise in workload throughout the teaching staff. The panel supports the plans presented by the programmes as well as the Faculty to tackle this challenge by the upcoming introduction of a *numerus fixus* on the BSc Biology and the MSc Biomedical Sciences per 2022, and hiring additional teaching staff. It urges the programmes and the Faculty to implement this as soon as possible to alleviate the strain that is currently put on the teaching staff. This will allow the programmes to address a number of recommendations by the panel associated with teaching capacity, such as the sometimes-limited availability of mentors and attention to educational innovation.

The *MSc Ecology and Evolution* offers an attractive and challenging curriculum for both tracks. The panel recommends investigating whether more interaction between the two tracks can be created, and increasing attention towards job market orientation in the programme. It also recommends investigating whether all students have sufficient knowledge of genetics and genomics upon entering the track Ecology and Conservation, and remedy this if this is not the case. The MEME double degree is well organized, and has a strong system of quality assurance in place to safeguard alignment between education at the different institutions. The panel recommends adapting the curriculum for MEME students to properly include the Colloquium, which students now follow outside their curriculum.

The *MSc Biomolecular Sciences* offers a high-quality, research-oriented curriculum offered in a small-scale, interactive setting. The panel appreciates the close integration of education and research, and the opportunity that students have to work with state-of-the-art equipment and research techniques. The panel recommends increasing attention towards job market orientation, and based on student remarks, investigating whether the current structure of three-week courses is optimal.

The *MSc Marine Biology* offers a varied and solid curriculum with a strong theoretical basis, hands-on experience with various research methodologies and techniques and many opportunities to obtain valuable field work experience. The panel recommends investigating whether the amount of statistics offered in the programme is sufficient, and providing more proactive support to students with regard to internships and career orientation.

The *MSc Biology* gives students a large amount of freedom to shape their own curriculum. The Modelling track is very relevant and a good addition to the programme. As students in the free Research track mainly follow courses in other programmes, they do not always feel part of a distinct community in the programme, but rather a guest in other programmes. According to the panel, students should be empowered to identify with an independent MSc programme. This could for instance be achieved through investing in social cohesion and community building, and by solving the issue where students cannot enter their preferred courses in other programmes due to capacity issues.

The *MSc Biomedical Sciences* offers a strong and well-organized curriculum with an impressive diversity of course topics that are strongly anchored in active research at FSE and UMCG. This provides students with the opportunity to do research at the interface of preclinical and clinical research. It recommends considering replacing the free Research track with more flexibility between the tracks. Furthermore, the panel supports discussing arrangements with the UMCG in securing adequate teaching and supervision for the programme due to capacity issues at both FSE and UMCG.

The *MSc Medical Pharmaceutical Sciences* offers a strong, interdisciplinary research-oriented programme that provides students with the opportunity to participate in state-of-the-art research in various specializations of pharmaceutical sciences. The compulsory course in academic skills remediates the variety in entry levels due to the interdisciplinarity of the programme. The programme could consider introducing more interaction between students in the different research tracks, and replacing the free Research track with more flexibility within and between tracks. Furthermore, the panel supports discussing arrangements with the UMCG in securing adequate teaching and supervision for the programme due to capacity issues at both FSE and UMCG.

Standard 3. Student assessment

The MSc programmes have a valid, transparent and reliable system of assessment in place. The assessment methods are sufficiently varied and fit the learning goals of the courses, and the CUAO's are helpful tools in the quality assurance of course assessment. The assessment in the MEME double degree programme in the MSc Ecology and Evolution, as well as the assessment in the SBP track are adequately safeguarded: the degree programmes always contribute one of the examiners for each externally conducted research project and internship. The Boards of Examiners plays an important and proactive role in safeguarding the quality of assessment in the programmes through structural checks and advice, in particular during the corona pandemic and the implementation of the new curricula. The staffing issues of the Board of Examiners for Biology and Biomedical Sciences should remain high on the agenda. The procedures for the assessment of the MSc projects and theses are solid, but should be better enforced, in particular with regard to the completion of assessment forms and the independence of the two assessors. To strengthen the role of the second assessors, the panel recommends appointing these from other research groups, and making their contribution to the assessment more explicit on the assessment form. The assessment of the internships in the SBP track is exemplary, with a transparent assessment form that is used in a thorough and insightful way.

Standard 4. Achieved learning outcomes

The panel concludes that the final products of the MSc programmes show that the intended learning outcomes of the programmes are achieved. In particular the research skills demonstrated in the research projects and the successful connection between science, business and policy in the internships stood out to the panel. Graduates find a job in various positions relevant to the life sciences, in many cases as PhD student, in a health-care environment, as policy advisor or as researcher or consultant in industry.

Score table

The panel assesses the programmes as follows:

MSc Ecology and Evolution

Standard 1: Intended learning outcomes	meets the standard
Standard 2: Teaching-learning environment	meets the standard
Standard 3: Student assessment	meets the standard
Standard 4: Achieved learning outcomes	meets the standard
General conclusion	positive

MSc Biomolecular Sciences

Standard 1: Intended learning outcomes	meets the standard
Standard 2: Teaching-learning environment	meets the standard
Standard 3: Student assessment	meets the standard
Standard 4: Achieved learning outcomes	meets the standard
General conclusion	positive

MSc Marine Biology

Standard 1: Intended learning outcomes	meets the standard
Standard 2: Teaching-learning environment	meets the standard
Standard 3: Student assessment	meets the standard
Standard 4: Achieved learning outcomes	meets the standard
General conclusion	positive

MSc Biology

Standard 1: Intended learning outcomes	meets the standard
Standard 2: Teaching-learning environment	meets the standard
Standard 3: Student assessment	meets the standard
Standard 4: Achieved learning outcomes	meets the standard
General conclusion	positive

MSc Biomedical Sciences

Standard 1: Intended learning outcomes	meets the standard
Standard 2: Teaching-learning environment	meets the standard
Standard 3: Student assessment	meets the standard
Standard 4: Achieved learning outcomes	meets the standard
General conclusion	positive

MSc Medical Pharmaceutical Sciences

Standard 1: Intended learning outcomes	meets the standard
Standard 2: Teaching-learning environment	meets the standard
Standard 3: Student assessment	meets the standard
Standard 4: Achieved learning outcomes	meets the standard
General conclusion	positive

Ton Bisseling, chair
Date: 18-02-2022

Peter Hildering, secretary

Introduction

Procedure

Assessment

On 4, 5, 6 and 7 October 2021, the Life Sciences programmes of the University of Groningen were assessed by an independent peer review panel as part of the cluster assessment Biology. The assessment cluster consisted of 21 programmes, offered by Utrecht University, Radboud University, the University of Groningen, Leiden University, the University of Amsterdam and Vrije Universiteit Amsterdam. The assessment followed the procedure and standards of the NVAO Assessment Framework for the Higher Education Accreditation System of the Netherlands (September 2018).

Quality assurance agency Academion coordinated the assessment upon request of the Biology cluster after taking over from Qanu per August 2021, when the first site visit to Utrecht University had already taken place. Els Schröder acted as coordinator for Qanu during the start-up phase and the site visit to Utrecht University. From then on, Fiona Schouten and Peter Hildering acted as coordinators and secretaries in the cluster assessment, and Mariëlle Klerks acted as secretary. They have all been certified and registered by the NVAO. For the University of Groningen, Peter Hildering acted as coordinator and secretary and Fiona Schouten as second secretary during several parallel sessions.

Preparation

Qanu composed the peer review panel in cooperation with the institutions and taking into account the expertise and independence of the members as well as consistency within the cluster. On 22 June 2021, the NVAO approved the composition of the panel. The coordinator instructed the panel chair on his role in the site visit.

The contact persons for the University of Groningen composed a site visit schedule in consultation with the Qanu coordinator (see appendix 3). They selected representative partners for the various interviews. It was determined that the development dialogue would take place after the site visit. A separate development report was made based on this dialogue.

The programmes provided the Qanu coordinator with a list of graduates over the period 2016-2020. In consultation with the coordinator, the panel chair selected 15 theses per programme. He took the diversity of final grades and examiners into account, as well as the various tracks. In addition, the panel studied 15 Science Business & Policy (SBP) internship reports from students of other degree programmes that followed the SBP track. These are the MSc programmes Astronomy, Biomedical Engineering, Chemical Engineering, Chemistry, Energy and Environmental Sciences and Mathematics. The MSc Computing Science and Physics also offer SBP, but had no graduates in this track since 2015. Prior to the site visit, the programmes provided the panel with the theses and the accompanying assessment forms. They also provided the panel with the self evaluation reports and additional materials (see appendix 4).

The panel members studied the information and sent their findings to the secretary. The secretary collected the panel's questions and remarks in a document and shared this with the panel members. In a preliminary meeting, the panel discussed the initial findings on the self-evaluation reports and the theses, as well as the division of tasks during the site visit. The panel was also informed on the assessment framework, the working method and the planning of the site visits and reports.

Site visit

During the site visit, the panel interviewed various programme representatives (see appendix 3). The panel also offered students and staff members an opportunity for confidential discussion during a consultation hour. No consultation was requested. The panel used the final part of the site visit to discuss its findings in an internal meeting. Afterwards, the panel publicly presented the preliminary findings.

Report

The secretary wrote a draft report based on the panel's findings and submitted it for peer assessment within Academion. Subsequently, the secretary sent the report to the panel for feedback. After processing this feedback, the secretary sent the draft report to the Faculty of Science and Engineering of the University of Groningen to have it checked for factual irregularities. The secretary discussed the ensuing comments with the panel chair and changes were implemented accordingly. The panel then finalised the report, and the coordinator sent it to the University of Groningen.

Panel

The following panel members were involved in the cluster assessment:

- Prof. dr. Ton Bisseling, professor emeritus Molecular Biology at Wageningen University & Research (chair);
- Em. prof. dr. Nico van Straalen, professor emeritus of Animal Ecology at Vrije Universiteit (vice-chair);
- Prof. dr. Aard Groen, professor of Entrepreneurship & Valorization at University of Groningen;
- Prof. dr. Menno Witter, Professor of Neuroscience at Norwegian University of Science and Technology;
- Prof. dr. Ellen Blaak, Professor of Human Biology at Maastricht University;
- Prof. dr. Roos Masereeuw, professor of Experimental Pharmacology at Utrecht University;
- Prof. dr. Sander Nieuwenhuis, professor Cognitive Psychology at Leiden University;
- Prof. dr. Maarten Frens, professor in Systems Physiology at Erasmus University Rotterdam;
- Prof. dr. ir. Jan Kammenga, professor of Functional Genetics at Wageningen University & Research
- Prof. dr. Dennis Claessen, professor Molecular Microbiology at Leiden University;
- Prof. dr. Isa Schön, team leader at the Royal Belgian Institute of Natural Sciences;
- Prof. dr. Hauke Smidt, professor Microbial Ecology at Wageningen University & Research
- Dr. ir. Frank van der Wilk, executive director Netherlands Commission on Genetic Modification;
- Dr. Mariken de Krom, head team Education and Research (Brain Division) at UMC Utrecht;
- Dr. Mieke Latijnhouwers, assessment expert at Education Support Office of Wageningen University & Research;
- Dr. Eric Schouwenberg, head of department Nature and Biodiversity at Arcadis;
- Prof. dr. ir. Wim Petegem, professor in Engineering Education at the unit Engineering Technology Education Research (ETHER) of KU Leuven;
- Dr. Peter Korsten, researcher and lecturer in Evolutionary Biology at Bielefeld University;
- Dr. Éva Kalmár, researcher and lecturer in Science Communication at Delft University of Technology;
- Dr. Mark Bos, researcher and lecturer in Science Communication at Utrecht University;
- Drs. Bas Reichert, founder and CEO of BaseClear (microbial genomics);
- Jelle Keijzer BSc, master student Molecular Cellular Life Sciences at Utrecht University (student member);
- Ishara Merhai, bachelor student Biology at University of Amsterdam (student member).

The panel assessing the Biology programmes at the University of Groningen consisted of the following members:

- Prof. dr. Ton Bisseling, professor emeritus Molecular Biology at Wageningen University & Research (chair);
- Em. prof. dr. Nico van Straalen, professor emeritus of Animal Ecology at Vrije Universiteit;
- Prof. dr. Menno Witter, Professor of Neuroscience at Norwegian University of Science and Technology;
- Prof. dr. Ellen Blaak, Professor of Human Biology at Maastricht University;
- Prof. dr. Roos Masereeuw, professor of Experimental Pharmacology at Utrecht University;
- Prof. dr. Dennis Claessen, professor Molecular Microbiology at Leiden University;
- Dr. Mieke Latijnhouwers, assessment expert at Education Support Office of Wageningen University & Research;
- Drs. Bas Reichert, founder and CEO of BaseClear (microbial genomics);
- Jelle Keijzer BSc, master student Molecular Cellular Life Sciences at Utrecht University (student member)

Information on the programmes

Name of the institution:	University of Groningen
Status of the institution:	Publicly funded institution
Result institutional quality assurance assessment:	Positive
Programme name:	Ecology and Evolution
CROHO number:	60365
Level:	Master
Orientation:	Academic
Number of credits:	120 EC
Specialisations or tracks:	Ecology & Conservation Evolutionary Biology
Location:	Groningen
Mode(s) of study:	Full-time
Joint programme:	Erasmus Mundus Programme in Evolutionary Biology (MEME) with the Ludwig Maximilians University of Munich, Uppsala University and University of Montpellier (double degree)
Language of instruction:	English
Submission date NVAO:	1 May 2022
Programme name:	Biomolecular Sciences
CROHO number:	60616
Level:	Master
Orientation:	Academic
Number of credits:	120 EC
Specialisations or tracks:	Chemical Biology
Location:	Groningen
Mode(s) of study:	Full-time
Language of instruction:	English
Submission date NVAO:	1 May 2022
Programme name:	Marine Biology
CROHO number:	60609

Level:	Master
Orientation:	Academic
Number of credits:	120 EC
Specialisations or tracks:	Research Science, Business and Policy
Location:	Groningen
Mode(s) of study:	Full-time
Language of instruction:	English
Submission date NVAO:	1 May 2022
Programme name:	Biology
CROHO number:	66860
Level:	Master
Orientation:	Academic
Number of credits:	120 EC
Specialisations or tracks:	Research Science, Business and Policy
Location:	Groningen
Mode(s) of study:	Full-time
Language of instruction:	English
Submission date NVAO:	1 May 2022
Programme name:	Biomedical Sciences
CROHO number:	66990
Level:	Master
Orientation:	Academic
Number of credits:	120 EC
Specialisations or tracks:	Science, Business and Policy Biomedical Sciences Research Biology of Ageing Biology of Cancer and Immune System Biology of Food and Nutrition Neuroscience
Location:	Groningen
Mode(s) of study:	Full-time
Language of instruction:	English
Submission date NVAO:	1 May 2022
Programme name:	Medical Pharmaceutical Sciences
CROHO number:	60611
Level:	Master
Orientation:	Academic
Number of credits:	120 EC
Specialisations or tracks:	Science, Business and Policy Research Pharmaceutical Design and Engineering Pharmacoepidemiology and Pharmacoeconomics

Location:	Drug Toxicology and Translational Technology
Mode(s) of study:	Groningen
Language of instruction:	Full-time
Submission date NVAO:	English
	1 May 2022

Description of the assessment

Organizational context

The MSc programmes Ecology and Evolution, Biomolecular Sciences, Marine Biology, Biology, Biomedical Sciences and Medical Pharmaceutical Sciences (MPS) are embedded in the School of Science and Engineering (SSE) at the Faculty of Science and Engineering (FSE) of the University of Groningen. SSE organizes 38 BSc and MSc programmes in six disciplinary clusters: Biology, Chemistry, Pharmacy, Physics, Mathematics and Engineering. The masters in Ecology and Evolution, Biology, Marine Biology, Biomolecular Sciences and Biomedical Sciences are organized by the Biology cluster, and the master MPS by the Pharmacy cluster. Education is organized at the level of the clusters, with the programme directors of the individual programmes forming (amongst others) the programme board that heads the cluster. The 'biological' masters Ecology and Evolution, Biomolecular Sciences, Marine Biology and Biology operate in close cooperation, and share a Board of Examiners as well as a Programme Committee. The 'biomedical' masters Biomedical Sciences and MPS have separate Programme Committees, and fall under the Boards of Examiners of Biomedical Sciences and Pharmacy respectively.

Science, Business and Policy (SBP) is a faculty-wide track offered by most of the master's programmes in FSE. To prevent repeated accreditation of this track in all associated master's programmes, the SBP track will be covered separately in this evaluation. Subsequent accreditation reports of other programmes offering SBP can refer to this report for discussion of the SBP track.

Standard 1. Intended learning outcomes

The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements.

Findings

General aims and profile

The master's programmes aim to offer research-driven and research-focused education. Students are provided with scientific knowledge, as well as research and academic skills to achieve a higher level of understanding and insights, developing themselves into scientific professionals in various areas of the life sciences. Students follow either a predominantly research-driven path or a societal-oriented path (SBP), preparing them for a career in either academia, industry, consultancy, or (non)-governmental organizations.

The aims of the programmes have been summarized in intended learning outcomes (ILOs). They have a similar structure, and have been adapted with programme-specific elements detailing the knowledge and research skills associated with the specific field. The four biological masters have jointly formulated goals on academic and learning skills. The same applies to the two biomedical masters. In addition, each MSc has added a description of each track to its ILOs, detailing the goals and focus of that specific track in relation to the programme's ILOs. The MSc Ecology and Evolution has formulated separate ILOs for both its tracks, which will be discussed below under the programme-specific aims and goals.

The panel studied the general aims and profile of the six master programmes as well as the ILOs and concludes that they form a well-structured overview of the main goals of the programmes translated into knowledge and skills to be acquired by students. An overview provided by the programmes demonstrates that the ILOs of each programme align with the Dublin descriptors for master's programmes, thereby

demonstrating the master's level and academic orientation. The panel praises the focus on research-driven education that the programmes demonstrate in their profile as well as the ILOs. Each programme is strongly aligned with one or more of the research institutes of FSE, creating a fruitful environment in which research and education are intertwined.

The panel also determined that the ILOs of the four biological MSc programmes are well-aligned with the Domain-Specific Framework of Reference (DSFR) for Biology (2020), and the two biomedical MSc programmes with the DSFR for Biomedical Sciences (2017). It concludes that the ILOs of all programmes meet the expectations of the academic and professional field. To further strengthen the ties with the field, the MSc MPS has an Advisory Committee consisting of representatives from industry and academia that annually discusses the aims and goals of the programme, as well as the content of the curriculum in the light of the demands of the professional field. The panel found that this Advisory Committee has an influential role: the track Pharmaceutical Design and Engineering was recently designed using advice from the Advisory Committee. The panel praises the programme for this, and recommends considering establishing a similar committee for the other master's programmes.

The SBP track offers students from a wide range of MSc programmes within the faculty an opportunity for orientation on and training for a non-academic career. It aims to train students as a scientist pursuing a career in business or policy, applying their scientific expertise as a consultant in industry, government or non-profit organizations. Four of the six master's programmes discussed in this report offer SBP, with the exception of Ecology and Evolution, and Biomolecular Sciences. Students from various disciplines jointly follow a separate, one-year curriculum. Afterwards, they receive a diploma from their original MSc, mentioning the SBP track. The panel is very positive on the opportunities provided by the SBP track. From the interviews during the site visit, the panel was impressed by the clear vision and drive of the staff organizing the track, the well-organized structure and the successful collaboration between the SBP track and the MSc programmes. The track is well-aligned with the associated MSc programmes, and is considered an integral part of their curricula for students interested in a career outside academia. The panel praises the track as well as the MSc programmes for this.

Aims and profile: Ecology and Evolution

Students in the MSc Ecology and Evolution learn to study complex biological systems consisting of all kinds of organisms in a diversity of habitats. It is a selective programme (maximum of 50 students) strongly aligned with the research of the Groningen Institute for Evolutionary Life Sciences (GELIFES). The programme aims for excellence, with high-quality specialist courses offering close interaction between small groups of students and top researchers. The track Ecology and Conservation links ecology and evolutionary biology with nature management and conservation. It offers fundamental ecological theory, as well as ecological field research, and prepares students for a career in research or conservation management. The track Evolutionary Biology focuses on fundamental research in the functioning of organisms in the light of evolutionary processes, both now presently and in the past.

The Evolutionary Biology track includes the Erasmus Mundus Programme in Evolutionary Biology (MEME). This is a joint programme between the University of Groningen, the Ludwig Maximilians University of Munich, Uppsala University and University of Montpellier as partners and Harvard University (USA) and University of Lausanne (Switzerland) as associated partners. Students compose an individual study programme in evolutionary biology by combining elements from the complementary programmes at the partner universities, and receive a double degree from Groningen and one of the partner universities, depending on where they did their research projects. The programme attracts approximately 12-16 of students annually. A

select number of excellent students receive a scholarship, allowing them to execute their final research project in cooperation with and at Harvard University or the University of Lausanne.

The panel concludes that the MSc Ecology and Evolution has a clear and distinctive profile. The programme is well-equipped to offer excellence within a high-quality research environment. The tracks each have a separate and relevant focus, with MEME functioning as an excellency programme. This is reflected in a separate set of additional ILOs for the two tracks. The panel considers these ILOs appropriate and well-aligned with the goals of the tracks. The panel considers the MEME consortium to be of a very high quality, bringing together some of the top universities in evolutionary biology worldwide. As an Erasmus Mundus programme, MEME is mainly a mobility programme, meaning that it is aimed at attracting students from abroad rather than students that did their BSc in Groningen. By bringing together the MEME students and single degree students in the first semester courses of the Evolutionary Biology track, other students in the track can also experience the international classroom provided by the MEME programme. The panel recommends fostering and stimulating this cross-reactivity between MEME and non-MEME students.

The panel was surprised to learn that the MSc Ecology and Evolution does not offer the SBP track to its students. Even though the programme profiles itself as a MSc focused on research, the Ecology and Conservation track is also clearly aligned with a career in conservation management, for instance in (non-)governmental organizations. The panel observed that some students follow the Ecology and Conservation courses as part of the MSc Biology in order to be able to pursue the SBP track, or extend their studies with one year to do the SBP track on top of their MSc Ecology and Evolution. The panel recommends investigating whether the SBP track can be integrated with at least the Ecology and Conservation track to prepare students for a professional field career.

Aims and profile: Biomolecular Sciences

The MSc Biomolecular Sciences is a selective master (maximum of 30 students) aimed at excellent fundamental research related to processes at the molecular level in living cells. It contains elements from various subfields of biology and biochemistry, all geared towards understanding the fundamental molecular properties of life, as well as skills required to work on innovations in biotechnology and synthetic biology. The programme is strongly related with the Groningen Biomolecular Sciences and Biotechnology Institute (GBB). It is geared towards a career in research in academic, medical or industrial research in biotechnology. Students combine the acquisition of fundamental knowledge and research skills with practical training using high-tech research equipment and techniques.

According to the panel, the MSc Biomolecular Sciences has a strong, fundamental research-oriented profile. The close cooperation with GBB provides students with an excellent, high-quality research environment, and allows students to work on the frontier of biotechnology research, using state-of-the-art research equipment. The programme distinguishes itself from similar programmes by a strong focus on practical research skills. Considering the focus of the programme on fundamental research, the panel understands its choice not to offer the SBP track to students. Even though the programme is oriented towards careers in industry, these are primarily careers in industrial research environments. The recent restructuring of the BSc Life Sciences and Technology, resulting in more focus on biochemistry, strengthens the link of the MSc Biomolecular Sciences to this BSc, which the panel expects to have a positive effect on the interest for this MSc programme.

Aims and profile: Marine Biology

The MSc Marine Biology aims for students to study and understand marine ecosystems and organisms, with the goal of contributing to solutions for their conservation in the light of pressure caused by human activity.

It is a selective MSc (maximum of 30 students) that combines various subdisciplines in biology and related fields, ranging from genetics to physiology, behaviour and field biology. Students are provided with knowledge as well as skills for studying marine systems, which often involves applied research and field work. The programme is related to the GELIFES institute in Groningen, and closely cooperates with the Royal Netherlands Institute for Sea Research (NIOZ). The programme consists of two tracks: the Research track, and the SBP track.

According to the panel, the MSc Marine Biology has a strong and very relevant profile. It has a unique orientation on ecological and evolutionary aspects of marine ecosystems. The cooperation with NIOZ as well as the proximity of the Wadden Sea ecosystem provide students with attractive opportunities for applied research. The two tracks provide students with the opportunity to orient themselves towards a career in either research or the professional field.

The panel learnt that the cap of 30 students was introduced in 2019 in response to a sudden increase in application numbers, which were traditionally around 10-15 students per year. The panel thinks that this limited capacity is unfortunate given the relevance of the programme and the high interest of students. It wonders whether the cap reflects practical or substantive considerations, and challenges the programme to form an explicit vision on the desired size of the programme, in particular in relation to the demand of the professional field. The panel would welcome any opportunities for sustainable growth, if deemed feasible by the programme, in order for the programme to meet demands from students and the field.

Aims and profile: Biology

The MSc Biology is a broad programme that allows students to combine knowledge and skills from different domains of the life sciences in an individual study programme. Students can choose a combination of courses from the MSc programmes Ecology and Evolution, Marine Biology, Biomolecular Sciences and Biomedical Sciences into a personalized focused or broad curriculum. The programme offers a Research track, and the SBP track. Within the Research track, students can opt for the specialized track Modelling in the Life Sciences, that trains students in quantitative modelling and theoretical research. The panel thinks that the MSc Biology offers a unique and flexible curriculum that can be tailored to the student's needs and future career plans. The Modelling track is a unique aspect of the programme that gives students the opportunity to specialize in quantitative research in the life sciences.

During the site visit, the panel spoke with several representatives of the programme about the positioning of the programme with regard to the other MSc programmes in the life sciences. The programme offers most of its content together with other MSc programmes, which sometimes leads to practical issues that hinder students from following their desired curriculum (see Standard 2). Furthermore, the panel understood that some students enrol in the programme because they are either not admitted to one of the selective MSc programmes, or because their initial MSc of choice does not offer specific elements they are interested in, such as the SBP track in the MSc Ecology and Evolution. While the panel in principle agrees with the programme's wish to facilitate these students, it also noted that the programme risks being associated with a negative rather than a positive option, also due to its dependence on other MScs and the relatively small number of students (around 16 students annually). The panel regrets this, as the flexibility of the programme is a strong asset in itself. It encourages the MSc Biology to strengthen its position. This would include a strong and visible organization with a clear profile for the MSc. To this end, the faculty could consider investing in staff specific for this programme. The panel stresses that the MSc Biology does not necessarily need to invest in programme-specific courses or tracks: the curriculum in its current form is already strong, but should be better positioned to highlight the integrative and interdisciplinary opportunities it offers.

Aims and profile: Biomedical Sciences

In the MSc Biomedical Sciences, students are educated in an interdisciplinary way in research areas necessary to understand mechanisms of and cures for diseases. Associated fields include molecular and cell biology, integrative physiology and behaviour, and molecular pathology of diseases. The programme works closely together with the University Medical Centre Groningen (UMCG), providing students with a research environment with state-of-the-art technologies as well as patient-associated research. The programme offers students a choice between five research tracks and the SBP track. The research tracks include Biology of Ageing (ageing and age-related pathologies), Biology of Cancer and Immune System (basic and translational oncology and/or immunology), Biology of Food and Nutrition (human nutrition and health, including the influence of food and nutrition on the metabolism, gut microbiota, ageing and behaviour), and Neuroscience (role of higher brain functions in health and disease). These tracks function as specialisms on top of the core curriculum in Biomedical Sciences, and are aligned with the research fields of the research departments associated with the programme. The fifth research track, Biomedical Sciences Research, is a general track, in which students can design a tailor-made programme to suit their own ambitions and interests. The MSc Biomedical Sciences is currently non-selective, but is in a process of applying for a cap of 90 students per year due to the high intake of over a 100 students per year in the past cohorts.

The panel is positive on the aims and profile of the MSc Biomedical Sciences. The programme offers an attractive research environment through the collaboration with UMCG, providing students with unique opportunities to perform research at the interface of preclinical and clinical research. The specializations offered in the five research tracks are relevant and challenging, and well-aligned with the frontier research conducted at FSE and UMCG. The SBP track is an attractive option for students interested in a career in for instance health policy or life science enterprise. The panel considers the planned cap on the number of students to be an adequate decision considering the number of students the programme can reasonably accommodate in an interactive research setting together with UMCG.

Aims and profile: Medical Pharmaceutical Sciences

The MSc Medical Pharmaceutical Sciences (MPS) focuses on educating students in the therapeutic intervention of diseases by drugs. Students acquire knowledge and understanding of molecular mechanisms of diseases and actions of drugs, of drug development and discovery, and of therapeutic drug use. They combine theoretical research with practical experience in innovative techniques, such as organoids and lab-on-a-chip. The programme prepares students for a career in research in academia, the medical or the pharmaceutical industry, or as a professional in industry or policy. It offers four research tracks as well as the SBP track. Three research tracks function as specialization areas aligned with the research interests of the Groningen Research Institute of Pharmacy (GRIP): Pharmaceutical Design and Engineering (drug development with a focus on drugs with disease-modifying capacity), Pharmacoepidemiology & Pharmacoconomics (economic impact of health and the effects of medicine and medicine policy) and Drug Toxicology & Translational Technology (drug metabolism and adverse reactions of drugs). The fourth track, Research, is a general track, in which students can design a tailor-made programme to suit their own ambitions and interests.

The panel concludes that MPS has a clear and unique profile, combining pharmaceutical sciences with medical and economical research. It clearly differs from an MSc in Pharmacy through its predominant research focus and interdisciplinary character. The programme is well-embedded in GRIP, offering a high-quality research environment with close ties to preclinical research in UMCG. This provides students with the opportunity to receive practical training in innovative techniques. The three research tracks offer distinctive and relevant specialization areas, with the SBP track offering orientation towards a career in policy or industry. The recent restructuring of the BSc Life Sciences and Technology, resulting in more focus on

biochemistry, strengthens the link of the MSc MPS to this BSc, which the panel expects to have a positive effect on the interest for the programme.

Considerations

The six MSc programmes in life sciences have generally clear and well-defined aims and profiles, spanning a wide range of research fields in biology and biomedical sciences. They are closely related to the research institutes at the Faculty, providing a high-quality, research-driven educational environment. The aims of the programmes have been adequately translated into intended learning outcomes that match the Dublin descriptors, as well as the requirements of the academic and professional field. The panel established that the external Advisory Committee in the MPS programme plays a meaningful role in this, and recommends considering setting up a similar committees for other programmes. The SBP track provides an interesting and very well-organized opportunity for students interested in a career as consultant in a non-academic organization.

The *MSc Ecology and Evolution* offers two separate and relevant tracks in ecology and evolutionary biology in cooperation with the GELIFES research institute. The international joint programme MEME is a prestigious asset of the programme, and is offered in a consortium of top universities in the field. The panel advises to assure that all students in the MSc Ecology and Evolution will be able to benefit to some extent by safeguarding sufficient contact between MEME and non-MEME students. It also advises the Ecology and Evolution programme to consider offering the SBP track for students in the Ecology and Conservation track.

The *MSc Biomolecular Sciences* has a fundamental research-oriented profile in biotechnology, with a strong focus on practical research skills. The cooperation with GBB provides students with an excellent, high-quality research environment and state-of-the-art research equipment.

The *MSc Marine Biology* has a strong, internationally recognized profile focusing on marine ecosystems and their conservation. The cooperation with NIOZ as well as the proximity of the Wadden Sea ecosystem provides students with attractive opportunities for applied research. The panel challenges the programme to consider whether there are any opportunities for sustainable growth considering the interest in the programme and the relevance of the field.

The *MSc Biology* offers a unique and flexible individual curriculum for students, as well as the opportunity to specialize in quantitative research in the life sciences in the Modelling track. The panel recommends strengthening the MSc's profile, as well as the positioning of the programme with regard to the other MSc programmes in the life sciences. A clearer profile might help attract more students specifically interested in the integrative and interdisciplinary opportunities the flexible curriculum offers.

The *MSc Biomedical Sciences* offers students an attractive research environment to study the biological aspects of diseases and their cures, with several specialization areas closely related to the expertise of the associated research departments. The collaboration with UMCG provides students with the attractive opportunity to perform research at the interface of preclinical and clinical research.

The *MSc Medical Pharmaceutical Sciences* has a clear and unique profile, focusing on interdisciplinary research related to pharmaceutical sciences. It is well aligned with research at the GRIP institute, offering distinctive and relevant specialization areas, as well as practical training in using innovative techniques.

Conclusion

The panel concludes that all programmes meet standard 1.

Standard 2. Teaching-learning environment

The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

Findings

Curriculum: General structure and didactics

Teaching in the MSc programmes is based on a hands-on approach: learning by doing under individual supervision. All six MSc programmes use a similar structure to shape their curriculum (see appendix 2). Students start with specialized courses that provide them with knowledge, skills and competences necessary for the discipline. Next to the compulsory core, the programmes offer a large choice of elective courses that are either track-specific or free, so students can specialize in a broad range of life sciences questions in research or industry. These courses have a strong relation with the research performed in the various institutes associated with the programme. Educational methods in the courses include lectures, tutorials, projects, and group work, and in most programmes also experimental laboratory or field work.

The largest part of each curriculum (70-80 EC) consists of a series of individual projects: the Colloquium, Essay, Research Project 1 and Research Project 2/Internship. During these projects, students are individually supervised, and learn through personal guidance. All students follow the Colloquium (an oral presentation based on a literature study) and Research Project 1 (an individual research project in one of the research groups). Students that choose one of the Research-tracks within a programme also write an Essay (written review and discussion based on a literature study) and execute Research Project 2 (a second research project in one of the research groups), which is also their final project. Students that choose the SBP track (see Curriculum: SBP-track) follow an Internship in an external organization, where they develop competences in relation to their role as scientific advisor in an external organization. Research Project 1 and the Internship together form their final projects.

The panel studied the general structure of the MSc programmes and concludes that this fits the general vision and the ILOs of the programmes. The main educational method is the learning by doing in a master-apprentice relation. The individual projects clearly reflect this approach pursued by the programmes, and ties the programmes strongly to the research conducted in the Faculty. The other courses and educational methods build towards this, providing students with the knowledge and skills necessary for the individual part of the programme. To this end, students have ample opportunities to shape their own curriculum through tracks and electives, as well as a choice of projects. In response to the recommendations of the previous evaluation panel, most programmes have introduced a common compulsory course that introduces the core concepts and skills of the programme and promotes community forming among students in the highly elective programmes. The panel notes that these common courses fulfil this function well, and are appreciated by students and advises the programmes and/or tracks that do not have these common courses to introduce one.

Although the programmes offer many opportunities for skills training, the panel missed a clear in-depth overview in the form of a skills learning trajectory throughout the curricula. It recommends creating this for each programme. Such a learning trajectory would be helpful to monitor the skill education throughout the curriculum, and to monitor whether all students receive comparable skills training, regardless of their choice of track and electives.

During the lockdowns in 2020 and 2021, the programmes were mostly successful in shifting their courses to an online setting. Nevertheless, both students and teaching staff reported that the lack of direct interaction in courses made online education challenging, and they were glad to resume on-site education later in 2021. Restrictions for lab and field work were felt in courses with an experimental focus. By dividing students into very small groups, the most important experimental work could still continue. All students could eventually be provided with the minimally required practical teaching, although not as much as usual. Some students had to adapt their Research projects to more theoretical or data-oriented approaches to account for the limited possibilities for lab work. Internships could mostly continue as planned, although students often had to work from home. The panel praises the programmes for this major effort in keeping the labs operational and providing students with sufficient training and opportunities in this challenging period.

Curriculum: Ecology and Evolution

Students in the MSc Ecology and Evolution choose between the tracks Ecology and Conservation or Evolutionary Biology right at the start of the programme. The tracks consist of 40 EC core courses and electives. For Ecology and Conservation, core courses and electives both cover 20 EC, for Evolutionary Biology this is 27 EC core and 13 EC electives. Each track starts with a series of mandatory specialist courses. As part of their first course, both groups of students spend one week at the field station on the Wadden island of Schiermonnikoog. This is not only an introduction to ecological field research, but also has an important community-forming aspect. The courses often focus on assignments, such as developing and presenting a strategy for nature conservation, or a poster presentation. Feedback from supervisors and peers helps students to further develop their skills. For the electives, students can choose from a list of programme-specific electives, or request alternative courses from other programmes or universities at the Board of Examiners.

The MEME double degree programme is a special variant of the Evolutionary Biology track. Students combine elements from complementary programmes at the four participating universities. They start with a Summer School where the participating students and research staff from all universities meet. Students that pursue a double degree with Groningen follow a 25 EC selection of core courses of the Evolutionary Biology track, the Essay (5 EC) and the Colloquium (5 EC) in the first semester. For their second semester, students move to either Montpellier or Munich, where they spend 15 EC on additional courses and 15 EC on a first brief research project. In the third and fourth semester, students conduct two 30 EC research projects, one at each university they want to obtain a degree from. A limited number of students from each MEME cohort get the opportunity to conduct a research project at Harvard University or University of Lausanne.

Based on the documents and the interviews during the site visit, the panel concludes that the MSc Ecology and Evolution offers an attractive and challenging curriculum. Both tracks offer a coherent combination of core courses, electives and individual projects that allow students to obtain the intended learning outcomes. The embedding in the GELIFES institute is a major asset that provides students with the opportunity to experience state-of-the-art research first-hand. The panel notes that the two tracks offer separate curricula, and that there is little interaction between the two groups (or three groups if MEME is considered separately). The panel thinks that there is sufficient overlap in content of the tracks to allow for more interaction, and thus recommends investigating whether more links between the student groups are possible and desirable.

From the interviews during the site visit, the panel learnt that some students miss attention towards job market orientation in the programme. Both tracks mainly focus on a research career, although not all students aspire this or will obtain a research position. In particular for the Ecology and Conservation track, the panel sees many opportunities for a professional career. It recommends reflecting on this, in combination with the recommendation to consider offering the SBP track (see Standard 1). Furthermore, the

panel noted that the Ecology and Conservation track does not have mandatory content on genetics or genomics. The panel considers this an integral part of ecology, which is not necessarily covered in-depth if students come from a BSc Biology outside Groningen. It recommends monitoring whether students have sufficient background in these fields before being admitted to the programme, and require additional courses if this is not the case.

The panel learnt that MEME double degree programme is well designed and organized. It offers students the opportunity to follow electives and conduct research projects at other universities next to the core curriculum in Groningen. Students feel well-informed on the programme and possibilities. The programme has its own management board and quality assurance committee, in which all universities are represented to safeguard alignment between procedures. The panel learnt from the student interviews that the Colloquium is a mandatory part of the MEME curriculum in Groningen, as recommended by the previous accreditation panel, but is not properly included in the curriculum. As the Colloquium does not fit the schedule, students follow 35 EC of courses in the first semester, rather than the 30 EC of regular students in the track Evolutionary Biology. The panel considers this distinction undesirable and recommends remedying this to ensure that the curriculum amounts to 120 EC for all students.

Curriculum: Biomolecular Sciences

The Biomolecular Sciences curriculum starts with a core course Protein and Enzyme Engineering (5 EC), followed by all students. This course makes students familiar with the scientific basis and main applications within the field. It also includes lab work as well as participation in the GBB annual symposium. After getting acquainted with the breadth of research within GBB through the core course, students make their individual choices for the remainder of the programme. Together with their mentor, they choose a 35 EC set of modules from a list of electives offered by the programme, supplemented with other courses that fit their interest. The resulting individual curriculum needs to be approved by the Board of Examiners, which checks whether the courses and projects cover all ILOs. Most students choose the majority of courses from the general programme Biomolecular Sciences (35 EC electives), and/or further specialization in Chemical Biology (15 EC core + 20 electives). Most of the courses run over a three-week period in which students focus all their time on that particular course before moving on to the next.

The panel studied the curriculum as well as the content of a number of courses, and concludes that the programme offers a high-quality, research-oriented curriculum that allows students to specialize in various fields related to biotechnology and biochemistry studied at the GBB institute. The courses are offered in small-scale, interactive settings by active researchers in the field. Both courses and research projects often involve working with state-of-the-art equipment and research techniques. The panel appreciates this close integration between education and research. The coherence of the programme in relation to the ILOs is safeguarded through a check of each individual curriculum.

From the interviews with students, the panel learnt that the programme is heavily focused on a research career. The programme advises students interested in a professional career to combine biomolecular sciences electives with the SBP track as part of the MSc Biology. The panel understands this based on the profile of the programme, but also noted that part of the student population only finds out during the programme that they are not interested in a career in academia or will not be able to obtain a research position. It recommends reflecting on what professional career orientation options can be provided to these students. The panel also noted from the interviews that some students felt that the short, three-weeks duration of the courses did not offer sufficient time for reflection and retention of knowledge. At the same time, others felt that it helped them focus on one topic at a time. The panel suggests investigating this and determining whether the current structure of the curriculum is optimal.

Curriculum: Marine Biology

Students in the MSc Marine Biology programme start their curriculum with three mandatory core courses (15 EC) that introduce the three thematic lines of the curriculum: biological oceanography, marine biology and population genetics. These courses include a number of excursions that help students get acquainted with practical field research and experience marine ecosystems first-hand, but also have an important role in community forming. Students visit the Royal Netherlands Institute for Sea Research (NIOZ) on the island of Texel, the Wadden Sea, the seal centre of Pieterburen and a fjord in Sweden. The programme offers two tracks: Research and SBP. In the Research track, students choose a minimum of 20 EC of electives. Furthermore, they can use 5 EC to either follow extra electives, or complement the 80 EC of individual study elements to allow for longer research projects. Students typically specialize in the direction of one of the main themes of the programme, but can also deviate from this if they have a specific interest. The mentor helps students compose a coherent curriculum, which is submitted for approval to the Board of Examiners.

The panel concludes based on the documentation and the interview that the MSc Marine Biology offers a varied and solid curriculum with a recognizable profile that attracts students from all over the world. Next to a strong theoretical basis, the programme offers students hands-on experience with various research methodologies and techniques. In particular the embedding in the GELIFES institute and the opportunities for field work close to the RUG in the ecologically rich Wadden Sea area are major assets of the programme. The core courses achieve a majority of the ILOs, and a check on each individual curriculum provides an extra safeguard that each student follows a coherent curriculum. Students appreciate the community building in the core courses and the overview of the field that is provided in these courses. One particular element mentioned by students in the interviews is the limited amount of statistics education offered by the programme. Some students felt that the statistics taught in the core courses is not sufficient for all research projects. The panel recommends either increasing time dedicated to statistics in the programme, or pointing students towards options to take extra statistics courses within the curriculum. Furthermore, the panel learnt that some students would appreciate additional support from the programme outside the courses, such as in finding (international) internships and career orientation. The programme staff is very helpful when asked, but some students felt that the programme could be more proactive in offering support. The panel recommends investigating these needs and possibilities to improve this.

Curriculum: Biology

The MSc Biology has a very open curriculum that only has the individual elements common to all MSc programmes as compulsory elements. Students can combine elements from all other MSc programmes in life sciences, or choose to specialize in the areas of a particular MSc programmes. They choose between two tracks: Research or SBP. The Research track is a free curriculum. Students start with the introductory course *Skills and Scopes in Biology* (5 EC). This course helps students explore what skills they want to develop in the programme, how they want to shape their curriculum, and what their future career plans are. After this core course, students build a tailor-made 35 EC curriculum to complement the 80 EC individual student components, advised by their mentor and checked by the Board of Examiners. Within the Research track, students can opt for a Modelling in Life Sciences specialization, focused on mathematical modelling. Students follow 20 EC of core courses on modelling and data analysis in the life sciences, complemented with 20 EC electives that can be either broadening or deepening.

The panel studied the structure and content of the MSc Biology and interviewed staff and students. It praises the flexibility and the large amount of freedom that students have to shape their own curriculum. The Modelling track is very relevant and an important and good addition to the programme. It combines life sciences with exact sciences through which students can specialize in the emerging field of mathematical

biology. As discussed in standard 1, the panel thinks that the programme would benefit from strengthening its profile as a distinct programme. According to the panel, one way to do this is to empower the students. Since students often join the courses of other programmes, the cohorts rarely meet and do not have a pronounced identity. The panel considers that the introductory course of the Research track could be made mandatory for students in all tracks, so it can have a role in community building, as it does in other MSc programmes. In addition, the programme could consider other activities to improve social cohesion, such as shared excursions or events.

A related issue that the panel noted during the site visit is that students sometimes have difficulties joining their preferred courses from other programmes. Some MSc programmes have a very limited number of places open in their courses for students from other programmes, which are quickly filled when students do not register within a very short time frame. Thanks to the intervention of the study advisor, students can often still enter the course, but nevertheless this can contribute to the feeling of being a 'guest' in other programmes rather than participating in an independent MSc programme. The panel recommends creating a structure in which the MSc Biology is entitled to places in the courses selected by its students. The courses that students of the MSc Biology will follow are known as soon as their individual curricula are approved, so this information could for instance be used to reserve places in popular courses in advance. The panel believes that if the students of the MSc Biology as well as the programme itself are sufficiently empowered, the programme has a lot of potential to further develop itself as an integrative and interdisciplinary MSc in Biology.

Curriculum: Biomedical Sciences

The MSc Biomedical Sciences consists of four specialized research tracks (Biology of Ageing, Biology of Cancer and the Immune System, Biology of Food and Nutrition and Neuroscience), a free Research track and the SBP track. Regardless of their track, students follow the two core courses Biomedical Sciences: Professional Perspectives and Data Science in Biomedicine (5 EC each). The Professional Perspectives course helps students get an overview of the field and explore their subdiscipline of interest to help them choose a track. The Data Science course was recently introduced to make students familiar with data techniques such as mining, analysing, and visualizing data, which are increasingly important in biomedical research. Within the four specialized research tracks, students follow 20 EC of track-specific core courses, and 10 EC of either track-specific or free electives. The remaining 80 EC is dedicated to the individual study components. The free Research track allows students to choose a combination of modules and electives from each of the other tracks.

The panel studied the structure and content of the curriculum, and interviewed students and teaching staff of the programme. It concludes that the MSc Biomedical Sciences offers a strong and well-organized curriculum that is clearly linked to the ILOs. The core at the start is an excellent opening for all students to form a community and to assure that fundamental skills, including data science, are covered. The four research tracks offer an impressive diversity of course topics that are strongly anchored in active research at FSE and UMCG. Students have the opportunity to do research at the interface of preclinical and clinical research, which provides potentially unique opportunities to use and analyse real clinical data and approaches.

During the site visit, the panel spoke with the programme about the role of the free Research track. The panel learnt that this track has no specific aim or profile, but is offered to provide students with the opportunity to compose a free selection of electives. The panel approves of this student-centred attitude, but also learnt that only a small percentage of students use this option. This makes it relatively labour-intensive to facilitate these students, in particular in the light of the high student numbers. The panel wonders whether the same

aims could also be achieved by allowing more freedom in the existing tracks, for instance by interpreting its tracks as suggested combinations of courses rather than a fixed curriculum. It recommends reflecting on this.

Curriculum: Medical Pharmaceutical Sciences

The MSc Medical Pharmaceutical Sciences starts with the compulsory course Drug Development: from Design to Evaluation (5 EC), in which students acquire fundamental knowledge of the steps involved in drug developments, and the associated skills. After this core course, students choose one of the three specialized research tracks (Pharmaceutical Design and Engineering, Pharmacoepidemiology & Pharmacoconomics or Drug Toxicology & Translational Technology), a free Research track or the SBP-track. With the exception of SBP, each track consists of 80 EC individual study components, and a 30 EC combination of core courses and track-specific electives. In addition, all students follow a compulsory course Academic Skills (5 EC), in which they learn and apply general and specific academic skills (such as statistical analysis) relevant for research in medical pharmaceutical sciences.

The panel studied the content of the curriculum and interviewed staff and students of the programme. It concludes that the programme has translated its ILOs into a strong, coherent research-oriented programme. The tracks are well-aligned with the research institute GRIP, and provide students with the opportunity to participate in state-of-the-art research in GRIP as well as UMCG. The introductory course is appreciated by students, in particular the community-forming aspect. The compulsory course on academic skills helps students in further skills development, but also in remediating the variety in entry levels due to the interdisciplinarity of the programme.

According to the panel, the programme could consider introducing more interaction between students in the different research tracks. The MSc MPS has a modest intake (20-25 students per year), which is distributed over several tracks and electives. More shared courses could provide students with more opportunities to work in larger groups and learn from each other, and also make switching between tracks easier. The panel understood during the site visit that the programme plans to drop its fourth, general Research track in order to provide more focus in the curriculum. The panel agrees with this, also in the light of the relatively small cohorts and the very limited use that is made of this free Research track. The panel wonders whether the aims of this track could also be achieved by allowing more freedom in the existing tracks, for instance by interpreting the tracks as suggested combinations of courses rather than a fixed curriculum. It learnt from students that there is already some flexibility between tracks, indicating that this suggestion is not far from the current situation.

Curriculum: SBP

The Science, Business and Policy-track has a special position in the portfolio of MSc programmes within FSE. It is a faculty-wide track offered in the majority of MSc programmes, in which students from different backgrounds form a class together to study the societal and commercial aspects of scientific knowledge. The track prepares students for a career as scientific policy advisor in business or policy organizations. The SBP-track has a one-year (60 EC) track-specific curriculum, which students combine with a 60 EC curriculum at their original degree programme. The curriculum at the degree programme usually consists of 15 EC core and/or elective courses (depending on the programme), Research Project 1 (40 EC), and the Colloquium (5 EC). Most students follow the curriculum of their degree programme in year 1, and the curriculum of the SBP-programme in year 2.

The curriculum of the SBP track consists of the compulsory courses Introduction to Science and Business and Introduction to Science and Policy (both 10 EC), and a 40 EC Internship. The core courses provide

students with fundamental knowledge in business and policy, and helps them develop relevant skills such as interdisciplinary teamwork, communication with non-scientists and general management skills. The Internship is conducted at an external organization, and lets students experience how to apply science to industrial goals, developing policies, or societal issues. The track requires that students have completed Research Project 1 before starting the internship, as students need the research skills acquired in the Research Project. Students are supervised by a daily supervisor in the internship organization, and a teaching staff member of the SBP track as formal supervisor. The resulting internship report, in which students demonstrate how they applied scientific knowledge to a specific problem within the internship organization, is the final product of the SBP-track.

The panel studied the content of the SBP-track and had the opportunity to interview management, staff and students in an interview specifically dedicated to the SBP-track. The panel was very enthusiastic about the content as well as the structure of the SBP track (see standard 1). The courses as well as the internship provide students with very relevant knowledge, skills, and experience for a career in business or policy. Students learn to translate the scientific knowledge they acquired in their degree programme to policy and business solutions. Furthermore, the participation of students from different MSc programmes offers students a unique opportunity for interdisciplinary learning by working together in courses and projects. The track offers a compact and structured curriculum that is well-aligned and complementary with the curricula of the associated MSc programmes. It aims to guide students through the curriculum as a single cohort, working towards a congress at the end of the academic year where all students present the results of their internship. This structure stimulates community-forming as well as high success rates, both of which are very much appreciated by students. The panel praises the SBP-track for this.

Feasibility and student support

Students are guided throughout the programme by a personal mentor, usually a full professor related to the research interest of the student. The MSc programmes in the life sciences are characterized by extensive personalization and choice. Students are in charge of their study programme within their chosen discipline. After one or more core courses, students develop an individual curriculum in consultation with their mentor and submit this for approval to the Board of Examiners, which checks whether students meet all ILOs. The Research Projects can be started at any moment throughout the year. Students approach a supervisor of their choice, and compose a proposal together with their supervisor and mentor. Progress is monitored through a tool in Nestor, the electronic learning environment used by the programmes. Furthermore, each programme has an academic advisor that helps students with individual advice on study-related issues and personal well-being. During the corona pandemic, the programmes, and in particular the academic advisors, closely monitored the well-being of students through regular surveys, and offered support wherever possible.

The panel appreciates the support offered by the programmes. Students that the panel interviewed were generally satisfied by the support they received from the programmes, both in regular times and during the corona pandemic. The appreciation of the personal mentor varied between students. Several students were happy with the frequent contact and personal advice provided by the mentors, whereas others only met their mentors once or twice at the start of the programme. This was sometimes attributed to the limited availability of the very busy staff members (see also 'Teaching staff'). The panel recommends safeguarding that mentors have sufficient time for supporting students, so that all students can experience a similar involvement of their mentor. This could for instance be achieved by introducing a system of recurring meetings, rather than meetings at the student's request, or by only assigning mentors that can reasonably be expected to have sufficient time for this. The programmes could also consider offering mentor training to help mentors prepare for their role.

During the site visit, the panel spoke with the representatives of several programmes on the success rates. Approximately 60-80% of the students graduate within three years. For two of the six programmes, this average is much lower, namely the MSc E&E (40-50%), the MSc Marine Biology (45-65%) and the MSc Biology (large fluctuation between 35-70%, mainly due to low student numbers). The panel found out from the interview that, apart from reasons unrelated to the programmes, such as illness and extracurricular activities, the main reason behind these delays is prolonged duration of research projects. Students and staff of the programmes report that students often take more time for their research projects than intended, in particular where field work is involved. Students use this time to get better data, improve the quality of their work or to gain extra research experience. To counter this trend, the programmes have recently started a closer monitoring of student progress through the electronic tool mentioned above.

The panel underlines the importance of reducing the duration of research projects. Extended projects lay an unnecessary large claim on the already limited supervision and research positions. The panel has the impression that it is mainly a cultural issue in the biological MSc programmes and associated research groups. The biomedical MSc programmes and the MSc Biomolecular Sciences have a similar set-up for the research projects, but much higher success rates. The same applies to tracks such as the MEME double degree or the SBP-track, which have a similar but stricter schedule, and very favourable success rates. According to the panel, this demonstrates that the curriculum is feasible within two years with stricter supervision and planning. It recommends the MScs E&E, Marine Biology and Biology to break the habit of tolerating substantive delays in research projects, and help students achieve a feasible and timely planning.

Language of instruction

All the MSc programmes are taught in English. The panel considers this an apt choice in light of the research and professional fields the programmes prepare for. Additional benefits are the international classroom and the programme's opportunity to include international researchers among the teaching staff. The panel learned from its interviews with staff and students that the English level among participants (students as well as teachers) clearly suffices for the programmes.

Teaching staff

Nearly all staff members participating in the MSc programmes are active researchers embedded in the research institutes participating in the programmes: the Groningen Institute for Evolutionary Life Sciences (GELIFES), Groningen Biomolecular Sciences and Biotechnology Institute (GBB), Groningen Research Institute of Pharmacy (GRIP), Stratingh Institute for Chemistry (Stratingh) and Zernike Institute for Advanced Materials (ZIAM). The SBP track is organized by the team Science and Society Education, part of the School Science and Engineering, and affiliated with the Integrated Research on Energy, Environment and Society (IREES) institute within FSE. The programmes have a relatively high involvement of senior research staff, with full and associate professors spending approximately 40% of their time on teaching. With regard to professionalization of teachers, the programmes require all new teaching staff to have obtained or pursue a University Teaching Qualification (UTQ). Current staff members have either followed or are following the UTQ trajectory, or received an exemption based on acquired teaching competences. The documents and in particular the interviews with students and teaching staff gave the panel a positive impression of the teaching staff of the programmes. Students praise the expertise, involvement, and motivation of their teachers.

A major topic during the site visit was the workload of the teaching staff, in particular in the Biology cluster within the SSE. After recommendations of the previous accreditation panel on this issue, the Faculty took several measures to improve the teaching capacity of the programmes by expanding the size of the research

staff. Furthermore, the Faculty took several measures to improve the teaching capacity of the programmes by expanding the site of the research staff, as well as appointing seven dedicated lecturers for the BSc programmes, which will alleviate the workload of the entire teaching staff within the Biology cluster. These measures resulted in 7,7 fte of extra teaching capacity for the programmes. At the same time, student numbers grew significantly within the faculty: in particular in the BSc Biology and the MSc Biomedical Sciences, that almost doubled in size. This growth in student numbers nullified a large part of the improvement in teaching capacity the Faculty made. Combined with a general high workload in academia, this workload of teaching staff puts a strain on the programmes. The staff members invest many hours in education beyond their teaching appointment, and still have only barely enough time for supervision, mentoring and educational innovation. The programme management and the Faculty are aware of these issues and are working hard on improvements. The BSc Biology and the MSc Biomedical Sciences have successfully requested a numerus fixus, limiting the intake to 250 students per year for the BSc Biology and 90 for the MSc Biomedical Sciences. Furthermore, the Faculty has provided funds for the hiring of tenure track researchers with a 60% teaching appointment. These new positions are created to provide a career path for researchers that want to specialize more in teaching. The GELIFES and GBB institutes are in the hiring process for six of these positions.

The panel supports the measures taken by the programmes to reduce the workload for the teaching staff. It is positive on the actions taken in response to the previous accreditation and sees an improvement. Nevertheless, as the programmes have been confronted with growing student numbers, the panel strongly encourages the programmes to continue their efforts to remediate this. The panel experienced during the site visit that the current situation is very demanding for the teaching staff, and limits the possibilities for further development of the programmes. The panel was glad to learn that funding for extra teaching staff is available for the BSc and MSc programmes in the Biology cluster, and encourages the Faculty to work out a plan together with the programmes to utilize these funds for extra teaching capacity. It expects that these extra investments, together with a the upcoming numerus fixus on the BSc Biology and MSc Biomedical Sciences and the hiring of tenure track researchers with an educational profile, will lead to a significant improvement of the current situation.

According to the panel, the programmes should take into account that putting a limit in one part of a system likely leads to an increase in another part. For instance, putting a cap on the MSc Biomedical Sciences could lead to a higher inflow of students in the MSc Biology. A sustainable solution should therefore focus on the capacity of the teaching staff within the SSE as a whole. A further complication for the MSc Biomedical Sciences and MPS is the dependence on teaching staff and research projects from UMCG. The UMCG is experiencing a similarly high workload that is outside the span of control of the FSE. The panel understands this issue and supports the Faculty in discussing arrangements with the UMCG in securing adequate teaching and supervision for the MSc Biomedical Sciences and MPS.

Several groups of teaching staff, in particular in the MSc Ecology and Evolution, the MSc Marine Biology and the MSc Biomolecular Sciences, expressed their concerns to the panel regarding the upcoming retirement of several key staff members, and the consequences this will have for the expertise of the teaching staff as a whole. The faculty management assured the panel that these issues have the attention of the faculty, and that plans for succession will be made in the short term. The panel supports these intentions.

Considerations

The MSc programmes in the life sciences have adequately translated their intended learning outcomes into a coherent curriculum focused on hands-on learning by participating in research. To this end, the programmes have a large individual component where students develop their skills in master-apprentice relation,

working with state-of-the-art research facilities. The courses and educational methods build towards this, providing students with knowledge and skills necessary for this individual component. The programmes are characterized by a large amount of choice: students compose an individual curriculum in consultation with their mentor from a large selection of tracks and electives, which is checked for coherence by the Board of Examiners. The panel appreciates the general design of the curricula, which fits the vision and profile of the programmes. To further improve coherence, it recommends introducing a skills learning trajectory to ensure that all students receive comparable skills training within their individual curricula. All programmes are offered in English, which the panel considers an apt and well-implemented choice considering the career perspectives of graduates. The faculty-wide track SBP is well-aligned with the associated MSc programmes, and is appreciated by students as well as the panel for its relevant content and structured curriculum with a high sense of community and high success rates.

The panel appreciates the guidance and support provided to students in the programmes. It appreciates the role of the core courses in most curricula in promoting community-building. The programmes have worked hard to keep the quality of education high during the corona pandemic, and monitored the well-being of students carefully. The mentor system works well in most cases, although experiences vary. The panel recommends safeguarding that mentors have sufficient time to support students. The curricula are feasible, yet in particular the MScs E&E, Marine Biology and Biology should work on breaking the habit of tolerating delays in research projects.

The teaching staff of the programmes is well-qualified with strong connections to research, and very much valued by students. The programmes have taken adequate measures to reduce the workload of the teaching staff in response to recommendations by the previous accreditation panel. Nevertheless, growing student numbers throughout the Faculty have posed the programmes with a new challenge, resulting in a renewed rise in workload throughout the teaching staff. The panel supports the plans presented by the programmes as well as the Faculty to tackle this challenge by the upcoming introduction of a numerus fixus on the BSc Biology and the MSc Biomedical Sciences per 2022, and hiring additional teaching staff. It urges the programmes and the Faculty to implement this as soon as possible to alleviate the strain that is currently put on the teaching staff. This will allow the programmes to address a number of recommendations by the panel associated with teaching capacity, such as the sometimes-limited availability of mentors and attention to educational innovation.

The *MSc Ecology and Evolution* offers an attractive and challenging curriculum for both tracks. The panel recommends investigating whether more interaction between the two tracks can be created, and increasing attention towards job market orientation in the programme. It also recommends investigating whether all students have sufficient knowledge of genetics and genomics upon entering the track Ecology and Conservation, and remedy this if this is not the case. The MEME double degree is well organized, and has a strong system of quality assurance in place to safeguard alignment between education at the different institutions. The panel recommends adapting the curriculum for MEME students to properly include the Colloquium, which students now follow outside their curriculum.

The *MSc Biomolecular Sciences* offers a high-quality, research-oriented curriculum offered in a small-scale, interactive setting. The panel appreciates the close integration of education and research, and the opportunity that students have to work with state-of-the-art equipment and research techniques. The panel recommends increasing attention towards job market orientation, and based on student remarks, investigating whether the current structure of three-week courses is optimal.

The *MSc Marine Biology* offers a varied and solid curriculum with a strong theoretical basis, hands-on experience with various research methodologies and techniques and many opportunities to obtain valuable field work experience. The panel recommends investigating whether the amount of statistics offered in the programme is sufficient, and providing more proactive support to students with regard to internships and career orientation.

The *MSc Biology* gives students a large amount of freedom to shape their own curriculum. The Modelling track is very relevant and a good addition to the programme. As students in the free Research track mainly follow courses in other programmes, they do not always feel part of a distinct community in the programme, but rather a guest in other programmes. According to the panel, students should be empowered to identify with an independent MSc programme. This could for instance be achieved through investing in social cohesion and community building, and by solving the issue where students cannot enter their preferred courses in other programmes due to capacity issues.

The *MSc Biomedical Sciences* offers a strong and well-organized curriculum with an impressive diversity of course topics that are strongly anchored in active research at FSE and UMCG. This provides students with the opportunity to do research at the interface of preclinical and clinical research. It recommends considering replacing the free Research track with more flexibility between the tracks. Furthermore, the panel supports discussing arrangements with the UMCG in securing adequate teaching and supervision for the programme due to capacity issues at both FSE and UMCG.

The *MSc Medical Pharmaceutical Sciences* offers a strong, interdisciplinary research-oriented programme that provides students with the opportunity to participate in state-of-the-art research in various specializations of pharmaceutical sciences. The compulsory course in academic skills remediates the variety in entry levels due to the interdisciplinarity of the programme. The programme could consider introducing more interaction between students in the different research tracks, and replacing the free Research track with more flexibility within and between tracks. Furthermore, the panel supports discussing arrangements with the UMCG in securing adequate teaching and supervision for the programme due to capacity issues at both FSE and UMCG.

Conclusion

The panel concludes that all programmes meet standard 2.

Standard 3. Student assessment

The programme has an adequate system of student assessment in place.

Findings

System of assessment

The programmes have defined an assessment system that aims to assure that assessments are valid, reliable, effective, fair, and transparent. The programmes aim to provide a variety of assessment methods, based on the nature of the course, and include written exams, essays, reports, presentations, lab work and field work. To this end, each course has a Course Unit Assessment Overview (CUAO). This is a systematic description of the place of the course in the curriculum and its relation to the ILOs, as well as the relation between the course goals, teaching methods and assessment methods. The CUAOs are reviewed yearly by the programmes, and are an important instrument for the Boards of Examiners in quality control of

assessment. Within the MEME programme (MSc Ecology and Evolution), course assessment is mandated to the individual partner universities, each of which is accredited using the European Standards & Guidelines. In addition, the MEME programme has an Examination Committee, composed of representatives of all partner universities, which monitors the quality and uniformity of assessment throughout the programme.

The MScs Biology, Ecology and Evolution, Biomolecular Sciences and Marine Biology share a Board of Examiners that also covers the BSc Biology and Life Science and Technology. The MSc Biomedical Sciences has a separate Board of Examiners. The Board of Examiners of MPS recently split off from the Board of the MSc Biomedical Sciences and merged with the Board of the BSc and MSc Pharmacy. The Boards monitor the quality of assessment in the programme by annually checking all CUAO's, the assessment of 10 randomly chosen course units throughout the programmes and a selection of recent MSc theses. The Boards check the level of the theses, as well as the reliability and transparency of the assessment. In the case of shortcomings, the Boards report their findings to the examiners, or the programme management in case of serious issues. In addition, the Boards are responsible for checking whether the individual curricula for all students cover the ILOs of the respective programmes. Due to the high flexibility of the programmes, this is a major task. The Board of Examiners for the Biology programmes also covers the SBP track. All MSc programmes within FSE that offer the track have mandated the assessment quality assurance of this track to the Board of Examiners for Biology. The Board includes the courses and internship reports of the track in its annual checks, and reports back to the responsible Boards if deemed necessary.

During the corona pandemic in 2020 and 2021, most course exams were held online. The Boards of Examiners played a major role in this process. The Boards were consulted with regard to alternative assessment methods, decided which adaptations could be made and what exams needed to be held on-site within the limited possibilities available. The latter mainly concerned assessment types which involved hands-on experience, such as lab and field work.

The panel is positive on the system of assessment in the MSc programmes. The assessment methods fit the learning goals of the courses, and cover the knowledge and skills described in the ILOs of the programmes. The CUAOs, of which the panel studied a few examples, are helpful and insightful tools to design and monitor the assessment in the courses and the programmes as a whole. The students and teaching staff that the panel interviewed were generally satisfied by assessment within the programmes, both in the regular curriculum and during the online assessments in 2020. The panel was impressed by the influential, proactive and constructive role of the Boards of Examiners in the programmes. The Boards take their role of safeguarding the quality of assessment in the programmes very seriously. This does not only involve regular checks; the Boards have also taken a central role in designing the assessment of the new curricula, as well as the transition to online assessment in 2020. The quality of assessment in the SBP track as well as the MEME double degree is adequately assured.

The panel noted that the high workload within the programmes also impacts the Boards of Examiners, in particular the Boards for Biology and Biomedical Sciences. On top of the extra time required for assessment during corona and the implementation of new curricula for the BSc programmes, higher student numbers lead to more requests and approvals of individual study programmes. Finding members for the Board is challenging due to the general workload in the programmes. To address this, the Boards have recently expanded the role of the formal secretary, with the intention of delegating more tasks. The panel supports the efforts of the Boards to reduce the workload of their members, and agrees that new board members are necessary, both for existing vacancies and expansion of the Board. Programme representatives expressed hope during the interviews that the new education-focused tenure track researchers can also take up roles in

the Boards and Committees. The panel supports this, and recommends safeguarding adequate staffing of the Boards of Examiners.

Assessment of Research Projects

The MSc Research Projects are assessed by two assessors who document their assessment in an assessment form. Assessment criteria include scientific quality, technical contribution, project management, interpersonal skills, and presentation and writing skills. The assessors jointly complete an assessment form on which they substantiate the grade on the various criteria, as well as provide feedback to the student. Research projects by MEME students within the MSc E&E are always graded by one examiner from the host university and one from the University of Groningen. The presentation that is part of the thesis is given twice: once at each university. Both examiners discuss the thesis and jointly decide whether the work is sufficient. Each examiner is responsible for checking the specific requirements of his or her home university, and giving a grade in the grading system used at that particular university. The MEME theses are also included in the annual checks by the Groningen Board of Examiners.

As part of its preparation of the site visits, the panel studied the work of 15 students from each programme. It concludes that the form used for the MSc theses has useful and clear criteria to evaluate the thesis, as well as a helpful rubric. The MSc Ecology and Evolution closely monitors the quality of theses written at other universities within the MEME programme. Requiring a RUG examiner as second assessor is a suitable procedure to achieve this, which the panel appreciates.

In most cases, assessors provided insightful considerations and feedback to substantiate the grades. However, the panel noted that a number of forms were less transparent and contained little more than the grades. Also, the panel found that, incidentally, the assessors consisted of the supervising PhD student and his or her promotor. Both are violations of the assessment policy of the Faculty, which requires substantiated assessment forms and two independent assessors. The Boards of Examiners informed the panel during the site visit that both observations also emerged from the Board's recent thesis checks. The management of all programmes acknowledged to the panel that some assessors choose the easy way-out due to time and capacity constraints, and agreed with the panel that better enforcement of the internal assessment policies is necessary. The panel suggests promoting a culture of accuracy by making a thesis coordinator responsible for checking the correct use of procedures at the start and completion of a project.

In addition, the panel recommends paying extra attention to the role of the independent second assessor. The panel recommends appointing a second assessor from a different research group or even institute unaffiliated with the project to assess the report and presentation. This serves as an extra, unbiased check of the thesis quality (see Standard 4). Furthermore, the panel recommends making the role of this second examiner more explicit in the assessment form, for instance by noting any differences of opinion or by including separate assessment forms for both assessors.

Assessment of internships

Students in the SBP track complete their programme with an internship in which they learn to give business or policy advice based on scientific insights. Their final product is an advice report that describes scientific advice on a particular business or policy issue. The internship is assessed based on the advice report and the internship process, each split into five criteria that contribute equally to the grade. The assessment form includes a rubric that details what performance should be expected for a specific grade on each of the criteria. Furthermore, assessors contribute a written justification of their overall grade. Each internship report has two examiners. The first examiner is a supervisor from SBP, the second examiner is from within

the MSc programme of the student. The external supervisor of the internship organization has an advisory role, in particular with regard to the internship process.

Prior to the site visit, the panel studied the internship reports of 30 students in the SBP-track, including the accompanying assessment forms. It was impressed by the solid system of assessment. The assessment forms are insightful, and completed meticulously. The examiners give ample qualitative feedback to the student and substantiate their grading in a transparent way. The panel understood that the track applies a strict policy on the correct use of assessment forms. The track coordinator checks all assessment forms on uniformity and transparency, and asks for additions and improvements if the assessment form does not meet the standards. The panel considers this an exemplary procedure, and praises the SBP track for this. The panel is also positive on the inclusion of a second examiner from the MSc programme of the student. This guarantees an external view on the internship, and solidifies the connection between the SBP track and the degree programme.

Considerations

The MSc programmes have a valid, transparent and reliable system of assessment in place. The assessment methods are sufficiently varied and fit the learning goals of the courses, and the CUAO's are helpful tools in the quality assurance of course assessment. The assessment in the MEME double degree programme in the MSc Ecology and Evolution, as well as the assessment in the SBP track are adequately safeguarded: the degree programmes always contribute one of the examiners for each externally conducted research project and internship. The Boards of Examiners plays an important and proactive role in safeguarding the quality of assessment in the programmes through structural checks and advice, in particular during the corona pandemic and the implementation of the new curricula. The staffing issues of the Board of Examiners for Biology and Biomedical Sciences should be solved. The procedures for the assessment of the MSc projects and theses are solid, but should be better enforced, in particular with regard to the completion of assessment forms and the independence of the two assessors. To strengthen the role of the second assessors, the panel recommends appointing these from other research groups, and making their contribution to the assessment more explicit on the assessment form. The assessment of the internships in the SBP track is exemplary, with a transparent assessment form that is used in a thorough and insightful way.

Conclusion

The panel concludes that all programmes meet standard 3.

Standard 4. Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

Prior to the site visit, the panel studied the Research Projects of 15 students for each MSc programme. The panel took care that all tracks of the programmes were sufficiently covered in the selection, and studied at least two theses per track for each programme. Furthermore, the panel studied the internship reports of 30 students in the SBP-track. This included 15 students that choose the SBP-track in one of the MSc programmes under review, and 15 students from other MSc programmes within the faculty that followed the SBP-track, including the MSc programmes Astronomy, Biomedical Engineering, Chemical Engineering, Chemistry, Energy and Environmental Sciences and Mathematics. The MScs Computing Science and Physics also offer SBP, but have had no graduates in this track since 2015. The documentation provided by the

programmes, as well as an alumni interview during the site visit provided the panel with information about the careers pursued by graduates of the programmes.

The Research Projects of the *MSc Ecology and Evolution* show a wide variety of interesting and sometimes very high-quality reports in both tracks as well as in the MEME programme. The programme has the highest average grade (8.4) of all MSc programmes, which the panel generally found to be justified in the theses it read, even though it notes that many students seem to have taken more time to work on their projects than reflected in the credits. Roughly one third of the alumni continue in a PhD position, either at GELIFES or elsewhere. The rest continues in other research positions or in the professional field.

The projects of the *MSc Biomolecular Sciences* show that students have a good background in the theoretical and practical knowledge needed to address problems in their field. The quality of the work is very good in most cases. Most graduates end up in research, with more than 40% of all graduates acquiring a PhD position.

For the *MSc Marine Biology*, the panel found the theses to be generally very good, well-structured and sometimes extensive. The latter might be attributed to the tendency of students to take more time than scheduled to complete their reports. The panel noted the relatively high prevalence of data analysis and statistics. The careers of graduates reflect the research focus as well as the societal relevance of the programme: alumni find positions in academia or at companies and organizations involved in water management.

Befitting the character of the programme, the research projects of the *MSc Biology* showed a wide range of topics, which were generally of a good level. The careers of the alumni are equally varied. The programme has a relatively high percentage of SBP graduates, which is reflected in the high number of business and policy careers pursued by its graduates.

The projects of the *MSc Biomedical Sciences* are of a generally high quality, demonstrating innovative and timely research topics. Graduates end up in a variety of organizations related to biomedical research, such as academic and general hospitals, biomedical, pharmaceutical or food industry. Approximately one third of the graduates find a PhD position at an academic hospital or a university.

The panel considered the Research Projects of the *MSc Medical Pharmaceutical Sciences* to be very good, with relevant and suitable research topics. The graduates have a very favourable career perspective, with most students finding a job shortly after graduation. Approximately 45% of students find a PhD position, and others end up in the pharmaceutical industry. In the latter case, they are sometimes even recruited before graduation.

The panel considered the internship reports of the *SBP track* to be of good quality, and finds they show how students with a master's level research background can contribute to developing ideas in policy and business. Graduates are very much appreciated by the professional field: the track estimates that 50% of the graduates are offered a job at their former internship organization, often as policy advisor.

In general, the panel was very positive on the quality of the Research Projects of all programmes. They demonstrated well-developed research skills, and clearly reflected the research-focused education pursued by the programmes. The alumni that the panel interviewed were very satisfied with their education, in particular the research skills they obtained and the opportunity to develop their professional skills through the SBP track offered by various programmes. A recent survey conducted by the Netherlands Institute for

Biology (NIBI) show that the large majority of students finds a job within three months after graduation, often in academia (25%), in hospitals (22%), in industry (28%), in a governmental organization (5%) or in education (5%). The panel considers this to be further proof of the realization of the intended learning outcomes of the programmes.

Considerations

The panel concludes that the final products of the MSc programmes show that the intended learning outcomes of the programmes are achieved. In particular the research skills demonstrated in the research projects and the successful connection between science, business and policy in the internships stood out to the panel. Graduates find a job in various positions relevant to the life sciences, in many cases as PhD student, in a health-care environment, as policy advisor or as researcher or consultant in industry.

Conclusion

The panel concludes that all programmes meet standard 4.

General conclusion

The panel's assessment of the MSc Ecology and Evolution is positive.
The panel's assessment of the MSc Biomolecular Sciences is positive.
The panel's assessment of the MSc Marine Biology is positive.
The panel's assessment of the MSc Biology is positive.
The panel's assessment of the MSc Biomedical Sciences is positive.
The panel's assessment of the MSc Medical Pharmaceutical Sciences is positive.

Development points

All programmes

1. Implement the plans for alleviating the workload of teaching staff as soon as possible, as it is a prerequisite for addressing most other development points.
2. Introduce a skills -learning trajectory to ensure that all students receive comparable skills training within their individual curricula.
3. Ensure that the Boards of Examiners remain sufficiently staffed.
4. Better enforce the assessment procedures in the programmes, in particular with regard to the completion of assessment forms, documented feedback to students and the independence of the two assessors.
5. Appoint second assessors of the final projects from other research groups, and make their contribution to the assessment of the report and presentation more explicit on the assessment form.

MSc Ecology and Evolution

1. Consider offering the SBP track for students in the Ecology and Conservation track.
2. Consider setting up an Advisory Committee to promote alignment between the programme and the academic and professional field.
3. Investigate whether more interaction between the student groups can be created.
4. Increase attention towards job market orientation.

5. Investigate whether all students have sufficient knowledge of genetics and genomics upon entering the track Ecology and Conservation, and remedy this if this is not the case.
6. Adapt the curriculum for MEME students to properly include the Colloquium, which students now follow, on top of their 120 EC curriculum.
7. Break the habit of tolerating delays in research projects.

MSc Biomolecular Sciences

1. Consider setting up an Advisory Committee to promote alignment between the programme and the academic and professional field.
2. Increase attention towards job market orientation
3. Investigate whether the current structure of three-week courses is optimal.

MSc Marine Biology

1. Consider whether there are any opportunities for sustainable growth higher than the current maximum of 30 students, considering the interest in the programme and the relevance of the field.
2. Consider setting up an Advisory Committee to promote alignment between the programme and the academic and professional field.
3. Break the habit of tolerating delays in research projects.
4. Provide more proactive support to students with regard to internships and career orientation.
5. Investigate whether the level of statistics offered in the programme is sufficient for all students.

MSc Biology

1. Strengthen the profile and positioning of the programme with regard to the other MSc programmes in the life sciences, highlighting the integrative and interdisciplinary opportunities of the flexible curriculum.
2. Empower students to identify with the MSc programme, for instance through investing in social cohesion and community building.
3. Solve the issue where students cannot enter their preferred courses in other programmes due to capacity problems.
4. Consider investing in staff specific for this programme.
5. Consider setting up an Advisory Committee to promote alignment between the programme and the academic and professional field.
6. Break the habit of tolerating delays in research projects.

MSc Biomedical Sciences

1. Consider setting up an Advisory Committee to promote alignment between the programme and the academic and professional field.
2. Consider replacing the free Research track with more flexibility within and between the tracks.
3. Secure adequate teaching and supervision for the programme at UMCG.

MSc Medical Pharmaceutical Sciences

1. Consider introducing more interaction between students in the different research tracks.
2. Consider dropping the free Research track in favour of more flexibility within and between tracks.
3. Secure adequate teaching and supervision for the programme at UMCG.

Appendix 1. Intended learning outcomes

MSc Ecology and Evolution

The graduate:

1. has acquired in depth knowledge on one or more scientific disciplines within the field of Ecology and Evolution, and can use this knowledge to explain in detail the relevant concepts, using the appropriate terminology;
2. can design, and conduct scientific research;
3. can independently investigate, and critically evaluate scientific literature;
4. can identify new developments in the relevant disciplines, and can become familiar with these developments;
5. can systematically organize his/her work in scientific research, and formulate realistic, and original solutions to complex problems;
6. can participate in, and contribute to a multidisciplinary team;
7. can effectively communicate acquired knowledge, insights and skills to others, both in writing, and in oral presentation;
8. can identify societal and ethical implications of scientific research, and is able to critically reflect on his/her actions in this context;
9. can independently acquire new knowledge, and skills that are relevant for his/her professional career, in science, in policy & management or society.

MSc Biomolecular Sciences

The graduate:

- 1 has acquired in depth knowledge on one or more scientific disciplines within the field of Biomolecular Sciences and can use this knowledge to explain in detail the relevant concepts, using the appropriate terminology;
- 2 can design and conduct scientific research;
- 3 can independently investigate and critically evaluate scientific literature;
- 4 can identify new developments in the relevant disciplines, and can become familiar with these developments;
- 5 can systematically organize his/her work in scientific research and formulate realistic and original solutions to complex problems;
- 6 can participate in and contribute to a multidisciplinary team;
- 7 can effectively communicate acquired knowledge, insights and skills to others, both in writing and in oral presentation;
- 8 can identify societal and ethical implications of scientific research and is able to critically reflect on his/her actions in this context;
- 9 can independently acquire new knowledge and skills that are relevant for his/her professional career, in science, in policy & management or society.

MSc Marine Biology

The graduate

- 1 has acquired in depth knowledge on one or more scientific disciplines within the field of Marine Biology and can use this knowledge to explain in detail the relevant concepts, using the appropriate terminology;
- 2 can design and conduct scientific research;
- 3 can independently investigate and critically evaluate scientific literature;

- 4 can identify new developments in the relevant disciplines, and can become familiar with these developments;
- 5 can systematically organize his/her work in scientific research and formulate realistic and original solutions to complex problems;
- 6 can participate in and contribute to a multidisciplinary team;
- 7 can effectively communicate acquired knowledge, insights and skills to others, both in writing and in oral presentation;
- 8 can identify societal and ethical implications of scientific research and is able to critically reflect on his/her actions in this context;
- 9 can independently acquire new knowledge and skills that are relevant for his/her professional career, in science, in policy & management or society.

MSc Biology

The graduate:

- 1 has acquired in depth knowledge on one or more scientific disciplines within the general field of Biology and can use this knowledge to explain in detail the relevant concepts, using the appropriate terminology;
- 2 can design and conduct scientific research;
- 3 can independently investigate and critically evaluate scientific literature;
- 4 can identify new developments in the relevant disciplines, and can become familiar with these developments;
- 5 can systematically organize his/her work in scientific research and formulate realistic and original solutions to complex problems;
- 6 can participate in and contribute to a multidisciplinary team;
- 7 can effectively communicate acquired knowledge, insights and skills to others, both in writing and in oral presentation;
- 8 can identify societal and ethical implications of scientific research and is able to critically reflect on his/her actions in this context;
- 9 can independently acquire new knowledge and skills that are relevant for his/her professional career, in science, in policy & management or society.

MSc Biomedical Sciences

Graduates Biomedical Sciences (BMS) are able to:

- 1. Explain in detail the major underlying principles of biomedical sciences (knowledge).
- 2. Manage and interpret (big) data and demonstrate proficiency in computing technology for biomedical sciences (application).
- 3. Formulate solutions to biomedical issues both theoretical, technical and in a practical laboratory setting (knowledge and application).
- 4. Critically evaluate scientific biomedical data and offer sound arguments to justify a position (judgement and communication).
- 5. Effectively communicate scientific concepts to specialists as well as to a lay audience through oral and written presentations (communication).
- 6. Critically appraise the role of 'biomedical sciences' and/or in the dedicated specialisms 'Biology of Ageing' or 'Biology of Cancer and Immune System', 'Biology of Food and Nutrition' and 'Neuroscience' research aiming on supporting healthy ageing (knowledge and judgement).
- 7. Work independently as well as in a team to solve scientific and societal challenges related to biomedical sciences (communication and application).
- 8. Independently draw conclusion on ethical issues in biomedicine and apply this to scientific or public discussions about the impact of such science on society (judgement).

9. Evaluate and reflect on personal capabilities and motivation for a (international) scientific, policy or business career (lifelong learning skills).
10. Develop an international perspective on up-to-date scientific advances and on-going biological science-related issues (knowledge and lifelong learning skills).

MSc Medical Pharmaceutical Sciences

A graduate Medical Pharmaceutical Sciences (MPS) is able to:

- 1 Explain in detail the major underlying principles within the field of Medical and Pharmaceutical Sciences and integrate knowledge of etiology and pathophysiology of disease to design and develop more effective and safer drugs (knowledge).
- 2 Identify new developments within the field of Medical Pharmaceutical Sciences and can become familiar with these developments (Lifelong learning skills)
- 3 Critically appraise the results of research in 'medical pharmaceutical sciences' and/or in the dedicated specialisms 'drug toxicology and translational technology', 'pharmaceutical design and engineering' or 'pharmacoepidemiology and pharmacoconomics' (knowledge and judgement).
- 4 Formulate hypotheses, design and conduct scientific research, manage and interpret data and demonstrate proficiency in statistical analyses for Medical Pharmaceutical Sciences (application).
- 5 Systematically organize his/her work in scientific research and formulate realistic and original solutions to complex problems (application).
- 6 Critically evaluate scientific data from experiments or literature, and offer sound arguments to justify a position (judgment and communication).
- 7 Work independently as well as in a team to solve scientific and societal challenges related to medical pharmaceutical sciences (application).
- 8 Effectively communicate scientific concepts to specialists as well as to a lay audience through oral and written presentations (communication).
- 9 Identify societal and ethical implications of Medical Pharmaceutical Research and acts according to the scientific code of conduct (judgement).
- 10 Evaluate and reflect on personal capabilities and motivation for a (international) scientific, policy or business career, and has knowledge and skills to develop their own career (lifelong learning skills).

Appendix 2. Programme curriculum

MSc Ecology and Evolution

Track Evolutionary Biology:

Study elements	ECTS	Entry requirements
<i>Behaviour, Ecology & Evolution *</i>	9	
<i>Evolutionary Theory</i>	8	
<i>Principles of Population Genetics in Natural Populations</i>	5	
<i>Genomics in Ecology and Evolution</i>	5	
<i>Essay @</i>	5	
Research project** (RP)	40 [@] or ≥	see appendix V
Research project** (RP)	30 or ≥	see appendix V
Colloquium	5	RP or @Behaviour, Ecology & Evolution and Evolutionary Theory
Electives***	≤15	see Ocasys

@ For students in the Mobility Programme MEME, the essay is a literature study written in the form of a research proposal during the course Research Proposal in Ecology and Evolution and both research projects are 30 ECTS

Track Ecology and Conservation:

Study elements	ECTS	Entry requirements
<i>Ecological Research Skills *</i>	10	
<i>Advanced Population & Community Ecology</i>	5	
<i>Conservation Ecology Practices</i>	5	
Research project** (RP)	40 or ≥	see appendix V
Research project** (RP)	30 or ≥	see appendix V
Colloquium	5	RP
Essay	5	-
Electives***	≤20	see Ocasys

* Because of overlap between Behaviour, Ecology & Evolution and Ecological Research Skills, students are allowed to have only one of these courses in their master study programme of 120 ECTS.

** The first research project (preferably the one ≥40 EC) must be an internal project. Internal projects must be performed at the FSE (within Life Sciences-oriented research groups) or the Netherlands Institute for Sea Research under supervision of one of the examiners of the degree programme.

*** The student may choose to use 5,10,15 or 20 ECTS to extend a research project, prepare a manuscript related to a master research project (no more than 10 ECTS, the assessment will be Pass or Fail), attend master courses (appendix IV), include a maximum of 10 ECTS of courses from other relevant Life Sciences programmes, and/or repair specific deficiencies or perform a research assignment of 5,10,15 or 20 ECTS. During the mid-term assessment one may extend the research project with only 5 or 10 ECTS.

MSc Biomolecular Sciences

Study elements	ECTS	entry requirements
<i>Protein and Enzyme Engineering</i>	5	
3 compulsory master courses [#]	15	see Ocasys
research project (RP)*	40 or ≥	see appendix V
research project (RP)*	30 or ≥	see appendix V
colloquium	5	RP
essay	5	-
electives**	≤20	see Ocasys

* The first research project (preferably the one ≥40 EC) must be an internal project. Internal projects must be performed at the FSE (within Life Sciences-oriented research groups) or the University Medical Centre Groningen under supervision of one of the examiners of the degree programme.

** The student may choose to use 5, 10, 15 or 20 ECTS to extend a research project, prepare a manuscript related to a master research project (no more than 10 ECTS, the assessment will be Pass or Fail), attend master courses, include a maximum of 10 ECTS of courses from other relevant Life Sciences programmes, and/or repair specific deficiencies or perform a research assignment of 5, 10, 15 or 20 ECTS. During the mid-term assessment, one may extend the research project with only 5 or 10 ECTS.

*Students have to pass three courses out of the following courses:

1. Advances in Signal Transduction; 5 ECTS
2. Advanced Membrane Biology; 5 ECTS
3. Organelle and Membrane Biogenesis; 5 ECTS
4. Molecular Dynamics and Modelling of Membranes and Proteins; 5 ECTS
5. Advanced Protein Crystallography; 5 ECTS
6. Tools and approaches of systems biology; 5 ECTS
7. Transcriptomics: DNA Microarrays and RNAseq; 5 ECTS
8. Advanced Genetic Engineering and Complex Gene Regulatory Circuitries; 5 ECTS

Additional requirements for the specialization Chemical biology

Students have to pass the following courses:

1. Advanced Protein Crystallography; 5 ECTS
2. Advances in Chemical Biology; 5 ECTS
3. Synthetic Biology & Systems Chemistry; 5 ECTS

MSc Marine Biology

The degree programme consists of:

Research-Track:

Study elements	ECTS	entry requirements
<i>Principles of Biological Oceanography</i>	5	
<i>Principles of Marine Biology</i>	5	
<i>Principles of Populations Genetics in Natural Populations</i>	5	
research project (RP)*	40 or ≥	see appendix V
research project (RP)*	30 or ≥	see appendix V
colloquium	5	RP
essay	5	-
compulsory master courses	5	see Ocasys
electives**	≤20	see Ocasys

SBP-Track:

Study elements	ECTS	entry requirements
<i>Principles of Biological Oceanography</i>	5	
<i>Principles of Marine Biology</i>	5	
<i>Principles of Populations Genetics in Natural Populations</i>	5	
Science and Business	10	
Science and Policy	10	
research project (RP)*	40 or ≥	see appendix V
Internship SBP (RP)*	35 + 5 [®]	see appendix V
colloquium	5	RP

[®]Part of the skills internship SBP (5 ECTS) is taught at the UG

* The first research project (preferably the one ≥40 EC) must be an internal project. Internal projects must be performed at the FSE (within Life Sciences-oriented research groups) or the Netherlands Institute for Sea Research under supervision of one of the examiners of the degree programme.

** The student may choose to use 5,10,15 or 20 ECTS to extend a research project, prepare a manuscript related to a master research project (no more than 10 ECTS, the assessment will be Pass or Fail), attend master courses, include a maximum of 10 ECTS of courses from other relevant Life Sciences programmes, and/or repair specific deficiencies or perform a research assignment of 5,10,15 or 20 ECTS. During the mid-term assessment one may extend the research project with only 5 or 10 ECTS.

MSc Biology

The degree programme consist of one of the following tracks:

Research-Track:

Study elements	ECTS	entry requirements
research project (RP)*	40 or ≥	see appendix V
research project (RP)*	30 or ≥	see appendix V
colloquium	5	RP
essay	5	-
compulsory master courses	20	see Ocasys
electives**	≤20	see Ocasys

Science Business and Policy-Track:

Study elements	ECTS	entry requirements
research project (RP)*	40 or ≥	see appendix V
compulsory master course	5	see Ocasys
colloquium	5	RP
internship SBP	35 + 5 [®]	RP
Science and Business	10	
Science and Policy	10	
electives**	≤ 10	see Ocasys

[®]Part of the skills internship SBP (5 ECTS) is taught at the UG

Modelling in the Life Sciences-Track:

Study elements	ECTS	entry requirements
research project (RP)* @	40 or ≥	see appendix V
research project (RP)* @	30 or ≥	see appendix V
colloquium	5	RP
essay	5	-
Mathematics in the Life Sciences	5	
Biological Modelling and Model Analysis	10	Mathematics in the Life Sciences or equivalent
Programming C++ for Biologists	5	
electives**	≤20	see Ocasys

@ At least one research project focusing on modelling in one of the domains of Life Science.

* The first research project (preferably the one ≥40 EC) must be an internal project. Internal projects must be performed at the FSE (within Life Sciences oriented research groups), the University Medical Centre Groningen or the Netherlands Institute for Sea Research, under supervision of one of the examiners of the degree programme.

** The student may choose to use 5, 10, 15 or 20 ECTS to extend a research project, prepare a manuscript related to a master research project (no more than 10 ECTS, the assessment will be Pass or Fail), attend master courses), include a maximum of 10 ECTS of courses from other relevant Life Sciences programmes, and/or repair specific deficiencies or perform a research assignment of 5, 10, 15 or 20 ECTS. During the mid-term assessment, one may extend the research project with only 5 or 10 ECTS.

MSc Biomedical Sciences

General requirements for all BMS R-Track:

Course unit	ECTS	Assessment	Practical	Entry requirements
research project (RP)	40	technical and/or laboratory skills, written report, oral presentation	x	Safe Microbiological Technique certificate [#]
research project (RP)	30	technical and/or laboratory skills, written report, oral presentation	x	Safe Microbiological Technique certificate [#]
colloquium	5	oral presentation	x	RP
essay	5	written report	x	-
master courses	≥ 30	see appendix IV	see app. IV	see appendix IV
electives	≤ 10	see appendix IV	see app. IV	see appendix IV

[#] Students who have not obtained a Safe Microbiological Technique certificate (VMT in Dutch) have to include the MBS course in the first year of their study programme.

General requirements for the SBP-track:

Course unit	ECTS	Assessment	Practical	Entry requirements
research project (RP)	40	technical and/or laboratory skills, written report, oral presentation	x	Safe Microbiological Technique certificate [#]
colloquium	5	oral presentation	x	RP
master courses	5	see appendix IV	see app. IV	see appendix IV
course units: Science & Business and Science & Policy	2x10 = 20	assignment, exam	x	-
internship SBP	40	performance, written report, reflection report	x	RP, course units S&B and S&P
electives	≤ 10	see appendix IV	see app. IV	see appendix IV

[#] Students who have not obtained a Safe Microbiological Technique certificate (VMT in Dutch) have to include the MBS course in the first year of their study programme, unless the student will conduct a research project that does not involve any laboratory work.

Additional requirements for the general research track Biomedical Sciences Research

- 30 ECTS master courses are filled with the following courses:
 - a. Courses (10 ECTS)

Course unit	ECTS
Biomedical Sciences: Professional Perspectives	5
Data Science in Biomedicine	5

- b. 20 ECTS of other master courses chosen from the BMS master courses as listed in appendix IV.

Additional requirements for the research track Biology of Ageing:

- topics of both research projects, essay, and colloquium are chosen within the biology of ageing research area.
- 30 ECTS master courses are filled with the following courses:
 - a. Courses (20 ECTS)

Course unit	ECTS
Biomedical Sciences: Professional Perspectives	5
Data Science in Biomedicine	5
Current Themes in Healthy Ageing	5
Molecular Biology of Ageing and Age-related Diseases	5

- b. 5 ECTS from the following list of courses:

Course unit	ECTS
Advanced Metabolism & Nutrition	5
Immunology: from Bedside to Bench and Back	5
Neurodegenerative Diseases	5
Stem Cells & Regenerative Medicine	5
Microbiome and Health	5

- c. 5 ECTS from the following list of courses:

Course unit	ECTS
Advanced Light Microscopy	5
Advanced Imaging Techniques	5
Practical Bioinformatics for Biologists	5
Scientific Writing	5
From Big Data to Personalised Medicine	5
Editing, Regulating and Targeting Genomes with CRISPR-Cas9	5

Additional requirements for the research track Biology of Cancer and Immune System:

- the subject of one research project (≥ 40 ECTS) and the subject of either the essay or the colloquium is chosen in the field of cancer and immune system research area.
- 30 ECTS master courses are filled with the following courses:
 - a. Courses (15 ECTS)

Course unit	ECTS
Biomedical Sciences: Professional Perspectives	5
Data Science in Biomedicine	5
Immunology: from Bedside to Bench and Back	5

b. 15 ECTS from the following list of courses:

Course unit	ECTS
Current Themes in Oncology [#]	5
Cancer Research [#]	5
Stem Cells & Regenerative Medicine	5
Microbiome and Health	5
Editing, Regulating and Targeting Genomes with CRISPR-Cas9	5
From Big Data to Personalised Medicine	5
Translational Research in Respiratory Disease	5

[#] choose at least one of these 2 course units

Additional requirements for the research track Biology of Food and Nutrition:

- topics of both research projects, essay, and colloquium are chosen within the food and nutritional life sciences research area.
- 30 ECTS master courses are filled with the following courses:

a. Courses (15 ECTS)

Course unit	ECTS
Biomedical Sciences: Professional Perspectives	5
Data Science in Biomedicine	5
Advanced Metabolism & Nutrition	5

b: 15 ECTS from the following list of courses:

Course unit	ECTS
Nutrition in Medicine	5
Neurobiology of Nutrition	5
Microbiome and Health	5
Nutrition, Brain Development and Cognition	5
From Big Data to Personalised Medicine	5

Additional requirements for the research track Neuroscience:

- topics of both research projects, essay, and colloquium are chosen within the neuroscience research area.
- 30 ECTS master courses are filled with the following courses:

a. Courses (25 ECTS)

Course unit	ECTS
Biomedical Sciences: Professional Perspectives	5
Data Science in Biomedicine	5
Neurodegenerative Diseases	5
Behavioral Pharmacology	5
Neurobiology of Psychiatric Disorders	5

b. 5 ECTS from the following list of courses:

Course unit	ECTS
Advanced Imaging Techniques	5
Nutrition, Brain Development and Cognition	5
Molecular Biology of Ageing and Age-related Diseases	5

MSc Medical Pharmaceutical Sciences

General requirements for all MPS R-Tracks:

Course unit	ECTS	Assessment	Practical	Entry requirements
research project (RP)	40	technical and/or laboratory skills, written report, oral presentation	x	Safe Microbiological Technique certificate [#]
research project (RP)	30	technical and/or laboratory skills, written report, oral presentation	x	Safe Microbiological Technique certificate [#]
colloquium	5	oral presentation	x	RP
essay	5	written report	x	-
master courses	≥ 25-26*	see appendix IV	see app. IV	see appendix IV
electives	≤ 10-15*	see appendix IV	see app. IV	see appendix IV

[#] Students who have not obtained a Safe Microbiological Technique certificate (VMT in Dutch) have to include the MBS course in the first year of their study programme.

* Depending on the chosen track.

General requirements for the SBP-track:

Course unit	ECTS	Assessment	Practical	Entry requirements
research project (RP)	40	technical and/or laboratory skills, written report, oral presentation	x	Safe Microbiological Technique certificate [#]
colloquium	5	oral presentation	x	RP
master courses	5	see appendix IV	see app. IV	see appendix IV
course units: Science & Business and Science & Policy	2x10 = 20	assignment, exam	x	-
internship SBP	40	performance, written report, reflection report	x	RP, course units S&B and S&P
electives	≤ 10	see appendix IV	see app. IV	see appendix IV

[#] Students who have not obtained a Safe Microbiological Technique certificate (VMT in Dutch) have to include the MBS course in the first year of their study programme, unless the student will conduct a research project that does not involve any laboratory work.

Additional requirements for the general research track Medical Pharmaceutical Sciences Research:

- 25 ECTS master courses are filled with the following courses:

a. Courses (5 ECTS)

Course unit	ECTS
Drug Development: from Design to Evaluation	5

- b. 20 ECTS of other master courses chosen from the MPS master courses as listed in appendix IV.

Additional requirements for the research track Toxicology and Drug Disposition:

- the subject of one research project (≥40 ECTS) and the subject of either the essay or the colloquium is chosen in the field of Toxicology and/or advanced translational models for drug testing.
- 25 ECTS master courses are filled with the following courses:

a. Courses (15 ECTS):

Course unit	ECTS
Drug Development: from Design to Evaluation	5
Molecular Toxicology	5
Advanced Pharmacokinetics	5

b. A minimum of 5 ECTS from the following list:

Course unit	ECTS
Pharmacovigilance	5
Animal and Human Experimentation*	5
Reproductive Toxicology and Epidemiology	5
Nanomedicine and Nanosafety	5
Clinical Toxicology	5

* In consultation with the study mentor students can either follow this course or the 4 ECTS course handling laboratory animals (ex. Art.9 Experiments on Animals Act).

- c. 5 ECTS of other master courses chosen from the MPS master courses as listed in appendix IV.

Additional requirements for the research track Pharmacoepidemiology:

- the subject of one research project (≥40 ECTS) and the subject of either the essay or the colloquium is chosen in the field of Pharmacoepidemiology.
- 26 ECTS master courses are filled with the following courses:

a. Courses (26 ECTS):

Course unit	ECTS
Drug Development: from Design to Evaluation	5
Medical Statistics	3
Basics in Medicine	8
Pharmacoepidemiology*	5
Pharmaco-epidemiology in Practice OR Pharmaco-economics	5

* students who accomplished the equivalent course phar-epi (= pharmacoepidemiology (EN)/farmacoepidemiologie (NL)) in their bachelor programme will be exempted from this requirement. The remaining 5 ECTS should be considered as 5 ECTS extra electives in their master programme.

- b. ≤ 14 ECTS of other master courses chosen from the MPS master courses as listed in appendix IV.
Preferred courses in this elective space are:

Course unit	ECTS
Advanced Pharmacoeconomics	5
Pharmacovigilance	5
Reproductive Toxicology and Epidemiology	5

Additional requirements for the research track Pharmaceutical Design and Engineering:

- the subject of one research project (≥40 ECTS) and the subject of either the essay or the colloquium is chosen in the field of target identification, drug design, biologics, biotechnology, or innovative drug and dosage forms.
- 25 ECTS master courses are filled with the following courses:
 - a. Courses (15 ECTS):

Course unit	ECTS
Drug Development: from Design to Evaluation	5
Pharmaceutical Biotechnology	5
Pharmaceutical Design and Engineering	5

- b. A minimum of 5 ECTS from the following list:

Course unit	ECTS
Molecular Toxicology	5
Translational Research in Respiratory Disease	5

- c. 5 ECTS of other master courses chosen from the MPS master courses as listed in appendix IV.
Suggested master courses and electives are given in table below:

Course unit	ECTS
Advanced Imaging Techniques	5
Nanomedicine and Nanosafety	5
Pharmaceutical Biology Practical	5
Medicinal Natural Products	10
Non-Sterile Dosage Forms*	6
Solving Problems in Product Technology *	6
Biotechnology*	5
Introduction to the Pharmaceutical Industry*	6-12
Pharmacology of Chronic Diseases and Ageing*	5
Quantitative Bioanalysis*	5

* Courses with an asterisks can only be chosen as electives.

Electives

Electives organised by the research institutes GELIFES and ESRIG:

Course	ECTS
Advanced self-organisation of social systems	5
Advanced Imaging techniques	5
Advanced Population & Community Ecology	5
Advanced statistics	6
Animal Experimentation: Design, Practice and Ethics	5
Biological Modelling and Model Analysis	10
Conservation Ecology Practices	5
Ecology of Sustainable Farming (biennial, does not run in 2020/2021)	5
Evolutionary Theory	8
Flyway Ecology (<i>biennial, runs in 2020/2021</i>)	5
Genomics in Ecology and Evolution	8
Mathematical Models in Ecology and Evolution	6
Mathematics in the Life Sciences	5
Marine Ecosystem Service & Global Change	5
Marine Conservation	5
Meta-analyses in Ecology (<i>biennial, runs in 2020/2021</i>)	5
Molecular Methods in Ecology & Evolution (<i>biennial, does not run in 2020/2021</i>)	5/10
Orientation on International Careers	5
Practical Bioinformatics for Biologists	5
Practical Modelling for Biologists	5
Principles of Biological Oceanography*	5
Principles of Marine Biology*	5
Principles of Population Genetics in Natural Populations*	5
Programming in C++ for Biologists **	5/10
Polar Ecosystems	5
Research Proposal Ecology and Evolution	5

*Students MSc Marine Biology have priority in enrolment

** Students who have already followed similar courses during their bachelor's degree will be given a deepening version of the course more tailored to their individual background knowledge and skills.

Electives courses organised by the research institute GBB:

Course	ECTS
Advanced Light Microscopy	5
Advanced Genetic Engineering and Complex Gene Regulatory Circuitries*	5
Biocatalysis & Green Chemistry	5
Radioisotopes in Experimental Biology	5
Tools and Approaches of Systems Biology*	5
Transcriptomics: DNA microarrays and RNAseq*	5

* Students MSc Biomolecular Sciences have priority in enrolment

Electives organised by Biomedical Sciences/GELIFES*:

Course	ECTS
Microbiological Safety	1
Microbiome & Health	5
Molecular Biology of Ageing and Age-related Diseases	5
Neurobiology of Nutrition	5
Neurodegenerative Diseases	5
Nutrition, Brain Development and Cognition	5
Scientific writing	5

* Students MSc Biomedical Sciences have priority in enrolment

Electives organised by Science & Society:

Course	ECTS
Science & Business	10
Science & Policy	10

Electives organised by Energy and Environmental sciences:

Course	ECTS
Impacts of Energy and Material Systems	5
Sustainable Use of Ecosystems	5
Sustainability & Society	5
Systems Integration and Sustainability	5

Students MSc Energy and Environmental Sciences have priority in enrolment

Electives organised by Education and Communication*:

Course	ECTS
Research Methods in Science Education and Communication	5
<u>Skills in Science Communication (2a only)</u>	5

* Students MSc Science Education and Communication have priority in enrolment

Elective master courses organised by Teacher Education**

Course	ECTS
Basiscursus Master Lerarenopleiding	5
Masterstage 1	5

** Dutch-speaking students only

Electives organised by The Donald Smits Center for Information Technology:

Course (max 2 ects per individual programme^)	½ day unit^
Access basic	5
Excel basic	3
Excel advanced	5

^ A minimum of 5 half-day units is required for a study load of 1 ECTS, for 2 ECTS 11 units are needed.

These courses have additional costs (at a low fee for students), which are at the student's own expenses. These courses are not available in Ocasys. Please consult the Donald Smits Center for further information, time schedules and enrolment details.

Elective master course organised by the centre for Synthetic Biology:

Course	ECTS
iGEM (International Genetically Engineered Machine competition)*	≤20

* Selection for this competition takes place in wintertime, an advertisement about application details will be announced via Nestor during the academic year.

Appendix 3. Programme of the site visit

Maandag 4 Oktober 2021			
<i>Tijd</i>	<i>tot</i>	<i>Sessie</i>	<i>Evt parallelsessie</i>
17.30	19.00	Voorbereidend overleg	

Dinsdag 5 Oktober 2021			
<i>Tijd</i>	<i>tot</i>	<i>Sessie</i>	<i>Evt parallelsessie</i>
8.45	9.00	Aankomst panel	
9.00	10.00	Voorbereidend overleg en inzien documenten	
10.00	10.40	Gesprek met inhoudelijk verantwoordelijken BSc Bio en BSc LST	
10.40	10.50	Pauze	
10.50	11.30	Gesprek met inhoudelijk verantwoordelijk MScs (EE, MB, BiMoS, Bio, BMS, MPS)	
11.30	12.00	Inloopspreekuur	
12.00	12.30	Lunch	
12.30	13.15	Overleg panel	
13.15	14.00	Gesprek met studenten van beide BSc-opleidingen	
14.00	14.15	Pauze	
14.15	15.00	Parallelsessie: Docenten BSc Biologie	Parallelsessie: Docenten BSc LST
15.00	15.15	Overleg panel	
15.15	16.00	Parallelsessie: Studenten MSc BMS	Parallelsessie: Studenten MSc MPS
16.00	16.15	Pauze	
16.15	17.00	Docenten MSc BMS en MSc MPS	

Woensdag 6 Oktober 2021			
<i>Tijd</i>	<i>tot</i>	<i>Sessie</i>	<i>Evt parallelsessie</i>
8.45	9.00	Aankomst panel	
9.00	10.00	Inzien documenten, voorbereiding gesprekken	
10.00	10.45	Parallelsessie: Studenten MSc EE	Parallelsessie: Studenten MSc Marine Biology
11.00	11.45	Docenten MSc EE en MSc MB	
11.45	12.30	Lunch	
12.30	13.00	Overleg panel	
13.00	13.45	Parallelsessie: studenten MSc Biology	Parallelsessie: studenten MSc BiMoS
13.45	14.15	Pauze	
14.15	15.00	Docenten MSc Bio en MSc BiMoS	
15.00	15.15	Pauze	
15.15	15.45	Overleg panel	
15.45	16.15	Studenten en docenten SBP-track	
16.15	16.30	Pauze	
16.30	17.30	Examencommissies	

Donderdag 7 Oktober 2021			
<i>Tijd</i>	<i>tot</i>	<i>Sessie</i>	<i>Evt parallelsessie</i>
8.45	9.00	Aankomst panel	
9.00	10.00	Overleg panel	
10.00	11.00	Alumni van alle MSc-opleidingen	
11.00	11.15	Pauze	
11.15	12.30	Overleg panel	
12.30	13.15	Lunch	
13.15	14.15	Formeel verantwoordelijken alle opleidingen	
14.15	16.15	Opstellen voorlopige bevindingen	
16.15	16.30	Vorbereiden mondelinge terugkoppeling	
16.30	16.45	Mondelinge terugkoppeling	

Appendix 4. Materials

Prior to the site visit, the panel studied 15 research projects for each MSc programme, and 15 SBP internship reports from other degree programmes in the Faculty. Information on these products is available from Academion upon request. The panel also studied other materials, which included:

- Domain-specific framework of reference Biology
- Domain-specific framework of reference Biomedical Sciences
- Teaching and Examination Regulations
- Assessment plans
- Selection of courses, assessment and CUAOs from each programme (incl. SBP)
- Overview members committees
- Overview examiners
- Guidelines master's research projects
- Guidelines SBP internships
- Quality assurance manuals FSE
- Annual reports Boards of Examiners
- Annual reports Programme Committees
- MEME Study guide