MASTER'S PROGRAMME BIOSCIENCES

FACULTY OF SCIENCE

UTRECHT UNIVERSITY

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REPORT ON THE MASTER'S PROGRAMME BIOSCIENCES OF UTRECHT UNIVERSITY

This report takes the NVAO's Assessment Framework for the Higher Education Accreditation System of the Netherlands for limited programme assessments as a starting point (September 2018).

ADMINISTRATIVE DATA REGARDING THE PROGRAMME

Master's programme Biosciences

Name of the programme:	Biosciences
CROHO number:	60710
Level of the programme:	master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specialisations or tracks:	Bioinformatics and Biocomplexity, Bio Inspired Innovation, Drug Innovation, Environmental Biology, Molecular and Cellular Life Sciences
Location(s):	Utrecht
Mode(s) of study:	full-time
Language of instruction:	English
Submission deadline NVAO:	1 May 2021, extension submission date until 1 March 2022 due to legislation WHW art. 5.16 lid 4

The visit of the assessment panel Biology to the Faculty of Science took place on 25-26 May 2021.

ADMINISTRATIVE DATA REGARDING THE INSTITUTION

Name of the institution:	Utrecht University
Status of the institution:	funded
Result institutional quality assurance assessment:	positive

COMPOSITION OF THE ASSESSMENT PANEL

The NVAO approved the composition of the panel on 6 May 2021. The panel that assessed the master's programme Biosciences consisted of:

- Prof. dr. Ton Bisseling, emeritus professor of Molecular Biology at Wageningen University & Research (chair);
- Em. prof. dr. Nico van Straalen, emeritus professor of Animal Ecology at Vrije Universiteit Amsterdam (vice-chair);
- Prof. dr. Aard Groen, professor of Entrepreneurship & Valorization at University of Groningen;
- Prof. dr. Dennis Claessen, professor of Molecular Microbiology at Leiden University;
- Dr. Mieke Latijnhouwers, assessment expert at Education Support Centre of Wageningen University & Research;
- Drs. Bas Reichert, founder and CEO of BaseClear (microbial genomics);
- Ishara Merhai, bachelor student Biology at University of Amsterdam (student member).

The panel was supported by Dr. Els Schröder, who acted as secretary.

WORKING METHOD OF THE ASSESSMENT PANEL

The site visit to the master's programme Biosciences at the Faculty of Science of Utrecht University was part of the cluster assessment Biology. Between May 2021 and January 2022 the panel assesses 21 programmes at six universities. The following universities participated in this cluster assessment: Utrecht University, Radboud University, University of Groningen, Vrije Universiteit Amsterdam, Leiden University and University of Amsterdam.

On behalf of the participating universities, quality assurance agency Qanu was asked for logistical support, panel guidance and the production of the reports. In the summer of 2021, Qanu withdrew from the assessments at Radboud University, University of Groningen, Vrije Universiteit Amsterdam, Leiden University and University of Amsterdam. In consultation with the participating universities, quality assurance agency Academion took over the responsibility for these assessments. Qanu and Academion closely collaborated to ensure a smooth transition. Els Schröder was project coordinator for Qanu. Fiona Schouten and Peter Hildering were project coordinators for Academion. Els Schröder, Peter Hildering, Mariëlle Klerks and Fiona Schouten acted as secretaries in the cluster assessment. All are certified NVAO secretaries. During the site visit at Utrecht University, the panel was supported by Els Schröder.

Panel members
The members of the assessment panel were selected based on their expertise, availability and independence. The panel consisted of the following members:

- Prof. dr. Ton Bisseling, emeritus professor of Molecular Biology at Wageningen University & Research (chair);
- Em. prof. dr. Nico van Straalen, emeritus professor of Animal Ecology at Vrije Universiteit Amsterdam (vice-chair and chair at Leiden University);
- 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. Sander Nieuwenhuis, professor of 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 of Molecular Microbiology at Leiden University;
- Prof. dr. Isa Schön, team leader at the Royal Belgian Institute of Natural Sciences;
- Prof. dr. Hauke Smidt, professor of Microbial Ecology at Wageningen University & Research
- Dr. Frank van der Wilk, executive director, Netherlands Commission on Genetic Modification;
- Dr. Mariken de Krom, head of team, Education and Research (Brain Division) at UMC Utrecht;
- Dr. Mieke Latijnhouwers, assessment expert at Education Support Centre of Wageningen University & Research;
- Dr. Eric Schouwenberg, head of department Nature and Biodiversity at Arcadis;
- 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;
- 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).

Schedule
The secretary composed a schedule for the site visit in consultation with the Faculty. Due to the covid-19 pandemic, the site visit was scheduled to take place on 25-26 May 2021 in an online setting. All panel members agreed with this approach. Prior to the site visit, the Faculty selected representative partners for the various interviews. It also offered students and staff members an opportunity for a confidential discussion during an online consultation hour

on 20 May 2021. Three students requested a consultation. For all three programmes included in this assessment, a separate development dialogue took place on 6 July 2021. See Appendix 3 for the final schedule.

Preparation
On 7 April 2021, the panel chair for Utrecht University was briefed by Qanu on his role, the assessment framework, the working method, and the planning of site visits and reports. Two separate preparatory panel meetings were organised on 25 March 2021 and 19 April 2021.

In the first meeting, on 25 March 2021, the panel received instructions on the use of the assessment framework. The preparation for the assessment and the study of the documentation were discussed. Panel members discussed points of interest for the assessment and chose areas to focus on in the preparatory phase. They also discussed their working method and the planning of the site visits and reports. A second preparatory meeting was organised on 19 April 2021. In it, the panel members shared their initial observations based on the study of the documentation, the final works and their assessment forms. Then they formulated their preliminary findings. The secretary collected all initial questions and remarks and distributed them amongst all panel members. Afterwards, some additional materials were requested from Utrecht University to complete the panel's preparation for the assessment. At the start of the site visit, the panel discussed its questions for the programme and assigned tasks during the site visit.

Documentation
Before the site visit to Utrecht University, the secretary received the relevant documentation from the programme and sent it to the panel. An extensive set of current documentation pertaining to the four standards of examination was provided serving as self-evaluation report to allow the panel a close study of daily practice at the programme. The secretary verified that the programme included a balanced review of the standards in the form of a comprehensive analysis of the programme's strengths and weaknesses, reflection on the way in which recommendations of the 2014 assessment panel had been taken forward, and a separate and independent student chapter along with the required appendices to ensure that all requirements for the self-evaluation report were met. Before and during the site visit, the panel studied the additional documents provided by the programmes. An overview of these materials can be found in Appendix 4.

A selection of 22 research project reports, 15 major research reports and 7 minor research reports, was made by the panel's chair and the secretary to assess the scientific achievement level of the graduates. The selection also included the assessment forms for the programme, based on a list provided of graduates between 2019-2020. A variety of topics and tracks and a diversity of examiners were included in the selection. The secretary and panel chair ensured that the distribution of grades in the selection matched the distribution of grades of all available theses.

Online site visit
The online site visit to Utrecht University took place on 25-26 May 2021. The panel conducted interviews with representatives of the programmes: students and staff members, the programme's management, alumni and representatives of the Board of Examiners. It used the final part of the site visit to discuss its findings in an internal meeting. Afterwards, the panel chair publicly presented the panel's preliminary findings and general observations. A separate report on the outcomes of the development dialogue will be disseminated by Utrecht University.

Consistency and calibration
In order to assure the consistency of assessment within the cluster, various measures were taken:
1. The panel composition ensured regular attendance of panel members, including the two chairs;
2. The coordinators ensured consistency by being present at the panel discussions leading to the formulation of preliminary findings at all site visits;
3. Representatives of the cluster regularly discussed procedures during the assessments with the coordinators;
4. The coordinators collaborated intensively during the transfer period in which Academion took over from Qanu to share knowledge, make agreements and ensure consistency in approach.

Report
After the site visit, the Qanu secretary wrote a draft report based on the panel's findings and submitted it to one of the Academion project coordinators for peer assessment. Subsequently, she sent the report to the panel. After processing the panel members' feedback, the secretary sent the draft reports to the Faculty in order to have them checked for factual irregularities. The secretary discussed the ensuing comments with the panel's chair, and changes were implemented accordingly. The report was then finalised and sent to the Faculty and University Board.

Definition of judgement standards
In accordance with the NVAO's Assessment framework for limited programme assessments, the panel used the following definitions for the assessment of the standards:

Generic quality
The quality that, from an international perspective, may reasonably be expected from a higher education Associate Degree, Bachelor's or Master's programme.

Meets the standard
The programme meets the generic quality standard.

Partially meets the standard
The programme meets the generic quality standard to a significant extent, but improvements are required in order to fully meet the standard.

Does not meet the standard
The programme does not meet the generic quality standard.

The panel used the following definitions for the assessment of the programme as a whole:

Positive
The programme meets all the standards.

Conditionally positive
The programme meets standard 1 and partially meets a maximum of two standards, with the imposition of conditions being recommended by the panel.

Negative
In the following situations:
- The programme fails to meet one or more standards;
- The programme partially meets standard 1;
- The programme partially meets one or two standards, without the imposition of conditions being recommended by the panel;
- The programme partially meets three or more standards.

SUMMARY JUDGEMENT

The two-year master's degree programme Biosciences offers five educational programmes, or tracks, for students to specialise in. All of them result in a MSc degree in Biosciences. Biosciences is part of the Graduate School of Life Sciences (GSLS), which also houses the master degree programmes Natuurwetenschappen en Bedrijf and Biomedical Sciences. The three master's degree programmes (Biosciences, Biomedical Sciences and Natuurwetenschappen en Bedrijf) fall under the remit of the same Board of Examiners, Board of Admissions and Educational Board.

Standard 1

The panel verified that the ILOs for the master's degree programme Biosciences tie in with its level and orientation. They form a well-designed hierarchical framework of learning outcomes that are fully compliant with the Dublin descriptors at the master's level. Biosciences has created a shared framework that ensures that all educational programmes under its remit achieve shared objectives and values. The ILOs for the educational programmes in turn specify that graduates obtain the relevant knowledge and expertise for their specialisation. They are strongly research-based and clearly define the advanced level of complexity that graduates should obtain for the master's level. Each of the career profiles has profile-specific ILOs, which feed into the students' acquired skills and knowledge. The panel ascertained that these ILOs and the Biosciences' orientation at the GLSL are in line with the expectations of the discipline, as formulated in the Domain-Specific Framework of Reference for Biology.

According to the panel, Biosciences is a well-designed and fully mature successor of the Biological Sciences degree programme. Biosciences' constellation of educational programmes in Bioinformatics and Biocomplexity, Bio-Inspired Innovation, Drug Innovation, Environmental Biology, Molecular and Cellular Life Science is aptly chosen regarding Utrecht University's research strengths and is well-placed to offer graduates a strong position on the labour market. The panel appreciates the strong learning line on systems biology, which confirms that the Utrecht University specialisations continue to adapt to new ideas and challenges in the field. It also noted that the GSLS and the Biosciences degree programme took the recommendation of the former assessment panel into account; they developed new research lines and a new educational programme in line with the ideas of the New Biology and successfully redesigned the ILOs accordingly.

Standard 2

The Biosciences degree programme has adequately translated its intended learning outcomes into a coherent curriculum that takes its students to an advanced level by the end of the programme. The panel considers the curriculum design and structure inventive and fit for the purpose. The students have ample opportunities for choice and are offered both extensive research experience in their major research project and specialisation opportunities as part of their educational track and themed profile. Biosciences offers the students a solid framework, in which the educational programmes and the themed profiles provide building blocks that help the students to create their unique learning pathway. In this way, they are trained as a specialist in a particular field while also paying attention to a recognisable career profile, providing a direction for their further career choices. The teaching methods are considered apt, and the module content of the educational programmes is up to date. The students consider the degree programme feasible in terms of knowledge and level requirements. The programme was also found to be highly adaptive and open to developments in the discipline, inspiring confidence in the future of the current degree programme and its ability to continue offering a teaching-learning environment of high quality.

It was brought to the attention of the panel that in order to allow a high level of flexibility, student guidance and good planning are essential. In both areas, it found room for improvement. While the students were in general pleased with their teachers and supervisors in terms of their enthusiasm and engagement, they also identified room for improvement. The Biosciences programme may want to start collecting best practices in terms of supervision and help provided to Dutch and international students arriving at the programme, in order to learn and adapt

practices where necessary. The panel heard various ways in which the educational programmes have tried to help their students with their planning skills, ranging from introducing good monitoring systems to helping with the planning of deficiency courses when the students moved to research groups slightly out of their comfort zone. The panel heard one suggestion from the students that may be worth investigating: schedule a mandatory planning appointment well into year 1, to discuss the students' choices again. Based on these findings, the panel concluded that the students are enabled to meet the intended learning objectives in terms of content and access to guidance.

The international classroom adds a dynamic which closely resembles the students' expected professional career line. Based on these findings, the panel is convinced that the use of English as the language of instruction is of added value for the quality of the teaching-learning environment and the students' future careers. The English proficiency of staff members is also sufficiently monitored and trained, where necessary. The staff in general is aptly trained and has a relevant background in the required research areas and disciplines to meet the requirements of the Biosciences curriculum. Facilities and staff have been under pressure during the period under assessment, which also affected the students' teaching-learning environment to some degree. The panel carefully looked into the situation and collected sufficient evidence to conclude that these challenges have been adequately met to the best of the abilities of all involved: some students will have been affected and made individual choices to postpone all or parts of their studies due to the pressure on certain research groups. But the educational programmes have really tried to tailor options to their students' needs and generally offered valid alternatives. This is considered laudable by the panel. It found staff members at Biosciences engaged, enthusiastic and highly adaptive, also in respect to their teaching practices that needed to shift due to the covid-19 pandemic. The panel noted a good, reflective attitude, enthusiasm for the new degree design, and dedication to the students amongst staff members at Biosciences, which engenders trust in the opportunities for development and change discussed during the site visit.

Standard 3

The master's degree programme Biosciences has a good assessment system in place that ensures that all students achieve the intended learning outcomes. Its quality assurance system guarantees the validity and transparency of student assessment using a peer-review principle applied to all exam questions and the assessment of the research projects, and frequent sampling to determine the quality of exams and the final projects.

In general, the panel was pleased by the way in which the assessment of the research projects is organised. It considered the quality of assessment satisfactory. For the assessment of both projects, rubrics with grade descriptors per criterion are used that ensure its reliability and validity. The panel also valued the interim assessment introduced. The students consider the assessment fair and clearly communicated, with which the panel concurs. The transparency of the assessment could be enhanced by introducing substantiation of grades in all cases; but the panel approves the choices made by the BoE in this matter based on the workload of staff members. It feels that the transparency of the assessment is sufficiently demonstrated and supports the suggestions by the BoE to start with creating additional room to comment on aspects that may have fed into the assessment that are not necessarily transparent from the categories in the rubrics used.

The panel concluded that the Board of Examiners of the GSLS, supported by the ASP, is fully in control. It assures the quality of assessment in the programmes under its remit to a high standard, is proactive and open to suggestions for change, and has a keen eye for the needs and challenges of staff members and students alike. It also adequately responded to the challenges posed by the pandemic caused by covid-19, by proactively enforcing proctoring where necessary and supporting staff members who had to redesign tests and assignments. In its opinion, the BoE and ASP are a positive driving force. They ensure a development-oriented quality culture at the heart of the GSLS. A compliment is in order.

Standard 4

Biosciences offers its students a good position to enter the labour market upon graduation. Their skills and knowledge are valued by employers, and they easily find employment as a PhD researcher or in other relevant fields.

The students are also satisfied with the programme and its preparation for their further careers. Based on the evidence presented, the panel concluded that graduates of Biosciences convincingly demonstrated in their research projects that they have met the level requirements for a master's degree programme and that they have achieved the ILOs during their studies.

The panel assesses the standards from the *Assessment framework for limited programme assessments* in the following way:

Master's programme Biosciences

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

The chair, prof. dr. Ton Bisseling, and the secretary, dr. Els Schröder, of the panel hereby declare that all panel members have studied this report and that they agree with the judgements laid down in it. They confirm that the assessment has been conducted in accordance with the demands relating to independence.

Date: 5 October 2021

DESCRIPTION OF THE STANDARDS FROM THE ASSESSMENT FRAMEWORK FOR LIMITED FRAMEWORK ASSESSMENTS

Organisational context

The two-year master's degree programme Biosciences offers five educational programmes, or tracks, for students to specialise in. All of them result in a MSc degree in Biosciences. Each one has its own programme leader and programme coordinator, ensuring specialisation, a separate identity, and different communities.

Biosciences is part of the Graduate School of Life Sciences (GSLS), which also houses the master degree programmes Natuurwetenschappen en Bedrijf (Science and Business Management; hereafter SBM) and Biomedical Sciences. The GSLS and its associated degree programmes are part of the Faculty of Science. The three master's degree programmes (Biosciences, Biomedical Sciences and Natuurwetenschappen en Bedrijf/SBM) fall under the remit of the same Board of Examiners, Board of Admissions and Educational Board. Biomedical Sciences has its own Director of Education. Biosciences and Natuurwetenschappen en Bedrijf/SBM share a Director of Education.

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

Since the last reaccreditation process, the Faculty of Science and the GSLS have radically changed the programme structure. In this process, the master's degree programme Biosciences was newly created. It consists of a structural unification of the master's educational programmes in Biology, Cellular and Molecular Life Sciences and Pharmacology, awarding a single degree: a MSc in Biosciences. Five educational programmes, tracks, now fall under Biosciences' scope: Bioinformatics and Biocomplexity (since 2020); Bio-Inspired Innovation (since 2016); Drug Innovation; Environmental Biology; and Molecular and Cellular Life Sciences. As each of these programmes retains its own separate identity, in this report they will be referred to as educational programmes or specialisations within Biosciences rather than as tracks. As Bioinformatics and Biocomplexity only started in 2020, the panel will not pay extensive attention to this educational programme in its review.

The Bioinformatics and Biocomplexity programme brings together the worlds of biology, computer and data sciences, combining bioinformatic data analysis, modelling and simulating biocomplexity. Bio-Inspired Innovation offers the knowledge and skills training that will support the search for and development of circular business models and bio-inspired research and innovations. Drug Innovation combines the knowledge of and skills training in combinatorial chemistry, drug delivery, immuno- and psychopharmacology, proteomics, epidemiology, and drug regulatory sciences. Environmental Biology explores how plants, animals and microorganisms function and adapt to their constantly changing environment. Molecular and Cellular Life Sciences takes a multidisciplinary approach to the study of molecules, cells and organisms. Where applicable, a systems biology approach is employed in order to cross the former boundaries based on the study of a single level of observation. The panel appreciates this move to systems biology, which confirms that the Utrecht University specialisations continue to adapt to new ideas and challenges in the field.

Profile Biosciences

The creation of Biosciences allowed for the clustering of the shared fundamentals and soft skills set particular to the Life Sciences. To this end, the Life Sciences Academy was created, aimed at broadening student horizons and developing soft skills. It includes shared topics such as scientific integrity and individual career orientation. As part of the creation of Biosciences, a focus on the New Biology and the new challenges modern society faces was also embraced. Biosciences started two new educational programmes as a result: Bio-Inspired Innovation (2016) and

Bioinformatics and Biocomplexity (2020). The degree programme Biosciences also created new themed profiles, which direct the students' focus and interests in line with their career ambitions alongside the chosen specialisation. These nine profiles are: applied data science, bioinformatics, communication, complex systems, education, management, general research, life sciences and society, translational life sciences.

The panel is pleased with these developments. In its opinion, the master's degree programme Biosciences benefits from Utrecht University's strong research expertise in the life sciences, and taps into the potential at the university for widening the scope of its research. In its view, the GSLS adapted well to the rapid changes in the life sciences. The newly created specialisations reflect Utrecht University's strength in the New Biology; quantitative biology, data analysis, and systems biology are the major elements of its new educational programme Bioinformatics and Biocomplexity. The knowledge clustered in the new specialisation also offers a solid base to allow the New Biology to feed into the other Biosciences educational programmes, through the chosen profiles or by the choices students make during their studies. In this respect, the GSLS aptly reacted to the suggestions by the 2016 assessment panel that reviewed the Biosciences predecessors, the Biological Sciences master's degree programmes, which asked for adaptation in line with the changes in the field. The research-intensive focus that always characterised the Utrecht University programmes has been maintained in these changes, which the panel approves. With the creation of Biosciences, GSLS managed to create coherence and structure amongst its educational programmes and adapted well to the needs of the New Biology.

The fields and topics studied at Biosciences fit the Domain-Specific Framework of Reference (DSFR; see Appendix 1), as formulated for all Biology master's degrees in the Netherlands in June 2020. The revised DSFR pays attention to the developments in the field, in line with the suggestions of the 2015/2016 assessment panel. It addresses that 'more than ever, biologists are required to be competent at integrating big data, dealing with dynamic systems and analysing complex networks of interactions, at multiple levels of biological organisation', which the panel agrees with. Also, it offers a clear career perspective for graduates. According to the panel, Biosciences' specialisations are in line with the expectations of the professional field and offer graduates a good preparation for their future career. These careers range from specialists in research and industry to consultancy for societal partners. Other graduates may opt for a career in entrepreneurship, education or communication.

The orientation of the specialisations also closely matches the mission statement of the GSLS in their objectives and aims for Biosciences: to improve life, by providing an inspiring and innovative academic environment that enables graduates to thrive in the dynamics of life sciences and society. Graduates are expected to become interdisciplinary thinkers and workers. They are educated to be able to create an impact in the dynamics of society and science, demonstrating integrity towards science and society by showing leadership and by becoming team players and life-long learners. The panel considers this redirection towards a society-relevant training programme a strong feature. The influence of this mission change is also visible in the creation of the themed student profiles. Four of these profiles are research-focused (General Research; Applied Data Science; Bioinformatics; Complex Systems), five are focused on science and society (Science Communication; Education; Management; Life Science and Society; Translational Sciences) in line with the students' potential career paths. The profiles direct student learning in a career orientation, which the panel considers a useful addition.

Programme aims and intended learning outcomes

The coherence and structure noted in the creation of Biosciences is also visible in the learning goals. Biosciences completely redesigned its approach to its intended learning outcomes (ILOs; see Appendix 2) in line with the former assessment panel's suggestions. It offers shared ILOs for all its educational programmes. Thus, a framework of shared objectives and values forms the basis for all specialisations. The various specialisations also have defined programme-specific ILOs. The panel found these programme-specific learning outcomes to be clearly formulated and framed in such a way that they contribute to achieving the overarching aims of the GSLS programmes with specific knowledge/expertise acquisition tailored to each educational programme. Each of the themed career-oriented profiles has profile-specific ILOs, which feed into the students' acquired skills and knowledge. All ILOs are

fully compliant with the Dublin Descriptors at the master's level. They are strongly research-based and clearly define the advanced level of complexity that graduates should obtain.

Considerations

The panel verified that the ILOs for the master's degree programme Biosciences tie in with its level and orientation. They form a well-designed hierarchical framework of learning outcomes that are fully compliant with the Dublin descriptors at the master's level. Biosciences has created a shared framework that ensures that all educational programmes under its remit achieve shared objectives and values. The ILOs for the educational programmes in turn specify that graduates obtain the relevant knowledge and expertise for their specialisation. They are strongly research-based and clearly define the advanced level of complexity that graduates should obtain for the master's level. Each of the career profiles has profile-specific ILOs, which feed into the students' acquired skills and knowledge. The panel ascertained that these ILOs and the Biosciences' orientation at the GLSL are in line with the expectations of the discipline, as formulated in the Domain-Specific Framework of Reference for Biology.

According to the panel, Biosciences is a well-designed and fully mature successor of the Biological Sciences degree programme. Biosciences' constellation of educational programmes in Bioinformatics and Biocomplexity, Bio-Inspired Innovation, Drug Innovation, Environmental Biology, Molecular and Cellular Life Science is aptly chosen regarding Utrecht University's research strengths and is well-placed to offer graduates a strong position on the labour market. The panel appreciates the strong learning line on systems biology, which confirms that the Utrecht University specialisations continue to adapt to new ideas and challenges in the field. It also noted that the GSLS and the Biosciences degree programme took the recommendation of the former assessment panel into account; they developed new research lines and a new educational programme in line with the ideas of the New Biology and successfully redesigned the ILOs accordingly.

Conclusion

Master's programme Biosciences: the panel assesses Standard 1 as 'meets the standard'.

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: design and structure

The basic outline for all five educational programmes of Biosciences is quite similar (if not identical). In their first year, the students typically follow the course elements of the Life Sciences Academy (1.5 EC), a specialised and mandatory theoretical course within their specialisation (7.5 EC) and the major research project, carried out at a research group associated with the students' specialised educational programme (51 EC). In their second year, they follow a second theoretical mandatory specialisation course (7.5 EC), carry out a writing assignment (7.5 EC), follow an elective component that is set within the context of their educational programme (12 EC), and take courses tailored to their chosen themed profile (33 EC). This combination of curriculum elements results in a master's degree in Biosciences, with a specialisation in Bioinformatics and Biocomplexity (BIBC), Bio-Inspired Innovation (BII), Drug Innovation (DI), Environmental Biology (EB) or Molecular and Cellular Life Sciences (MCLS) and a profile in General Research, Applied Data Science, Bioinformatics, Complex Systems, Science Communication, Education, Management, Life Science and Society or Translational Sciences.

For the Life Sciences Academy (1.5 EC), the students are required to attend the Introducing Life Sciences week, at least seven Life Sciences seminars, and three workshops of the Navigation Towards Personal Excellence programme. Depending on the specialisation, the mandatory theoretical courses (15 EC) are either fixed (at BII, DI) or to be

chosen from a set list (BBIC; EB; MCSL). The elective component (12 EC) can be used to address deficiencies in their previous education or to complete additional theoretical courses in their specialisation or extend their profile. The Writing Assignment (7.5 EC) can take one of two forms. It is either a thesis based on a literature overview or a research proposal. This proposal is in the format of an NWO Top Talent application or a scientific proposal in the form of a TTW/EU application. It should present a clear and thorough overview of the recent literature addressing the topic in question. It should include an in-depth discussion that demonstrates the students' ability to critically evaluate hypotheses and results, present their own views and draw conclusions that point to new research.

At first, the panel wondered whether it would not be more useful to combine the Writing Assignment with the major research project or some other component in the curriculum. Biosciences' representatives explained that they have a clear didactical vision underlying the current set-up. They want their students to experience the process of quickly gaining new knowledge within a set time frame, a skill highly relevant for research. In addition, they consider the change of supervisor, and hence supervisory style, beneficial as it gives the students an opportunity to encounter new perspectives and approaches. Many students use the Writing Assignment to explore a new topic, practise proposal writing for a new project to be pursued after finishing their degree programme, or deepen their knowledge in an area recently identified as knowledge deficient. They confirmed that they like the flexibility of its current form, which allows them to tailor it to their specialisation needs or to pursue interests inspired by their themed profile route. Guidance during the Writing Assignment is intensive and didactically aimed at showing the students the need for focus in their research interest and the design of a research question or proposal. The programme representatives convinced the panel of the benefits of keeping the Writing Assignment as a separate curriculum element. The panel was pleased to find such a structured and clear didactical view as its building block, demonstrating the careful way in which Biosciences has designed its curriculum.

The nine themed profiles each have their own structure. Some offer a set curriculum with limited elective space, while others offer tailor-made options within their theme. The four research-focused profiles focus on in-depth research skills and aim to deepen the students' experience in a research field by being part of a research group. The students follow a minor research project as part of their study – usually at an external research group – which contributes to the final achievement level. The General Research Profile is a flexible profile, consisting of both practical work and courses. The profiles in Applied Data Science, Bioinformatics or Complex Systems offer an interdisciplinary approach, in which the students combine courses with a project or assignment on a specific topic/field. The five science and society-oriented profiles focus on broader skills and have a practical approach. The Science Communication Profile and Education Profile consist of theoretical courses followed by practical work in the specific field. The Management Profile combines skills in the life sciences with courses in business and economics. The Life Science and Society Profile and Translational Sciences Profile have a capstone project throughout the profile, supplemented with courses (some compulsory). This gives students a broader view on how to translate problems (and solutions) from a scientific perspective to society.

The panel considers the curriculum design and structure of Biosciences inventive and fit for the purpose. The students have ample opportunities for choice and are offered both extensive research experience in their major research project and specialisation opportunities as part of their educational track and themed profile. They may opt to change the sequence of some curriculum elements if that meets their interests or fits their schedule better. The flexible approach offers students starting in September and February a fairly similar chance of designing a curriculum tailored to their individual needs.

Curriculum: content

The newly created educational programme Bioinformatics and Biocomplexity (BIBC) brings together the worlds of biology, computer and data sciences, combining bioinformatic data analysis and modelling and simulating biocomplexity. The programme is interdisciplinary and benefits from the involvement of many of Utrecht University's faculties and leading research institutes. Bioinformaticians and biocomplexity scientists may expect to work in many different laboratories, such as in the hospital to discover novel genes that are associated with diseases, or at research

institutes and companies that study novel drug targets, explore ecological models or improve crop yield. The compulsory course work of this specialisation consists of the Essentials module (4.5 EC) in combination with one or more courses with a minimum of 5.5 EC from the elective courses for this specialisation. In addition, the students should choose one of the compulsory options Biological Modelling (5.0 EC) or Bioinformatics and Genomics (5.0), in consultation with the coordinator. For their major research projects, they are required to complete a research project, which should be done in one of the Bioinformatics and Biocomplexity participating research groups.

Bio-Inspired Innovation (BII) offers the knowledge and skills training that will support the search for and development of circular business models and bio-inspired research and innovations. Science and Design are used for innovations that support a transition to a sustainable, circular economy. Graduates of Bio-Inspired Innovation are expected to work as a bio-inspired circular economy expert, innovator, entrepreneur, scientist or consultant, working for organisations that want to be part of a sustainable society with a guaranteed food supply. Students in this educational programme follow two mandatory courses for their theoretical knowledge: Bioinspiration & Value creation (7.5 EC) and Integrative Bio-Inspired Design (7.5 EC). For their major research project, they usually choose groups specialising in Fungal Biology (microbiology), Ecology, Molecular Plant Physiology or Plant Eco Physiology.

Drug Innovation (DI) combines knowledge of and skills training in combinatorial chemistry, drug delivery, immuno- and psychopharmacology, proteomics, epidemiology, and drug regulatory sciences. Graduates are expected to contribute to drug innovation in either research institutes or the pharmaceutical industry. Alternatively, they may opt to set up their own start-up companies or play a role in policy-making in science and health care related to the disciplines of medicine, veterinary medicine, biology, chemistry, pharmaceutical sciences, physics and computer sciences (bioinformatics). They follow two mandatory courses for their theoretical knowledge: Drug Discovery (7.5 EC) and Drug Development and Regulation (7.5 EC). They are required to choose their major research project within the Utrecht Life Sciences research groups: UIPS, at UMCU, Veterinary Medicine, Biology, or Chemistry.

Environmental Biology (EB) explores how plants, animals and micro-organisms function and adapt to their constantly changing environment. The students acquire knowledge of the biological mechanisms underlying the interactions of plants, animals or micro-organisms with the biotic and abiotic environment at organisational levels that can range from genes, cells and organisms to populations and whole ecosystems. Environmental Biologists usually continue their career in research at research institutes and universities, but also as consultants at engineering companies or for societal partners. The educational programme in EB offers four different study routes: Ecology and Natural Resource Management, Plant Biology, Fungal Biology and Behavioural Biology. These routes each have compulsory courses that fit into the specialisation's theoretical knowledge and, when necessary, elective space. The major research project is carried out in one of the participating Environmental Biology research groups, chosen in line with the students' route within EB.

Molecular and Cellular Life Sciences (MCLS) takes a multidisciplinary approach to study molecules, cells and organisms. The programme is focused on cell signalling, membrane biogenesis and intracellular transport mechanisms, using methods from the fields of biochemistry, cell biology, computational biology, proteomics and genomics. The educational programme adopts a systems biology approach in order to cross the former boundaries based on studies on a single level. The acquired knowledge can be used to work on solutions in the biomedical field but also in the field of plant biology, biotechnology (e.g. industrial enzymes for biofuels) and nanotechnology (e.g. nanoparticles in medicine). Graduates often continue in research, in an academic or industrial context. The educational programme MCLS offers three study routes within its specialisation: Genes to Organisms, Molecules and Cells, and Biophysics and Molecular Imaging. To meet the MCLS track criteria, the students have to complete at least 9 EC in courses that fit their chosen MCLS route and a choice of two out of three General MCLS specialisation courses of 3 EC each. The major research internship must be done in a MCLS-affiliated research group. These research groups can be found within the Bijvoet Center for Biomolecular Research, the Institute of Biodynamics and Biocomplexity, the Institute of Biomembranes and the Institute of Environmental Biology. The students are required to align their major research project with their MCLS route.

The panel studied the contents of the various educational programmes, the study routes in EB and MCLS and the themed profiles. It also examined a selection of modules in more detail, including their assessment. It considers the specialisations of high quality in terms of level and knowledge provision. The teaching methods are considered apt, including lectures, seminars, group work, project work, self-study and the research project, which has both a practical component and a more theoretical component. The students were pleased with their curriculum and tailored learning journeys. They felt that Utrecht University delivered on its promise of choice and individual, tailored learning at a high scientific level while also offering consistency within the various specialisations and a recognisable profile for its graduates. They pointed out, however, that this freedom needs to be carefully managed. They considered planning skills and good guidance of the utmost importance to create alignment between the various curriculum elements. In general, they were pleased with the guidance received at their educational programmes, in terms of both planning help and supervision. At MCLS and DI, the study coordinator was praised. At EB and BII, the community feeling amongst students and the staff at the research groups was mentioned as being very helpful. Based on these findings, the panel concluded that the students are enabled to meet the intended learning objectives in terms of content and access to guidance.

During the site visit, the panel also discussed the upcoming changes in the discipline with representatives of Biosciences, the master's programme Science and Business Management (SBM) and the bachelor's programme Biology. In the 1970 and 1980s, Molecular Biology was 'new' but now it is a fully mature part of Biology. Then Bioinformatics and Systems Biology offered food for thought and a motor for change within the degree programmes. The students now consider these areas of interest central to their studies, showing how quickly adaptations to the degree have been internalized. Utrecht University's researchers in the Life Sciences now foresee a shift to a quantitative approach to Ecology, including complex ecological interaction and metagenomics, and paying heightened attention to biophysics as part of Systems Biology. In hiring new staff and creating research groups, these developments are being addressed. This will provide research opportunities for master students to integrate these developments within the curriculum of the Biosciences degree programme. The panel members are pleased with the line of thought and action. To them, it proves that Biosciences not only offers a teaching-learning environment that is currently of good quality in terms of its content and curriculum, but is also adapting to changes in the field and playing on the research strengths of Utrecht University. This confirms the panel's confidence in the degree programme's ability to continue to offer future-proof education to students.

Programme language, name and international classroom

At Biosciences, English is the language of instruction. The panel learnt that the main reason for this choice is inspired by career-oriented motivations. According to the programme, it is becoming increasingly important for students to be equipped with intercultural and international competences. These international competences include language skills, in order to have the best possible starting position on the labour market. In addition, the influx of international talent contributes to an increase in the quality of education and to the creation of a diverse and international student population. The panel wants to add that this last argument holds particularly true for a science-based programme, such as Biosciences; for scientific advancement, international talent may play a key role in driving scientific advancement and innovation.

Students enrolling in Biosciences may reasonably expect to work in a highly international environment; as innovators, entrepreneurs, consultants or scientists at multinationals in the pharmaceutical, biomedical or food industry or as academics in international research groups and research networks. To prepare the students for working in these international settings, Biosciences is offered in an international classroom setting. The panel noted that the content of the programme has an international focus. Therefore, all course content and materials are provided in English. To maintain the quality of research at a high level, international networks and sufficient international scientific staff are of great importance. Here, too, English is considered the only realistic choice by the degree programme, a view confirmed by the panel. Employers also value good English proficiency in Biosciences graduates, as the panel read in a report produced by the Nederlands Instituut voor Biologie (NIBI).

These arguments are also solidly supported by the realities of the teaching-learning environment at Biosciences. The academic community is internationally oriented, and staff members involved in teaching in the programme are also internationally educated; many received their prior training in an international context, and several staff members worked some time abroad. For their research, staff members participate in international projects. Staff research inspires teaching at the programme, so the students benefit directly from this international orientation and context. The creation of an international classroom is also grounded by a diverse intake. In 2019, the international student intake fluctuated between 35-71% per specialisation; in 2020, between 49-68%. During the site visit, the students emphasised that they considered the international classroom setting very valuable for their training as scientists, as it guaranteed interaction between various perspectives and approaches. Based on these findings, the panel is convinced that the English programme name Biosciences and the use of English as the language of instruction are a cornerstone of the programme's international classroom setting and of added value for the quality of the teaching-learning environment and the students' future careers.

Teaching Staff and responses to covid-19

Biosciences shares a Director of Education with the master's programme SBM. All specialisations are headed by a programme leader, who is supported in turn by a coordinator. For its teaching and research, Biosciences benefits from the expertise of staff members with a diverse background in the Life Sciences. Staff members often have an interdisciplinary interest and a disciplinary training in Biology, Pharmacy or Chemistry. For some of the more specialised courses, this may also include a background in Computer Science or (bio)medical research. The students carry out their first-year project at different research groups within the Faculty of Science while following theory courses tailored to their needs and interests. This means that potentially all staff members of the Faculty of Science are involved in teaching. As a result, it was very difficult for the panel to get a comprehensive picture of the content expertise of all teaching staff. Based on the excellent record of the Faculty's research groups and student testimonies reflecting positively on the content knowledge of their teachers, the panel considers the content knowledge sufficient.

The teaching credentials of staff members are monitored through the appointment of qualified examiners by the Board of Examiners, which also checks the quality of the assessment. The panel has no concerns in this matter. It studied the lists of teaching staff involved in the departments of Biology, Pharmacy and Chemistry and verified that nearly all of them hold a (senior) teaching qualification (BKO/SKO or equivalent) or were in the process of obtaining one. Good policies are in place to monitor the level of English proficiency of staff members, and opportunities to improve their capabilities are available and easily accessible for staff members needing or wanting to. The panel also noted that in general, professional support for teaching staff was well organised and of very high quality. It concluded that Utrecht University takes its responsibility for professional and personal growth very seriously; its staff is actively encouraged to invest in their teaching practice, and there are career perspectives for excellent teachers. The panel wants to commend all involved at Utrecht University for this practice.

The students praised the staff members for their enthusiasm and engaged attitude: they always felt welcome to ask for support or direction, felt challenged and taken seriously as researchers in their own right. The supervision was considered of satisfactory to good quality, depending on the persons involved and the students' individual needs. These seemed to be opportunities for more standardised training of staff with respect to supervisory and feedback practices and sharing of experiences, in the panel's opinion. It was pleased that students felt generally satisfied with their teachers' involvement and supervision. This student satisfaction is important to the panel, particularly in a year in which teaching and research opportunities have been massively influenced by the circumstances inspired by the covid-19 pandemic. As a result, the programme had to move to online lectures and meetings and had to vastly reduce the opportunity for physical experimentation.

Although the programme identified the pandemic as a potential threat to the programme in their SWOT analysis, the students considered this fear countered by reality. Their options had been restricted of course. Group work had to be organised online, and fewer options to mingle were all seen as unavoidable yet regrettable results of the

circumstances. There were no opportunities to go abroad, international students enrolled from home and missed out on the physical experience of studying in Utrecht, and research time in laboratories was strictly monitored and allocated according to need. This left less room for a change of plans during their studies, but also forced the students to carefully plan their research and prepare for online courses – which could be considered important lessons learnt that are also relevant for their future professional careers.

The students felt that the teaching staff and management had gone the extra mile to ensure a rich and still challenging teaching-learning environment during the pandemic. The staff responded quickly to questions, offered additional online support through social media outlets where necessary, and inquired regularly after the students' mental and physical health and offered guidance to relevant services, if needed. They were also considered responsive in terms of adapting their teaching practices and guidance: they actively implemented feedback on their online courses, resulting in quick changes and fine-tuning of modes of delivery. This responsive staff attitude even gave the students a sense of increased ownership in some cases, as they felt like they were learning alongside the staff members and felt sincerely appreciated for their contributions. The staff members noted, on the other hand, that the students were often very well prepared for the online classes, and even better than they had been for physical classes; they also felt rewarded for their efforts as the students were really trying to adapt to the changed circumstances.

The panel was impressed by the way the programme, its staff and the students reacted to the covid-19 circumstances. It found it very promising that the programme was already reflecting on 'lessons learnt'. Also, the programme really valued its short communication lines with students through social media outlets, which created a new dimension of interactivity within and outside of the classroom that the programme wants to maintain. Although the panel agrees with all involved that in general the pre-pandemic teaching is to be preferred over the pandemic teaching, it considered the pandemic teaching of good quality – which was also confirmed by the passing rates of students. It was pleased to hear that the post-pandemic teaching would reap the benefits of new insights obtained.

Staff workload, facilities and feasibility of the programme

The student population of degree programmes in the life sciences has exploded in the period under assessment; enrolment numbers in the associated bachelor's programme in Biology has been very high – nearly 500 new students started their studies in 2020. As a result, all associated programmes, research groups and staff members have been affected in terms of allocation of facilities and time to properly manage the large student cohorts. Biosciences is affected by its close links to the bachelor's programme Biology. Biosciences has no numerus clausus, but has been forced to restrict its enrolments in some of its educational programmes to guarantee the availability of facilities to its students. As a side effect, Biosciences students have had to compete for places at research groups of their first and second choice and could be one of several students supervised by the same scientist. The students mentioned that in some cases, when allocated a place in a project of their third or fourth choice, they decided to postpone or extend their studies even though alternative projects were offered. Although feasibility was not necessarily an issue, freedom of choice certainly was in their view as alternative options were available.

Representatives of the Faculty of Sciences and staff members of Biosciences, the master's programme Science and Business and the bachelor's degree programme Biology assured the panel that the University was doing everything it could to address this situation. In the last two years, many new members had been hired, which had brought down the staff to student ratio to acceptable proportions. Great investments were made in support structures, such as coordinator functions, which could reduce the pressure on the teaching and research staff. Active investment in new research groups and research lines was heavily supported, along with the necessary facilities to go with these investments. Naturally, these investments followed the increased demands, but were now starting to meet them. As a result, more and more students would again be able to follow a research project of their first or second choice. Staff members mentioned being seen and felt that the programme management, Faculty and University took their

needs and concerns seriously. They also confirmed that the work pressure was being reduced, and they felt like breathing space was actually in sight.

The students of all educational programmes emphasised that they were pleased with the supervision provided in general and that the high number of students had, in their view, not greatly influenced the quality of the education. If they encountered unforeseen deficiencies in their prior training or knowledge, support was available to address them as soon as possible. This holds true for international students with a different training background, but also for students who needed to refresh or touch up their knowledge in certain areas when changing their research orientation due to the availability of places at research groups. The students agreed that the various educational programmes reacted appropriately to their training needs in this respect. They also considered their specialisations feasible in terms of content and level aimed for, as long as they managed to schedule the various programme elements in a proper sequence.

These scheduling difficulties were also identified by Biosciences in their SWOT analysis as a challenge to the system. It is relatively difficult for the students to schedule their studies within 24 months as this requires all courses to neatly align in time. The students are granted great freedom in electing and arranging their own courses, which offers many opportunities for creating a unique learning journey. However, the drawback of this system is, as the degree programme acknowledges, that the best sequence of courses is not always clear to the students and/or logistically feasible. As a result, the students would encounter small delays – typically up to two months at the end of their studies. The panel learned that a research project coordinator actively monitors student progress to limit delays in research projects, and a new digital registration system has been developed to help the students plan the order of their programme elements. This system will make monitoring student progress easier and is considered useful by the students who have already worked with it.

The panel is pleased that the specialisations are trying to address this point of concern and considers the initiatives taken useful. During the online visit, the students offered another suggestion that could be worth investigating: they indicated that at the start of their studies, much help was offered to plan and schedule their courses. As their plans and teaching needs sometimes changed – due to choice or availability of places at the research groups – it could be useful to offer another planning meeting after, say, six to eight months into their studies, as a mandatory 'schedule check'. To the panel, this may be worth considering.

At times, international students found it challenging at the start of their studies in Utrecht: they really needed to 'hit the ground running' in a new, unfamiliar setting. Some of them felt un(der)prepared for the challenge of finding a good major research project in the first five weeks, as competition for certain groups is fierce due to the limited number of places and the influx of students in recent years. International students sometimes felt disadvantaged, and worried that some of their Dutch peers with prior knowledge of the Utrecht University system and research groups would snap up the best places. As a result, some international students fell behind or decided to wait for a place at a group more to their liking, if they were not successful in their first bid for a place. The panel found that this problem is directly connected to the massive influx of students to both Biosciences and its associated bachelor's programmes in recent years, which resulted in a shortage of places at the research groups for student research.

The panel heard that all educational programmes try to create a level playing field, which ensures equal treatment for all students with respect to access to the most actively pursued research groups. They try to counteract any apparent potential advantages to Dutch students and Utrecht BSc Biology graduates and to prepare international students for what lies ahead upon arrival. The panel heard, however, that different approaches exist. All educational programmes have an introductory course, in which all various research groups present themselves to the students. However, only MCLS students seemed to find the introductory week very helpful, suggesting that this specialisation apparently gave its students an advantage over those from the other specialisations. One MCLS student also mentioned a particular 3.0 EC elective course (Concepts in Science for Life) that really helped him and many of his fellow students to understand their options. The panel advises the five specialisations to share their experiences

with all students and, potentially, to learn from MCLS's good practice. BII sends out information packages upon enrolment; this was also a suggestion of some of the international students the panel spoke with, which suggests that either practices vary over the specialisations or that the content of this information package should be revised to communicate more clearly what is expected from students prior to their arrival.

The MCLS staff members indicated that their investment in the introductory week was partly in reaction to the specialisation's completion rates, which had been falling together with the growing competition for places at research groups. As a very popular educational programme of choice and area of student interest, MCLS was hit hard by the influx of students at the bachelor and master degree level. The panel verified in conversations with staff members and the programme management that adequate measures were taken: new research groups had been created in response to the growing demand, but these initiatives need some time to flourish. Meanwhile, the programme invested in encouraging the students: they needed to start seeing the new groups and new research lines as valid and inspiring alternatives to earlier experiences and pursued interests. The introductory week tried to illustrate the variety of options, hoping to convince them to opt for new research angles and alternative groups instead of deferring or waiting for a place to open up at their original group of interest. MCLS has started seeing a shift among its students and is convinced that the study delay will shorten due to these measures. The panel considers the reaction of MCLS and Biosciences apt in this matter.

The panel concludes that the Faculty and University have amply reacted to the massive increase in student numbers. It considers the obstacles encountered by the students regrettable but unavoidable; the Faculty and Biosciences management could not have anticipated the enormous growth and were hindered by the funding system, which only provides financial means to react to the new circumstances after a certain delay. It wants to praise the staff members working at the Faculty, who still managed to deliver education at such a high standard and who continued to go the extra mile for their research and their students. The staff's enthusiasm, positive attitude and collective energy really stood out during the site visit; staff members did not belittle the challenges that they and the students face or cover up their high work load. They showed how they addressed student and staff concerns, convincing the panel that the encountered problems have been or are being addressed. That the Faculty managed to keep its spirits up and maintain its staff members' trust is laudable and a sign of good leadership and community, the panel notes.

Considerations

The Biosciences degree programme has adequately translated its intended learning outcomes into a coherent curriculum that takes its students to an advanced level by the end of the programme. The panel considers the curriculum design and structure inventive and fit for the purpose. The students have ample opportunities for choice and are offered both extensive research experience in their major research project and specialisation opportunities as part of their educational track and themed profile. Biosciences offers the students a solid framework, in which the educational programmes and the themed profiles provide building blocks that help the students to create their unique learning pathway. In this way, they are trained as a specialist in a particular field while also paying attention to a recognisable career profile, providing a direction for their further career choices. The teaching methods are considered apt, and the module content of the educational programmes is up to date. The students consider the degree programme feasible in terms of knowledge and level requirements. The programme was also found to be highly adaptive and open to developments in the discipline, inspiring confidence in the future of the current degree programme and its ability to continue offering a teaching-learning environment of high quality.

It was brought to the attention of the panel that in order to allow a high level of flexibility, student guidance and good planning are essential. In both areas, it found room for improvement. While the students were in general pleased with their teachers and supervisors in terms of their enthusiasm and engagement, they also identified room for improvement. The Biosciences programme may want to start collecting best practices in terms of supervision and help provided to Dutch and international students arriving at the programme, in order to learn and adapt practices where necessary. The panel heard various ways in which the educational programmes have tried to help their students with their planning skills, ranging from introducing good monitoring systems to helping with the

planning of deficiency courses when the students moved to research groups slightly out of their comfort zone. The panel heard one suggestion from the students that may be worth investigating: schedule a mandatory planning appointment well into year 1, to discuss the students' choices again. Based on these findings, the panel concluded that the students are enabled to meet the intended learning objectives in terms of content and access to guidance.

The international classroom adds a dynamic which closely resembles the students' expected professional career line. Based on these findings, the panel is convinced that the use of English as the language of instruction is of added value for the quality of the teaching-learning environment and the students' future careers. The English proficiency of staff members is also sufficiently monitored and trained, where necessary. The staff in general is aptly trained and has a relevant background in the required research areas and disciplines to meet the requirements of the Biosciences curriculum. Facilities and staff have been under pressure during the period under assessment, which also affected the students' teaching-learning environment to some degree. The panel carefully looked into the situation and collected sufficient evidence to conclude that these challenges have been adequately met to the best of the abilities of all involved: some students will have been affected and made individual choices to postpone all or parts of their studies due to the pressure on certain research groups. But the educational programmes have really tried to tailor options to their students' needs and generally offered valid alternatives. This is considered laudable by the panel. It found staff members at Biosciences engaged, enthusiastic and highly adaptive, also in respect to their teaching practices that needed to shift due to the covid-19 pandemic. The panel noted a good, reflective attitude, enthusiasm for the new degree design, and dedication to the students amongst staff members at Biosciences, which engenders trust in the opportunities for development and change discussed during the site visit.

Conclusion

Master's programme Biosciences: the panel assesses Standard 2 as 'meets the standard'.

Standard 3: Student assessment

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

Board of Examiners

The Board of Examiners (BoE) ensures the quality of assessment at all programmes of the GSLS, including the master's degree programme Biosciences. It consists of nine members in total: a chair, a vice-chair, five representatives of the programmes, and two external members, and is supported by two secretaries and an additional support officer. The chair of the BoE also teaches in Biosciences.

The core activities of the BoE are to:

- ensure the quality of the examinations;
- adopt guidelines and instructions in order to assess and record the quality of examinations;
- assess research projects and the applications selected by students in terms of content, scientific value and relevance, and standards;
- grant exemptions from one or more examinations;
- decide on special requests regarding the study programme;
- deal with formal aspects concerning fraud or plagiarism;
- assess graduation files on the basis of the examination requirements stated in the Education and Examinations Regulations (EER);
- conceive rules and regulations on the implementation of the tasks and authorities;
- report on their actions and findings to the Board of Studies via an annual report.

The BoE has delegated sample checks of final projects and course checks to the Assessment Support Panel (ASP), which reports back to the BoE. The ASP consists of 4-6 staff members from the degree programmes at the GSLS and is chaired by the vice-chair of the BoE, who also ensures direct input from the ASP to the BoE. The BoE and ASP

both meet regularly; during the covid-19 pandemic, intensive contact between both bodies and the management teams of the degree programmes at the GSLS ensured quick communication regarding the assurance of the quality of assessment and changed assessment procedures.

The panel studied many documents reflecting on the activities of the BoE and ASP and was impressed by the level of care taken to assure the quality of assessment in the programmes under their remit. The BoE, with the input of the ASP, fulfils its legal tasks of appointing examiners by scrutinising teachers' profiles and checking their teaching and assessment credentials, overseeing the quality of assessment by performing regular module checks, and ensuring that students meet the intended learning outcomes by performing final checks when they are about to graduate and by planning sample checks of final projects. It also oversees clear procedures regarding cases of academic misconduct and acts upon them if necessary. The panel was impressed by the professionalism of the BoE and ASP, which aim to improve the quality of the assessment system and establish good working relations with staff members. The work associated with administrative procedures is considered less of an obstacle by staff members. For example, the ASP has proactively invested in computer systems that would help reduce the workload for staff members and took pride in the fact that more and more staff members actually reached out for advice and support regarding their assessment practices, often already during the design of new courses or the redesign of assessment in existing ones.

Assessment system

The panel studied the assessment plan of the degree programme and an overview of the assessment methods and criteria per course for the various educational programmes, and some examples of exams used within the programme. It concluded that all intended learning outcomes are appropriately assessed throughout the programme. The assessment plan details how the intended learning outcomes are assessed within the courses. Each course has an assessment matrix which relates the course goals to the tests and assignments within it.

Courses have multiple tests, providing students with a mid-term update on their performance and allowing for growth based on formative feedback. The course guides clearly outline the types of assessment used and how they are aligned with the course objectives and the programme's ILOs. The panel considers these overviews very transparent and well-designed. The students felt the examination methods were diverse and fit the assignments. The assessment method varies depending on the specific course goals. This is often a written exam with open questions, but there are also assignments testing practical skills, presentations and essays. The students are assessed both individually and in groups; the group work assessment in many cases also reflects on the individual student's contribution to the outcomes and includes peer-review. The students indicated in the student chapter that they value this diversity of assessment types. They considered the rules and regulations and the information provided on assessment clear and well-communicated. They appreciated the use of peer feedback during their courses and the major research project. The panel is enthusiastic about these practices, and suggests extending peer feedback to the Writing Assignment.

During the site visit, Biosciences students confirmed that they considered the assessment fair and transparent, and they appreciated the staff's formative feedback. The satisfaction with the feedback received seemed to fluctuate between the educational programmes. The panel read in the student chapter that feedback on research projects and writing assignments is well organised, and the students considered the feedback sufficient, for instance with personal feedback sessions during and after projects. They considered the way research skills and reports are assessed to be clear and accessible thanks to the rubrics available on the university website. These rubrics help them to check their own progress and give them information on what is expected of them. They felt, however, that the substantiation of grades obtained in the courses should be improved. They often had to specifically ask the teacher for feedback on assignments. Especially MCLS students felt that they had received less feedback than those in some of the other educational programmes of Biosciences, likely due to the enormous pressure on their staff due to the raised student numbers. Staff at Biosciences and MCLS are aware of these complaints and are hoping to address these concerns in the coming period, now new staff members have been hired.

Prior to setting an exam, the quality of the exam questions and answer models is checked by a second reader in terms of clarity, length, level and coverage of the course materials, usually a direct colleague. The panel heard during the site visit that the ASP is now regularly asked to advise on the assessment in new courses and redesigned modules, resulting in better designed and more varied types of assessment used in the programme. The quality of the courses is also monitored by the ASP on behalf of the BoE. The ASP takes annual samples of courses and checks whether their assessment fit the course goals and was of sufficient quality. Through this process, each course is checked approximately once every four years. For the master's theses, the ASP takes random samples of master's theses annually and studies the report and the assessment form to check whether the assessment has taken place according to the regulations. Checking for fraud and plagiarism is the responsibility of the examiners together with the individual supervisors, while an automated plagiarism check is part of the procedure for checking the research reports and business internship reports. According to the panel, the annual checks by the ASP add to the quality of assessment within the programme.

Assessment of the research projects

All Biosciences students conduct a major research project during their studies: the first-year major research project (51 EC). Students opting for a research-themed profile add a minor research project to their portfolio (18-33 EC). Quality monitoring of the large projects is therefore important when discussing the quality of assessment within the programme. To this end, the panel studied 15 major research projects and 7 minor research projects and their assessments. In general, it was pleased by the way in which the assessment was organised. For the assessment of both types of projects, rubrics in combination with grade descriptors are used that ensure the reliability and validity of the assessment.

For the major research project, the assessment is performed by the examiner from Utrecht University or the UMCU, in close consultation with a second, independent reviewer and, if applicable, the daily supervisor. The second reviewer is a staff member who is not involved with the student's project directly and is asked to assess the report and presentation. If the daily supervisor is a PhD student or a post-doc (a non-staff member), s/he cannot act as second reviewer (but will be consulted by the examiner). The weighting of the practical work, written report and verbal presentation is 60%, 30% and 10% of the final grade, respectively. The BoE indicated that it still struggles with the large practical component and how to really monitor the quality of its assessment. A rubric is provided to enhance the transparency, validity and reliability, but the BoE strives to strengthen the role of the examiner in the assessment, by perhaps readjusting the weighting in favour of the final presentation. The panel leaves this matter safely in the hands of the BoE and programme.

The panel also discussed minor research projects performed externally. To ensure consistency in the examiner's involvement, rules and regulations safeguard the academic supervisor's involvement and responsibility for the students' academic performance. Along with the academic supervisor, a second independent academic staff member is involved, acting as reviewer of the project report; the academic supervisor and reviewer are appointed as examiners. The examiners are ultimately responsible for the grade, the local supervisor only advises. If the students conduct their project at a foreign university, the academic supervisor at UU is also responsible for the translation of the grades, which is especially important for students in a different grading system. To the panel, this all sounded fair and transparent.

Regarding transparency and consistency, the panel was of two minds. On the one hand, the use of rubrics ensured a clear overview of the criteria used for assessment. On the other, the panel sometimes missed the substantiation of the grade. Also, an assessment in the form of a completed rubric was not produced for all final projects. The panel stressed that, in addition to valuable personalised feedback to the student, a formal form of feedback, substantiated by rubrics, is very helpful in understanding the rationale behind the grading. The BoE and ASP explained that substantiation is currently not mandatory, in reaction to signs that staff members felt overwhelmed by their administrative load. Originally, the BoE and ASP had also favoured mandatory substantiation along with the use of rubrics, but due to the enormous growth of the programmes associated with the GSLS and the workload for

the staff members involved, it decided to give the staff members a choice in the matter. Oral feedback is mandatory, however, so students are provided with feedback on their performance. This last claim was substantiated by the current students for the research project and by alumni.

In most cases, the panel agreed with the grades given, but for a minority of the projects, it would have graded slightly higher or lower than was the case. It noted that the ASP also came across some grading differences in their own sample checks and wondered how they had reacted. The ASP explained that they had clear procedures. Two members of the BoE and/or ASP would check the original finding. If the grading difference was maintained, a discussion was planned with the involved examiners to explore the circumstances. They found that in some cases, the grade was the result of differences of opinion amongst examiners. In other instances, the independent working of a student had been included in the grading. Where necessary, they explained to the examiners why certain aspects could not be included as part of the assessment, in this way strengthening the assessment practices and rationale behind certain criteria of the staff members. As a result of these conversations, the ASP and BoE are in favour of revising the current assessment forms. They want to give examiners some additional room to comment on aspects that may have fed into the assessment that are not necessarily transparent from the categories in the rubrics used. The panel approves of this plan, which is in line with its own wish for further substantiation, and is pleased with the proactive attitude of the ASP and BoE.

Reaction to covid-19
The panel also discussed the implication of the covid-19 pandemic in terms of the assurance of assessment. For many exams, digital alternatives have been sought. The BoE had insisted on a form of proctoring of at-home exams right from the start, to ensure that all exams could stand up to any scrutiny. This resulted in some resistance from some students and staff members, but proctoring was implemented for all at-home testing. It started with simple forms, such as teachers live-checking behind cameras, and moved on to using proctoring software when it became available. Members of the BoE and ASP supported staff members who needed to find alternatives for group work assignments, and ways to ensure that the original intended learning outcomes were met. Additional feedback sessions were scheduled, when necessary. Some tests were redesigned, but no major changes to course objectives or the Biosciences programme's ILOs were necessary. The students indicated in the student chapter that they were pleased that their teachers were allowed some flexibility in relation to choosing the examination method during the covid-19 lockdowns. There was, for example, the possibility of having online oral exams or combining an oral discussion with answering questions on paper. The students appreciated that their teachers trusted them to take the online exams according to the set regulations. The panel concluded that the Biosciences and the BoE and ASP acted appropriately and adequately in reaction to the pandemic.

Considerations
The master's degree programme Biosciences has a good assessment system in place that ensures that all students achieve the intended learning outcomes. Its quality assurance system guarantees the validity and transparency of student assessment using a peer-review principle applied to all exam questions and the assessment of the research projects, and frequent sampling to determine the quality of exams and the final projects.

In general, the panel was pleased by the way in which the assessment of the research projects is organised. It considered the quality of assessment satisfactory. For the assessment of both projects, rubrics with grade descriptors per criterion are used that ensure its reliability and validity. The panel also valued the interim assessment introduced. The students consider the assessment fair and clearly communicated, with which the panel concurs. The transparency of the assessment could be enhanced by introducing substantiation of grades in all cases; but the panel approves the choices made by the BoE in this matter based on the workload of staff members. It feels that the transparency of the assessment is sufficiently demonstrated and supports the suggestions by the BoE to start with creating additional room to comment on aspects that may have fed into the assessment that are not necessarily transparent from the categories in the rubrics used.

The panel concluded that the BoE of the GSLS, supported by the ASP, is fully in control. It assures the quality of assessment in the programmes under its remit to a high standard, is proactive and open to suggestions for change, and has a keen eye for the needs and challenges of staff members and students alike. It also adequately responded to the challenges posed by the pandemic caused by covid-19, by proactively enforcing proctoring where necessary and supporting staff members who had to redesign tests and assignments. In its opinion, the BoE and ASP are a positive driving force. They ensure a development-oriented quality culture at the heart of the GSLS. A compliment is in order.

Conclusion

Master's programme Biosciences: the panel assesses Standard 3 as 'meets the standard'.

Standard 4: Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

Major and minor research projects

For the assessment of the achievement level, the panel studied 15 major research reports of the educational programmes BII, DI, EB and MCLS. For BIBC, no final projects are available yet, as the programme started in 2020. These reports served as the basis for the selection: the panel studied 3 research reports for BII and 4 each for DI, EB, and MCLS. The panel ensured that the selection included the full grading scale and a variety of examiners involved in these projects.

Not all students follow a minor research project, as it is not a compulsory element of Biosciences. Nevertheless, they have been added to the selection for three reasons: first, the panel wants to see how the achievement level compares to the major research project. Second, as minor projects are usually followed externally, it is good to look into them for quality assurance purposes (see Standard 3). And third, for the research-focused theme profiles (General Research; Applied Data Science; Bioinformatics and Complex Systems), they are considered highly important in terms of demonstrating the achievement level. Of the 15 students selected for their major research projects, 7 also included a minor research project in their individual study path. Therefore, the panel reflected on the quality of research in these 7 minor research projects to verify whether externally followed research projects were in line with the level requirements. It looked into 1 minor research project for BII and 2 each for DI, EB and MCLS. As not all students could follow their minor research project externally due to the covid-19 pandemic, the panel was also offered examples of how Biosciences reacted to the pandemic circumstances in this selection.

Based on this selection of 22 reports, the panel concluded that students meet the intended learning outcomes of both the degree programme Biosciences and the chosen profiles and reflect the different types and methods of research available within the degree programme Biosciences. It considered the presented research to be of a good scientific level for a master's degree programme. It concluded that the students demonstrated that they have matured into critical thinkers, who reflect well on the limitations of their research, the challenges experienced and potential avenues for further research. They have fulfilled the academic requirements and have become able communicators. The panel appreciated in particular the layperson summaries, which show that the students are challenged to explain their research and main outcomes to different types of audiences.

The minor research reports demonstrated that externally followed research projects were also of the required level and were followed at well-established research groups and institutions. The students usually used different methods of research in their minor project compared to their major project, resulting in a more diverse range of research methods and approaches exercised within their degree programme at the master's level. This is in line with the ILOs of their themed profile. The reaction of the programme to the pandemic seems adequate, where appropriate. For

example, a student who was originally planning to go to a South American country for her project instead wrote a technical report based on a provided data set and a literature survey. The analytical quality and reflection in the discussion was of a very good standard and, hence, met the required master's level. The panel concluded that the research projects it studied convincingly demonstrated that graduates have achieved the ILOs for the master's level, and that Biosciences and its students adapted well to the challenges posed by the covid-19 pandemic.

Performance of alumni

Prior to the site visit, the panel studied two reports produced by NIBI; one presented the findings of a questionnaire amongst all Dutch alumni of Biosciences and associated programmes (2019), the other presented the findings of discussions with representatives of the labour market (2020). During the site visit, it spoke with some alumni who joined the conversation with the master students. The current master students were very positive about their labour market perspective; they felt well-prepared for their future careers and appreciated the various ways in which they can create a unique learning path tailored to their prospective careers. The reports and experiences of the alumni substantiated this confidence: Utrecht University graduates in Biosciences very easily find employment and usually in their preferred field. No major differences exist between the educational programmes in this respect; all offer easy access to further career opportunities. As the panel expected for Biosciences, a large majority (up to 85-90%) of the graduates pursue a PhD upon completion of their master's programme. They easily find PhD positions at well-established and renowned research groups in both the Netherlands and other countries. Some graduates opted for alternative careers in consultancy, education, communication or policy. Employers have indicated that they consider the master's level a good entry level for the job market. They are in general pleased with the level of skills and knowledge obtained by master graduates. Based on this evidence, the panel concluded that the students are well-prepared for their career upon graduation from Biosciences.

Considerations

Biosciences offers its students a good position to enter the labour market upon graduation. Their skills and knowledge are valued by employers, and they easily find employment as a PhD researcher or in other relevant fields. The students are also satisfied with the programme and its preparation for their further careers. Based on the evidence presented, the panel concluded that graduates of Biosciences convincingly demonstrated in their research projects that they have met the level requirements for a master's degree programme and that they have achieved the ILOs during their studies.

Conclusion

Master's programme Biosciences: the panel assesses Standard 4 as 'meets the standard'.

GENERAL CONCLUSION

The panel assessed standards 1, 2, 3, and 4 of master's degree programme Science and Business Management as 'meets the standard'. Based on the NVAO decision rules regarding limited programme assessments, it therefore assesses the programme as 'positive'.

Conclusion

The panel assesses the *master's programme Biosciences* as 'positive'.

APPENDICES

APPENDIX 1: DOMAIN-SPECIFIC FRAMEWORK OF REFERENCE

DOMAIN-SPECIFIC FRAMEWORK OF THE MASTERS' PROGRAMME IN BIOLOGY

Version June 26, 2020

The field of Biology encompasses living systems and their interaction with the environment. Cutting across levels of biological organisation, spanning from molecules and cells to organisms, populations and ecosystems, biological research addresses questions pertaining to energy conversion and metabolism; interaction, communication, feedback and regulation; development and the emergence of complex structure; and heredity, function, evolution and bio-diversity. The coherence of these concepts and their role in the organisation and dynamics of life should, therefore, be the central themes in every Biology programme. Rapid progress in the characterization of the building blocks of life and the molecular mechanisms that lie at its basis, have transformed Biology into an explanatory and predictive science that is firmly integrated with other disciplines such as mathematics, physics, chemistry, informatics and earth sciences. A fundamental understanding of biological systems is indispensable for resolving major societal challenges, such as transitioning to sustainable food production, conserving bio-diversity, unlocking the potential of green energy and bio-based materials, healthy ageing, personalized medicine and fighting disease. As these are projected key areas of global societal and economic development, Biology is vital to preserving and reinforcing the leading position of the Netherlands on the international stage.

In view of the rapid development of the biological sciences and the broad range of positions for which biologists are required, educational programmes must prepare biology students for jobs in fundamental research, applied research and technology, education, communication and policy; both in biology and at its interface with other disciplines. More than ever, biologists are required to be competent at integrating big data, dealing with dynamical systems and analysing complex networks of interactions, at multiple levels of biological organisation. Biologists work as specialist experts in their own discipline and as part of broad multi-disciplinary teams. To function adequately in these contexts, students need to develop excellent academic skills in conceptual thinking, scientific writing, oral presentation, critical reading of the scientific literature, self-reflection, teamwork, project planning and time-management. In addition they should be aware of the societal aspects of science, the professional responsibilities of scientists and be able to translate biology to society.

The MSc Biology covers a two-year programme, offering a deepening of knowledge in one or more biological sub disciplines in the fields of research, policy, management, communication or teaching. Next to the research specialisation, in each of the other specialisations at least one research project is incorporated. After completion of the masters' programme, students are well equipped to follow a biologically oriented PhD trajectory or to obtain other positions at the academic level related to biology.

<u>Demands of (international) colleagues and the professional environment</u>

Biology has a long and world-wide tradition as an academic core discipline. Over the course of this history, its educational programmes have shifted from emphasising descriptive science and specialised factual knowledge to explanatory research approaches that increasingly integrate across sub-disciplines and levels of biological organisation. The masters' programme aims to provide students with knowledge and skills in their specific domain and with general academic competences that will enable them to perform in an excellent manner in a broad range of professional environments. Students should be able to explain and reflect on their choice for a specialized PhD trajectory, or for another position in the labour market within the area of research and development, policy/administration, management, education or communication.

Dutch masters' programmes in biology have a good international reputation. The institutions offering a biologically-oriented MSc in the Netherlands participate in the 'Overlegorgaan Hoger Onderwijs Biologie' (OHOB; Consultative Body of Higher Educational Teaching in Biology). Students are allowed to take courses within the elective part of

their master programme from other (Dutch) biology masters' programmes. Students with a Dutch masters' diploma can enter into all relevant international biologically-oriented PhD positions.

What can be expected from a MSc Biology?

1. Knowledge and research skills

The graduate:

a) is able to make use of the conceptual framework of the discipline in which he/she has specialized in order to explain the state of the art of developing theories and to identify the most important research issues;
b) can systematically solve scientific problems within the context of relevant biological fields;
c) can develop, apply and optimize research techniques in biological research under supervision;
d) can independently formulate, initiate and execute a biological research project and analyse and interpret the results

2. Academic and learning skills

The graduate:

a) can report orally and in writing on the field of study for a specialist and a general audience;
b) is able to critically reflect on the performance of him/herself and others in the professional context and to evaluate the societal and ethical consequences of biological research;
c) can communicate effectively within the chosen field of specialization.
d) can collaborate in multidisciplinary teams and can manage projects
e) is aware of the societal needs regarding biology and feels challenged to deal with them

APPENDIX 2: INTENDED LEARNING OUTCOMES

Utrecht University, Graduate School of Life Sciences

Opleidingseindtermen versus programmaspecifieke eindtermen

De afgestudeerde van masterprogramma: ***Environmental Biology***	
Opleiding Biosciences	**Programma specifiek**
Kennis en inzicht	
1. Is in staat om met de kennis van tenminste één van de deelgebieden van de Biosciences een wezenlijke bijdrage te leveren aan het ontwikkelen en/of toepassen van wetenschappelijke concepten en methodes, veelal in onderzoeksverband.	1a. Heeft voldoende domeinkennis van het onderzoeksterrein van tenminste één van de specialisaties van de Environmental Biology. 1b. Is in staat om domeinkennis in een deelgebied van de Environmental Biology toe te passen in wetenschappelijk onderzoek.
2. Is in staat de belangrijke recente ontwikkelingen binnen de Biosciences te overzien en de implicaties van die ontwikkelingen voor vakgebied en samenleving aan te geven.	2a. Heeft kennis van onderzoeksgroepen en onderzoeksprogramma's op het terrein van de Environmental Biology. 2b. Is in staat om het belang van recente ontwikkelingen binnen de Environmental Biology aan te geven voor fundamenteel en toegepast onderzoek. 2c. Is in staat het maatschappelijk belang van belangrijke ontwikkelingen binnen de Environmental Biology aan te geven.
3. Is in staat om gespecialiseerde vakliteratuur op tenminste één van de deelgebieden van de Biosciences adequaat te hanteren en te interpreteren	3a. Heeft actuele kennis van de vakliteratuur van tenminste één van de deelgebieden van de Environmental Biology.
Toepassen kennis en inzicht	
4. Is in staat een probleem uit het domein van de Biosciences te vertalen in een voor wetenschapsontwikkeling of productontwikkeling relevante en geschikte onderzoeksvraag.	4a. Kan een probleemstelling uit de Environmental Biology destilleren en op basis van recente literatuur vertalen naar een onderzoeksvraagstelling.
5. Is in staat bij deze onderzoeksvraag een passend onderzoeksontwerp te formuleren conform de daarbij vereiste methodologische en wetenschappelijke standaard.	5a. Heeft kennis van en vaardigheid in moderne onderzoeksmethoden in deelgebied van de Environmental Biology. 5b. Is in staat om onderzoeksvraag uit fundameneel wetenschappelijk of toegepast onderzoeksgebied te vertalen naar doelmatig onderzoekswerkplan.
6. Is in staat dit onderzoek op eigen kracht en met de vereiste zorgvuldigheid uit te voeren en de daarbij empirisch verkregen data op juiste wijze te verwerken, te analyseren, te	6a. Is in staat om de biologische relevantie van de resultaten van het uitgevoerde onderzoek statistisch te analyseren.

interpreteren en te evalueren.	
Oordeelsvorming	
7. Is in staat de uitkomsten van empirisch onderzoek te bediscussiëren en te verbinden met de theorie.	7a. Kan uitkomsten van eigen onderzoek theoretisch verantwoorden en is in staat actief deel te nemen aan wetenschappelijke discussie in de onderzoeksgroep.
8. Is in staat de relevantie aan te geven van dit onderzoek voor de oplossing van vragen en problemen op het gebied van de Biosciences, waar mogelijk ook vanuit een maatschappelijk standpunt.	8a. Is in staat de wetenschappelijke relevantie van de uitkomsten van het eigen onderzoek aan te geven en dit te plaatsen in een breder kader binnen het deelgebied van de Envirnomental Biology. 8b. Is in staat de maatschappelijke relevantie van het eigen onderzoek aan te geven.
9. Is in staat kritisch te reflecteren op de eigen inspanningen als onderzoeker op het gebied van de Biosciences vanuit een maatschappelijk perspectief.	9a. Kan reflecteren op het eigen handelen, en op ethische verantwoordelijkheden die gepaard gaan met toepassing van (eigen) onderzoeksresultaten en voorstellen (b.v werken met genetisch gemodificeerde organismen).
Communicatie	
10. Is in staat de resultaten van onderzoek zowel schriftelijk als mondeling duidelijk over te brengen op een publiek van specialisten en niet-vakdeskundigen in een internationale context.	10a. Is in staat om een projectvoorstel te schrijven voor de uitvoering van fundamenteel of toegepast onderzoek binnen de Environmental Biology.
11. Is in staat effectief te functioneren in een multidisciplinair samengesteld onderzoeksteam	11a. Kan effectief communiceren. Kan prioriteiten stellen, afspraken nakomen, tijd managen, samenwerken. Kan (kritische) feedback geven en accepteren en staat open voor inbreng vanuit andere disciplines.
Leervaardigheden	
12. Bezit de vaardigheid om het eigen leer- en ontwikkelproces tijdens de studie te evalueren en zichzelf zonodig te motiveren en 'bij te sturen'.	12a. Kan studeren op een grotendeels zelfgestuurde en zelfstandige manier.
13. Heeft zich een effectieve en resultaatgerichte werkwijze eigen gemaakt die hem of haar in staat stelt om zelfstandig te functioneren op een competitieve arbeidsmarkt.	13a. Kan een (in principe) subsidiabel onderzoeksvoorstel schrijven. 13b. Kan zelfstandig fundamenteel wetenschappelijk en/of toegepast onderzoek uitvoeren binnen een deelgebied van de Environmental Biology.
14. Heeft de kwalificatie om een promotieopleiding te verkrijgen, dan wel een functie op de arbeidsmarkt.	14a. Is in staat een promotiepositie op het gebied van de specialisatie, of een baan in publieke of commerciële organisatie op het gebied van de Environmental Biology of de toepassing daarvan te verwerven.

De afgestudeerde van masterprogramma: **Molecular and Cellular Life Sciences**	
Opleiding Biosciences	**Programmaspecifiek**
Kennis en inzicht	
1. Is in staat om met de kennis van tenminste één van de deelgebieden van de Biosciences een wezenlijke bijdrage te leveren aan het ontwikkelen en/of toepassen van wetenschappelijke concepten en methodes, veelal in onderzoeksverband.	1a Kan vraagstellingen formuleren uitgaande van actuele kennis m.b.t. eigenschappen van de belangrijkste biomoleculen (zoals DNA, RNA, eiwitten, lipiden en koolhydraten) en hun interacties, structuur en dynamica, en functies in celbiologische en organismale processen. 2a Heeft actuele kennis van de onderzoeksmethoden variërend van stucturele, biochemische, biofysische en celbiologische methoden tot onderzoeksmethoden op basis van bioinformatica.
2. Is in staat de belangrijke recente ontwikkelingen binnen de Biosciences te overzien en de implicaties van die ontwikkelingen voor vakgebied en samenleving aan te geven.	2a Heeft kennis van de onderzoeksgroepen en onderzoeksprogramma's van het Bijvoet centrum voor Biomoleculair Onderzoek, het Instituut voor Biomembranen en Theoretische biologie & Bioinformatica
3. Is in staat om gespecialiseerde vakliteratuur op tenminste één van de deelgebieden van de Biosciences adequaat te hanteren en te interpreteren	3a. Heeft actuele kennis op het gebied van een of meerdere van de volgende onderzoeksgebieden: • *Structuurbiologie* • *Cel- en ontwikkelingsbiologie* • *Membraanbiogenese* • *Systeembiologie*
Toepassen kennis en inzicht	
4 .Is in staat een probleem uit het domein van de Biosciences te vertalen in een voor wetenschapsontwikkeling of productontwikkeling relevante en geschikte onderzoeksvraag.	4a. Kan de relevantie van probleemstellingen inschatten. Kan een onderzoeks vraagstelling definiëren en onderbouwen vanuit theorie en recente literatuur.
5. Is in staat bij deze onderzoeksvraag een passend onderzoeksontwerp te formuleren conform de daarbij vereiste methodologische en wetenschappelijke standaard.	5a. Is in staat bij deze onderzoeksvraag een passend onderzoeksontwerp te formuleren conform de methodologische en wetenschappleijke standaarden binnen d emoleculaire en cellulaire levenswetenschappen. 5b. Kan de haalbaarheid van een onderzoeksvoorstel inschatten.
6. Is in staat dit onderzoek op eigen kracht en met de vereiste zorgvuldigheid uit te voeren en de daarbij empirisch verkregen data op juiste wijze te verwerken, te analyseren, te interpreteren en te evalueren.	6a. Is in staat de regels van de experimentele praktijk en andere ethische aspecten in acht te nemen en is voldoende zelfstandig, volhardend en geordend om het onderzoeksplan uit te voeren. 6b Beschikt over experimentele vaardigheden, variërend van celbiologische, biochemische en biofysische technieken tot het werken met dier en plant modellen zoals toegepast bij de verschillende aangesloten onderzoeksgroepen of

	onderzoeksvaardigheden op basis van bioinformatica. 6c Is in staat de uitkomsten uit eigen onderzoek te verwerken, analyseren, te interpreteren en te evalueren.
Oordeelsvorming	
7. Is in staat de uitkomsten van empirisch onderzoek te bediscussiëren en te verbinden met de theorie.	7a. Kan uitkomsten van eigen onderzoek theoretisch verantwoorden en is in staat actief deel te nemen aan wetenschappelijke discussie in de onderzoeksgroep.
8. Is in staat de relevantie aan te geven van dit onderzoek voor de oplossing van vragen en problemen op het gebied van de Biosciences, waar mogelijk ook vanuit een maatschappelijk standpunt.	8a. Kan de eigen onderzoeksresultaten kritisch evalueren in het licht van overeenkomstig onderzoek binnen de Moleculaire en Cellulaire levenswetenschappen en kan een visie formuleren op de plaats van de Moleculaire en Cellulaire levenswetenschappen in de maatschappij.
9. Is in staat kritisch te reflecteren op de eigen inspanningen als onderzoeker op het gebied van de Biosciences vanuit een maatschappelijk perspectief.	9a. Kan reflecteren op het eigen handelen, en op sociale en ethische verantwoordelijkheden die gepaard gaan met toepassing van (eigen) onderzoeksresultaten en voorstellen.
Communicatie	
10. Is in staat de resultaten van onderzoek zowel schriftelijk als mondeling duidelijk over te brengen op een publiek van specialisten en niet-vakdeskundigen in een internationale context.	10 a. Is in staat tot helder formuleren in woord en geschrift van wetenschappelijke rapporten beftreffende literatuur dan wel praktisch onderzoek
11. Is in staat effectief te functioneren in een multidisciplinair samengesteld onderzoeksteam	11a. Kan effectief communiceren. Kan prioriteiten stellen, afspraken nakomen, tijd managen, samenwerken. Kan (kritische) feedback geven en accepteren en staat open voor inbreng vanuit andere disciplines.
Leervaardigheden	
12. Bezit de vaardigheid om het eigen leer- en ontwikkelproces tijdens de studie te evalueren en zichzelf zonodig te motiveren en 'bij te sturen'.	12a. Kan studeren op een grotendeels zelfgestuurde en zelfstandige manier.
13. Heeft zich een effectieve en resultaatgerichte werkwijze eigen gemaakt die hem of haar in staat stelt om zelfstandig te functioneren op een competitieve arbeidsmarkt.	13a. Kan een (in principe) subsidiabel onderzoeksvoorstel schrijven. 13b. Kan zelfstandig onderzoek uitvoeren op het gebied van de moleculaire en cellulaire levenswetenschappen.
14. Heeft de kwalificatie om een promotieopleiding te verkrijgen, dan wel een functie op de arbeidsmarkt.	14a. Is in staat een promotiepositie op het gebied van de specialisatie, of een sleutelpositie in publieke of commerciële organisatie op het gebied van de moleculaire en cellulaire levenswetenschappen of de toepassing daarvan te verwerven.

De afgestudeerde van masterprogramma: ***BioInspired innovation***	
Opleiding Biosciences	**Programma specifiek**
Kennis en inzicht	
1. Is in staat om met de kennis van tenminste één van de deelgebieden van de Biosciences een wezenlijke bijdrage te leveren aan het ontwikkelen en/of toepassen van wetenschappelijke concepten en methodes, veelal in onderzoeksverband.	1a. Heeft voldoende domeinkennis van het onderzoeksterrein van tenminste één van de specialisaties in de biologie. 1b. Is in staat om domeinkennis in een deelgebied van de Biologie toe te passen in wetenschappelijk onderzoek.
2. Is in staat de belangrijke recente ontwikkelingen binnen de Biosciences te overzien en de implicaties van die ontwikkelingen voor vakgebied en samenleving aan te geven.	2a. Is in staat de belangrijkste ontwikkelingen binnen Bio-inspired onderzoek en de circulaire economie te overzien en de implicaties van die ontwikkelingen voor vakgebied en samenleving aan te geven. 2b. Is in staat om het belang van recente ontwikkelingen binnen de Natuurwetenschappen aan te geven voor fundamenteel onderzoek en onderzoek gericht op valorisatie.
3. Is in staat om gespecialiseerde vakliteratuur op tenminste één van de deelgebieden van de Biosciences adequaat te hanteren en te interpreteren	3a. Is in staat vakliteratuur uit verschillende wetenschapsgebieden met elkaar te verbinden rond een wetenschappelijk geformuleerd probleem. (multidisciplinariteit) 3b. Is in staat om na verbinding van vakgebieden deze te integreren. (transdisciplinariteit)
Toepassen kennis en inzicht	
4. Is in staat een probleem uit het domein van de Biosciences te vertalen in een voor wetenschapsontwikkeling of productontwikkeling relevante en geschikte onderzoeksvraag.	4a. Kan een probleemstelling op basis van recente literatuur vertalen naar een voor Valorisatie geschikte onderzoeks- of ontwerpvraag.
5. Is in staat bij deze onderzoeksvraag een passend onderzoeksontwerp te formuleren conform de daarbij vereiste methodologische en wetenschappelijke standaard.	5a. Heeft kennis van biologisch geïnspireerde onderzoeks- en ontwerpmethoden. 5b. Is in staat om een onderzoeksvraag uit fundamenteel wetenschappelijk of toegepast onderzoeksgebied te vertalen naar een plan van aanpak voor valorisatie.
6. Is in staat dit onderzoek op eigen kracht en met de vereiste zorgvuldigheid uit te voeren en de daarbij empirisch verkregen data op juiste wijze te verwerken, te analyseren, te interpreteren en te evalueren.	6. Is in staat om de biologische en economische relevantie van de resultaten van het uitgevoerde onderzoek te analyseren en deze te gebruiken om valorisatieontwerpen te evalueren.
Oordeelsvorming	
7. Is in staat de uitkomsten van empirisch onderzoek of valorisatieontwerpen te bediscussiëren en te verbinden met de theorie.	7a. Kan uitkomsten van eigen onderzoek interpreteren met betrekking tot de bijdrage die potentieel geleverd kan worden aan het creëren van een duurzame circulaire economie en samenleving.

	7b. is in staat actief deel te nemen aan wetenschappelijke discussies in de onderzoeksgroep en deze te verbreden.
8. Is in staat de relevantie aan te geven van dit onderzoek voor de oplossing van vragen en problemen op het gebied van de Biosciences, waar mogelijk ook vanuit een maatschappelijk standpunt.	8. Is in staat de wetenschappelijke relevantie van de uitkomsten van het eigen onderzoek aan te geven en dit te plaatsen in het bredere kader van een transitie naar een circulaire economie.
9. Is in staat kritisch te reflecteren op de eigen inspanningen als onderzoeker op het gebied van de Biosciences vanuit een maatschappelijk perspectief.	9a. Kan reflecteren op eigen handelen en rol in het proces van onderzoeken en/of ontwerpen 9b. Is in staat om kritisch te reflecteren op de maatschappelijke en ecologische implicaties van de onderzoeksresultaten en/of het valorisatie ontwerp.
Communicatie	
10. Is in staat de resultaten van onderzoek zowel schriftelijk als mondeling duidelijk over te brengen op een publiek van specialisten en niet-vakdeskundigen in een internationale context.	10a. Is in staat biologisch geïnspireerde onderzoeksresultaten en/of valorisatie ontwerpen op een voor de opdrachtgever begrijpelijke manier te communiceren. 10b. Kan de waarde(-n) en inhoud van het onderzoek of ontwerp bediscussiëren (mondeling en schriftelijk) met relevante stakeholders en wetenschappelijke collega's.
11. Is in staat effectief te functioneren in een multidisciplinair samengesteld onderzoeksteam	11. Kan effectief communiceren & actief luisteren en samenwerken.
Leervaardigheden	
12. Bezit de vaardigheid om het eigen leer- en ontwikkelproces tijdens de studie te evalueren en zichzelf zonodig te motiveren en 'bij te sturen'.	12a. Kan studeren op een grotendeels zelfgestuurde en zelfstandige manier. 12b. Is in staat om eigen rol in groepsproces te herkennen en indien nodig bij te stellen 12c. Is in staat (kritische) feedback te geven en te accepteren.
13. Heeft zich een effectieve en resultaatgerichte werkwijze eigen gemaakt die hem of haar in staat stelt om zelfstandig te functioneren op een competitieve arbeidsmarkt.	13a. Kan een (in principe) subsidiabel onderzoeksvoorstel schrijven. 13b. Kan zelfstandig fundamenteel wetenschappelijk en/of toegepast onderzoek uitvoeren gericht op een transitie naar een circulaire economie.
14. Heeft de kwalificatie om een promotieopleiding te verkrijgen, dan wel een functie op de arbeidsmarkt.	14. Is in staat een promotiepositie op het gebied van de specialisatie, of een baan in publieke of commerciële organisatie in de sectoren: 'Food, Health and Sustainability' te verwerven.

De afgestudeerde van masterprogramma: **Drug Innovation**	
Opleiding Biosciences	**Programma specifiek**
Kennis en inzicht	
1. Is in staat om met de kennis van tenminste één van de deelgebieden van de Biosciences een wezenlijke bijdrage te leveren aan het ontwikkelen en/of toepassen van wetenschappelijke concepten en methodes, veelal in onderzoeksverband.	1a. Heeft voldoende domeinkennis van de onderzoeksterreinen van de drug discovery en van de drug development. 1b. Heeft kennis van de fasen van het geneesmiddelonderzoek, is bekend met de gehanteerde technieken en.
2. Is in staat de belangrijke recente ontwikkelingen binnen de Biosciences te overzien en de implicaties van die ontwikkelingen voor vakgebied en samenleving aan te geven.	2a. Heeft kennis van onderzoeksgroepen en onderzoeksprogramma's op het terrein van Drug Innovation. 2b. Heeft kennis van de *drivers*, successen en valkuilen van geneesmiddelonderzoek en inzicht in de geschiedenis en toekomst van geneesmiddel innovatie.
3. Is in staat om gespecialiseerde vakliteratuur op tenminste één van de deelgebieden van de Biosciences adequaat te hanteren en te interpreteren.	3a. Heeft actuele kennis van de vakliteratuur op tenminste één van de deelgebieden van geneesmiddel onderzoek. De deelgebieden zijn: *target finding and evaluation, discovery and design, drug and biomolecular analysis, targeting and delivery, regulatory sciences, utilisation and response*.
Toepassen kennis en inzicht	
4. Is in staat een probleem uit het domein van de Biosciences te vertalen in een voor wetenschapsontwikkeling of productontwikkeling relevante en geschikte onderzoeksvraag.	4a. Kan de relevantie van probleemstellingen inschatten. Kan een onderzoeksvraagstelling definieren en onderbouwen vanuit theorie en recente literatuur.
5. Is in staat bij deze onderzoeksvraag een passend onderzoeksontwerp te formuleren conform de daarbij vereiste methodologische en wetenschappelijke standaard.	5a. Heeft kennis van en vaardigheid in het werken met de belangrijkste technieken in het deelgebied en kan de meest geschikte methode kiezen en de juiste methodologische proefopzet formuleren. 5b. Kan de haalbaarheid van een onderzoeksvoorstel inschatten.
6. Is in staat dit onderzoek op eigen kracht en met de vereiste zorgvuldigheid uit te voeren en de daarbij empirisch verkregen data op juiste wijze te verwerken, te analyseren, te interpreteren en te evalueren.	6. Is in staat om zorgvuldig experimenten uit te voeren en analyseren in een of meer van de volgende deelgebieden. 6a. Moleculaire biologie, biotechnologie en biochemie. 6b. In vitro en in vivo farmacologie, alsmede toxicologie, zowel farmacodynamie als kinetiek. 6c. Synthetische en analytische chemie van kleine en grote moleculen. 6d. Celbiologie, biofarmacie en fysische farmacie. 6e. Farmacoepidemiologie, therapie en *regulatory science*.
Oordeelsvorming	

7. Is in staat de uitkomsten van empirisch onderzoek te bediscussiëren en te verbinden met de theorie.	7a. Kan uitkomsten van eigen onderzoek theoretisch verantwoorden en is in staat actief deel te nemen aan wetenschappelijke discussie in de onderzoeksgroep.
8. Is in staat de relevantie aan te geven van dit onderzoek voor de oplossing van vragen en problemen op het gebied van de Biosciences, waar mogelijk ook vanuit een maatschappelijk standpunt.	8a. Kan de eigen onderzoeksresultaten kritisch evalueren in het licht van overeenkomstig onderzoek binnen de geneesmiddelontwikkeling en kan een visie formuleren op de plaats van geneesmiddelonderzoek en regelgeving in de maatschappij.
9. Is in staat kritisch te reflecteren op de eigen inspanningen als onderzoeker op het gebied van de Biosciences vanuit een maatschappelijk perspectief.	9a. Kan reflecteren op het eigen handelen, en op sociale en ethische verantwoordelijkheden die gepaard gaan met toepassing van (eigen) onderzoeksresultaten en voorstellen. 9b. Kent de wetenschappelijke normen met betrekking tot bronvermelding van ideëen en eigendomsrechten van technieken, moleculen en materialen.
Communicatie	
10. Is in staat de resultaten van onderzoek zowel schriftelijk als mondeling duidelijk over te brengen op een publiek van specialisten en niet-vakdeskundigen in een internationale context.	10a. Kan manuscripten schrijven in het Engels voor peer gereviewde internationale tijdschriften op het terrein van geneesmiddelonderzoek. 10b. Kan wetenschappelijke resultaten mondeling presenteren en bediscussiëren in het Engels voor een wetenschappelijk forum.
11. Is in staat effectief te functioneren in een multidisciplinair samengesteld onderzoeksteam	11a. Kan effectief communiceren. Kan prioriteiten stellen, afspraken nakomen, tijd managen, samenwerken. Kan (kritische) feedback geven en accepteren en staat open voor inbreng vanuit andere disciplines.
Leervaardigheden	
12. Bezit de vaardigheid om het eigen leer- en ontwikkelproces tijdens de studie te evalueren en zichzelf zonodig te motiveren en 'bij te sturen'.	12a. Kan studeren op een grotendeels zelfgestuurde en zelfstandige manier.
13. Heeft zich een effectieve en resultaatgerichte werkwijze eigen gemaakt die hem of haar in staat stelt om zelfstandig te functioneren op een competitieve arbeidsmarkt.	13a. Kan, onder begeleiding, een (in principe) subsidiabel onderzoeksvoorstel schrijven. 13b. Kan zelfstandig geneesmiddelonderzoek uitvoeren.
14. Heeft de kwalificatie om een promotieopleiding te verkrijgen, dan wel een functie op de arbeidsmarkt.	14a. Is in staat een promotiepositie op het gebied van de specialisatie, of een sleutelpositie in publieke of commerciële organisatie op het gebied van de gezond-heidswetenschappen of de toepassing daarvan te verwerven.

INDENDED LEARNING OUTCOMES FOR THE THEMED PROFILES:

Research profiles (4):

General Research Profile:
After finishing his/her research project the student is capable of:

- Translating a Life Sciences problem into a relevant research question, suitable for research development or product design.
- Designing a suitable research plan to test the formulated research questions, according to methodological and scientific standards.
- Independently performing research, with the required accuracy. Graduates are able to handle, analyse, interpret and evaluate the empirically derived data in a correct manner.
- Discussing the outcomes of empirical research and linking them with scientific theories.
- Indicating the importance of research activities for solving a biomedical question or problem, if applicable from a social perspective.
- Critically reflecting on their own research work in Life Sciences, from a social perspective.
- Comprehensibly reporting research results orally and in writing, to specialised and non-specialised audiences in an international context.

Applied Data Science:
Upon completion of the Master's profile Applied Data Science (ADS) the student:

- Understands the basic methods and techniques in data science
- Is able to apply this knowledge and analyse large datasets in a specific domain

Bioinformatics:
Upon completion of the bioinformatics profile the student is:

- acquainted with the concepts of using bioinformatics tools and algorithms in the analysis and interpretation of large datasets (big-data) in the Life Sciences;
- able to apply this knowledge and analyse large datasets originating from high throughput experiments, databases or repositories within the context of an actual research project;
- able to write scripts for the processing or analysis of data;
- able to use software such as [R] to analyze data.

Complex Systems:
Upon completion of the complex systems profile the student is:

- acquainted with the complex systems research field and the place of the life sciences within this field;
- able to use a modelling approach to get grip on complexity problems in the life sciences;
- able to understand interdisciplinary papers about complex systems;
- able to present his/her results to a critical audience;
- able to work in interdisciplinary teams.

Science profiles (5):

Science Communication:
Upon completion of the Communication profile the student is able to:

- Understand and critically use the core knowledge of science education and communication theories, and the research underlying such theories;
- Develop and adapt a theoretically based design for science education or communication;
- Develop adequate science communication and education products according to design criteria, based on both theory and the personal research project

Education:

Upon completion of the E-profile the student is able to:

- Understand and critically use the core knowledge of science education and communication theories, and the research underlying such theories;
- Develop and adapt a theoretically based design for science education or communication;
- Develop adequate science communication and education products according to design criteria, based on both theory and the personal research project.

Management profile:

Upon completion of the management profile, the student is:

- acquainted with several essential concepts within business management & entrepreneurship;
- able to apply this knowledge in different modules, case studies and business plans;
- able to work in interdisciplinary teams.

Life Science and Society:

Upon completion of the LS&S profile, the student is able to:

- Understand that Life Sciences research occurs in a societal context and has gained knowledge about specific mechanisms through which Life Sciences research and society are interconnected and mutually influenced by each other.
- Understand to which extent the core values of society at any given moment influence the interpretation and outcome of scientific research.
- Understand the effect of Life Sciences research on society and how scientific research helps to present, communicate, and integrate new knowledge within society.
- Translate Life Sciences research data and outcomes to the societal context and understand the translation of these data into policy.
- Implement adequate approaches, methodologies, and theories for integrating the societal context into Life Sciences research.

Translational Sciences:

In the context of communication, the student is able to:

- Communicate effectively and appropriately both orally and in writing in a multidisciplinary setting.

In the context of reflection, the student is able to:

- Formulate the own strengths and weaknesses in expertise and in professional skills such as communication and collaboration;
- Apply the learning cycle of Kolb (see below);
- Handle ambiguity in a resilient manner.

In the context of translational science, the student is able to:

- Identify a life science related societal need and translate this need into a well-defined problem definition revealing the root cause;
- Recognise and integrate the needs and intentions from stakeholders and other disciplines that are related to the unmet societal need and solutions;
- Design a feasible solution that alleviates or satisfies the identified social/societal need and takes the entrepreneurial perspective into account;
- Execute or prepare a pilot, or test a concept (prototype) in the field and incorporate the outcomes into a final design or solution.

In the context of boundary crossing, the student is able to:

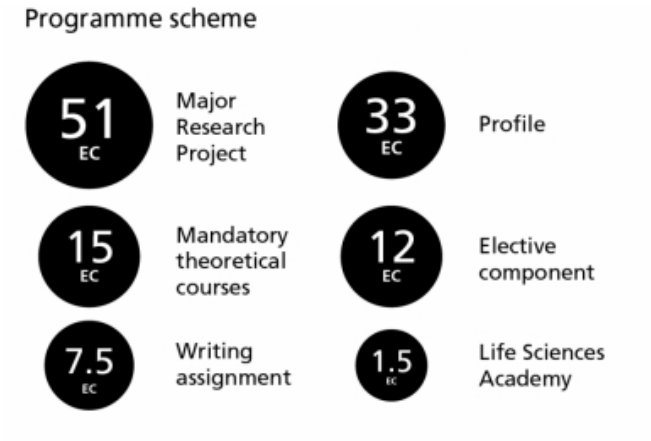
- Understand the perspectives of peers and of stakeholders/other disciplines that are related to the unmet societal need and solutions;
- Recognise the limitations and biases of the student's own discipline and perceive the added value of other disciplines beyond life sciences to create a solution for an unmet societal need;
- Include information and knowledge from relevant disciplines into the designed solution.

In the context of collaboration, the student is able to:

- Share knowledge and feelings with the team, convey respect for others, and be open-minded towards their ideas;
- Be flexible and compromise when necessary to move forward with the group;
- Participate actively and being accountable;
- Provide constructive feedback and accept feedback from others;
- Take the lead, monitor, redirect or adjust the group process.

APPENDIX 3: OVERVIEW OF THE CURRICULUM

The general programme scheme for all educational programmes part of the master's degree in Biosciences is:



Each educational programmes has some compulsory courses. These are listed below per educational programme:

Bioinformatics and Biocomplexity (BIBC):

COMPULSORY COURSES

The compulsory course work of this programme consists of:

- **Essentials (4.5 EC)** *I*n addition one or more courses with a minimum of 5.5 EC should be selected from the elective courses.

Plus choose **one of the compulsory options** below, in consultation with the coordinator and based on your prior knowledge:

- **Option 1: Biological Modeling (5.0 EC)**
- **Option 2: Bioinformatics and Genomics (5.0 EC)**

See the menu below for all course options and course descriptions. For a description of the full curriculum, please see the Study Programme page.

COMPULSORY COURSES (15 EC)

- BIBC ESSENTIALS (COMPULSORY)
- INTRODUCTION TO (BIOLOGICAL) MODELLING (COMPULSORY)
- BIOINFORMATICS AND GENOMICS (COMPULSORY)

Bio-Inspired Innovation (BII):

COURSES

The course part of this programme consists of 15 EC compulsory courses and 12 EC elective courses.

COMPULSORY COURSES

- BIOINSPIRATION & VALUE CREATION (COMPULSORY)
- INTEGRATIVE BIO-INSPIRED DESIGN: THE SYS

Drug Innovation (DI):

COMPULSORY COURSES (15 EC)

- DRUG DISCOVERY (COMPULSORY)
- DRUG DEVELOPMENT AND REGULATION (COMPULSORY)

Environmental Biology (per study route):

BEHAVIOURAL ECOLOGY

- SUSTAINABLE DEVELOPMENT GOALS (COMPULSORY)
- MEASURING BEHAVIOUR (COMPULSORY)
- EVOLUTIONARY PERSPECTIVES ON SEXUAL BEHAVIOUR (COMPULSORY)
- ZOO CONSERVATION BIOLOGY
- PRIMATE SOCIAL BEHAVIOUR

PLANT BIOLOGY

- SUSTAINABLE DEVELOPMENT GOALS (COMPULSORY)
- PLANT-ENVIRONMENT INTERACTIONS
- PLANT-MICROBE INTERACTIONS
- APPLIED PLANT BIOLOGY

FUNGAL BIOLOGY

- SUSTAINABLE DEVELOPMENT GOALS (COMPULSORY)
- FUNGAL BIOLOGY (COMPULSORY)
- FUNGAL BIODIVERSITY

ECOLOGY & NATURAL RESOURCE MANAGEMENT

- SUSTAINABLE DEVELOPMENT GOALS (COMPULSORY)
- MANAGEMENT OF NATURAL RESOURCES IN CONTEXT (COMPULSORY)
- ECOLOGY OF NATURAL RESOURCES (COMPULSORY)

Molecular and Cellular Life:

To meet the MCLS track criteria, the students have to complete at least 9 EC in courses that fit their chosen MCLS route and a choice of two out of three General MCLS specialisation courses of 3 EC each. For each study route, all courses are listed below per route:

BIOPHYSICS & MOLECULAR IMAGING

- CONCEPTS IN SCIENCE 4 LIFE
- MASTER COURSE BIOPHYSICS & MOLECULAR IMAGING
- MASTER COURSE GENES TO ORGANISMS
- MASTER COURSE MOLECULES & CELLS
- ADVANCED BIOMOLECULAR MASS SPECTROMETRY
- APPLIED PROTEIN CRYSTALLOGRAPHY
- STRUCTURAL BIOINFORMATICS & MODELLING
- ADVANCED PROTEIN CRYSTALLOGRAPHY
- LIGHT MICROSCOPY
- ADVANCED BIOMOLECULAR NMR

GENES TO ORGANISMS

- CONCEPTS IN SCIENCE 4 LIFE
- MASTER COURSE GENES TO ORGANISMS
- MASTER COURSE MOLECULES & CELLS
- MASTER COURSE BIOPHYSICS & MOLECULAR IMAGING
- VIROLOGY
- BIOTECHNOLOGY
- PLANT-ENVIRONMENT INTERACTIONS
- PLANT-MICROBE INTERACTIONS
- BIOINFORMATICS AND EVOLUTIONARY GENOMICS
- LIGHT MICROSCOPY
- MICROBIAL GENOMICS
- INTRODUCTION BIOMOLECULAR MASS SPECTROMETRY
- APPLIED PLANT BIOLOGY
- ANALYTICS AND ALGORITHMS FOR OMICS DATA

MOLECULES & CELLS

- CONCEPTS IN SCIENCE 4 LIFE
- MASTER COURSE MOLECULES & CELLS
- MASTER COURSE GENES TO ORGANISMS
- MASTER COURSE BIOPHYSICS & MOLECULAR IMAGING
- VIROLOGY
- APPLIED PROTEIN CRYSTALLOGRAPHY
- RESEARCH IN INTRACELLULAR PROCESSES AND
- BIOTECHNOLOGY
- STRUCTURAL BIOINFORMATICS & MODELLING
- CHEMICAL BIOLOGY
- LIGHT MICROSCOPY
- INTRODUCTION BIOMOLECULAR MASS SPECTROMETRY
- DESIGN OF ANTI-INFECTIVE DRUGS

APPENDIX 4: PROGRAMME OF THE SITE VISIT

Tijd	Sessie
25 mei **09:30 – 9:45**	Inloop (opvangen technische problemen)
09:45 – 10:45	**Vooroverleg panel**
10:45 – 11:30	**Sessie 1 – Opleidingsmanagement** vicedecaan onderwijs, directeur Undergraduate School, opleidingsdirecteur Bachelor, opleidingsdirecteur Biosciences, opleidingsdirecteur NW&B, voorzitter BoS GSLS, portefeuillehouder onderwijs Biologie
11: 30 – 11:45	**Pauze**
11:45– 12:45	**Sessie 2 – Studenten bachelor** 6 studenten, verdeeld over de jaren
12:45 – 13:45	**Overleg panel (met lunch)**
13:45 – 14:45	**Sessie 3 – Studenten master** 5 studenten, 1 per programma waaronder 2 studenten die alumni zijn van de bacheloropleiding 3 alumni
14:45 – 15:00	**Pauze**
15:00 – 16:00	**Sessie 4 – Docenten Bachelor** 6-8 Docenten (examinatoren), alle jaren vertegenwoordigd, incl. docenten met een rol in ow-management (ow-coördinator, OC, …)
16:00 – 16:15	**Pauze**
16:15 – 17:15	**Sessie 5 – Docenten Master** 6-8 Docenten (examinatoren), ieder programma vertegenwoordigd, incl., docenten met een rol in ow-management (programmacoördinatoren, OC, …)
17:15 – 17:45	**Paneloverleg: nabespreking dag 1**
26 mei **9:00 – 9:30**	**Vooroverleg panel**
9:30 – 10:30	**Sessie 6 – Examencommissies** vz EC bachelor, kamervoorzitter biologie, lid EC bachelor, vz EC GSLS, 2 leden EC GSLS (gebied biosciences/SBM)
10:30 – 10:45	**Pauze**
10:45 – 11:30	**Sessie 7 – Themasessie bachelor** Interdisciplinariteit
11:30 – 11:45	**Pauze**
11:45 – 12:30	**Sessie 8 – Themasessie master Biosciences** Nieuwe biologie
12:30 – 13:30	**Overleg panel (met lunch)**
13:30 – 14:15	**Sessie 8 – Themasessie master Natuurwetenschap en Bedrijf** Rol en omvang van stage in het curriculum
14:15– 15:45	**Overleg panel en opstellen voorlopige bevindingen** opleidingsmanagement op afroep beschikbaar voor vragen
15:45 – 16:15	**Pauze**
16:15 – 16:45	**Terugkoppeling panel** openbaar

APPENDIX 5: FINAL WORKS AND DOCUMENTS STUDIED BY THE PANEL

Prior to the site visit, the panel studied 22 research project reports to assess the achievement level of the master's programme Biosciences, of which 15 major research project reports and 7 minor research projects. The project coordinator and panel chair ensured that the distribution of grades in the selection matched the distribution of grades of all available theses. Information on the selected theses is available upon request.

The panel studied 15 major research reports of the educational programmes BII, DI, EB and MCLS. For BIBC, no final projects are available yet, as the programme started in 2020. These reports served as the basis for the selection: the panel studied 3 research reports for BII and 4 each for DI, EB, and MCLS. The panel ensured that the selection included the full grading scale and a variety of examiners involved in these projects. It looked into 7 minor research projects for those students in the selection that included one in their individual study path: 1 minor research project for BII and 2 each for DI, EB and MCLS. As not all students could follow their minor research project externally due to the covid-19 pandemic, the panel was also offered examples of how Biosciences reacted to the pandemic circumstances in this selection.

In preparation for the site visit, the panel had access to the programme's digital learning environment for information on modules and course materials. In addition, it studied the following information: