

# Biology

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This report was finalized on 25 February 2016



# Report on the master's programmes in Biology, Ecology & Evolution, Marine Biology, Molecular Biology & Biotechnology, Biomedical Sciences and Medical Pharmaceutical Sciences of the University of Groningen

This report takes the NVAO's Assessment Framework for Limited Programme Assessments as a starting point.

## Administrative data regarding the programmes

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### Master's programme Biology

|                               |   |
|-------------------------------|---|
| Name of the programme:        | Biology   |
| CROHO number:                 | 66860   |
| Level of the programme:       | master's  |
| Orientation of the programme: | academic  |
| Number of credits:            | 120 EC  |
| Specializations or tracks:    | Behaviour and Neurosciences track                     |
| Profiles:                     | Research profile<br>Science Business & Policy profile |
| Location(s):                  | Groningen   |
| Mode(s) of study:             | full time   |
| Expiration of accreditation:  | 08-05-2017  |

### Master's programme Ecology & Evolution

|                                |   |
|--------------------------------|---|
| Name of the programme:         | Ecology & Evolution   |
| CROHO number:                  | 60365   |
| Level of the programme:        | master's  |
| Orientation of the programme:  | academic  |
| Number of credits:             | 120 EC  |
| Specializations or tracks:     | Top programme Evolutionary Biology<br>Erasmus Mundus programme in Evolutionary Biology  |
| Profiles:                      | Research profile<br>Science Business & Policy profile   |
| Location(s):                   | Groningen   |
| Mode(s) of study:              | full time   |
| Joint programme:               | Erasmus Mundus programme in Evolutionary Biology  |
| partner institutions involved: | Uppsala Universitet (Sweden), Université Montpellier II (France), Ludwig Maximilians-Universität Munich (Germany), Harvard University (US). |
| Expiration of accreditation:   | 08-05-2017  |

### Master's programme Marine Biology

|                               |                |
|-------------------------------|----------------|
| Name of the programme:        | Marine Biology |
| CROHO number:                 | 60609          |
| Level of the programme:       | master's       |
| Orientation of the programme: | academic       |
| Number of credits:            | 120 EC         |
| Specializations or tracks:    |                |

Profiles: Research profile  
Science Business & Policy profile  
Location(s): Groningen  
Mode(s) of study: full time  
Expiration of accreditation: 08-05-2017

#### **Master's programme Molecular Biology & Biotechnology**

Name of the programme: Molecular Biology & Biotechnology  
CROHO number: 60612  
Level of the programme: master's  
Orientation of the programme: academic  
Number of credits: 120 EC  
Specializations or tracks: Top programme Biomolecular Sciences  
Chemical Biology  
Profiles: Research profile  
Science Business & Policy profile  
Location(s): Groningen  
Mode(s) of study: full time  
Expiration of accreditation: 08-05-2017

#### **Master's programme Biomedical Sciences**

Name of the programme: Biomedical Sciences  
CROHO number: 66990  
Level of the programme: master's  
Orientation of the programme: academic  
Number of credits: 120 EC  
Specializations or tracks: Biology of Ageing  
Profiles: Research profile  
Science Business & Policy profile  
Location(s): Groningen  
Mode(s) of study: full time  
Expiration of accreditation: 08-05-2017

#### **Master's programme Medical Pharmaceutical Sciences**

Name of the programme: Medical Pharmaceutical Sciences  
CROHO number: 60611  
Level of the programme: master's  
Orientation of the programme: academic  
Number of credits: 120 EC  
Specializations or tracks: Pharmaco-epidemiology  
Toxicology & Drug disposition  
Profiles: Research profile  
Science Business & Policy profile  
Location(s): Groningen  
Mode(s) of study: full time  
Expiration of accreditation: 08-05-2017

The visit of the assessment panel Biology to the Faculty of Mathematics and Natural Sciences of the University of Groningen took place on 16-18 November 2015.

## **Administrative data regarding the institution**

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|  |                             |
|--|-----------------------------|
| Name of the institution:                           | University of Groningen     |
| Status of the institution:                         | publicly funded institution |
| Result institutional quality assurance assessment: | positive                    |

## **Composition of the assessment panel**

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The NVAO approved the composition of the panel on 21 September 2015. The panel which assessed the master's programmes in Biology, Ecology & Evolution, Marine Biology, Molecular Biology & Biotechnology, Biomedical Sciences and Medical Pharmaceutical Sciences consisted of:

- Prof. dr. Jan Kijne (chair), Professor emeritus of BioScience, Leiden University;
- Prof. dr. Ton Bisseling (vice-chair), Professor of Molecular Biology, Wageningen University;
- Prof. dr. Marieke van Ham, Professor of Biological Immunology, University of Amsterdam;
- Dr. Andries ter Maat, Research Scientist, Max Planck Institute for Ornithology;
- Dr. Maarten van der Smagt, Associate Professor of Experimental Psychology, Utrecht University;
- Prof. dr. Joost Teixeira de Mattos, Professor of Quantitative Microbial Physiology, University of Amsterdam;
- Prof. dr. Herman Verhoef, Professor emeritus of Soil Ecology, VU University Amsterdam;
- Jeffrey Verhoeff BSc. (student member), master's student in Biology and Animal Sciences, Wageningen University.

The panel was supported by drs. José van Zwieten and dr. Fiona Schouten, who acted as secretaries.

Appendix 1 contains the curricula vitae of the members of the panel.

## **Working method of the assessment panel**

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The panel which assessed the master's programmes in Biology, Ecology & Evolution, Marine Biology, Molecular Biology & Biotechnology, Biomedical Sciences and Medical Pharmaceutical Sciences of the University of Groningen, participated in a cluster assessment. From June 2015 until January 2016, the panel assessed a total of twenty-three programmes at seven universities.

The panel consisted of thirteen members:

- Prof. dr. Jan Kijne (chair), Professor emeritus of BioScience, Leiden University;
- Prof. dr. Ton Bisseling (vice-chair), Professor of Molecular Biology, Wageningen University;

- Prof. dr. Maarten Frens, Professor of Systems Physiology, Erasmus University Rotterdam;
- Prof. dr. Marieke van Ham, Professor of Biological Immunology, University of Amsterdam;
- Prof. dr. Paul Hooykaas, Professor of Molecular Genetics, Leiden University;
- Dr. Andries ter Maat, Research Scientist, Max Planck Institute for Ornithology;
- Dr. Maarten van der Smagt, Associate Professor of Experimental Psychology, Utrecht University;
- Prof. dr. Joost Teixeira de Mattos, Professor of Quantitative Microbial Physiology, University of Amsterdam;
- Prof. dr. Herman Verhoef, Professor emeritus of Soil Ecology, Vrije Universiteit Amsterdam;
- Prof. dr. Jos Verhoeven, Professor emeritus of Landscape Ecology, Utrecht University;
- Prof. dr. Rens Voeselek, Professor of Plant Ecophysiology, Utrecht University;
- Pieter Munster MSc. (student member), policy officer at Leiden University and graduate of the master's programme Cancer, Genomics & Developmental Biology, Utrecht University;
- Jeffrey Verhoeff BSc. (student member), master's student in Biology and Animal Sciences, Wageningen University.

For every site visit, a (sub)panel was composed, based on the expertise and availability of panel members, thereby preventing possible conflicts of interests. Panels regularly consisted of five or six members. In order to enhance consistency of assessment within the cluster, professor Kijne acted as chair during all seven site visits. Coordinator of the cluster assessment Biology is dr. Kees-Jan van Klaveren, employee of QANU. He acted as secretary of the panel at Wageningen University and Utrecht University. He was also present during the final meetings of the five other site visits and read and commented upon each draft report in order to safeguard consistency of assessment. Drs. José van Zwieten, freelance employee of QANU, acted as secretary of the panel at Leiden University, Radboud University Nijmegen, the University of Groningen, the University of Amsterdam and Vrije Universiteit Amsterdam. In Groningen dr. Fiona Schouten, employee of QANU, acted as second secretary to the panel.

#### *Preparation*

The panel held a preliminary meeting on May 22, 2015. In this meeting, the panel was instructed about the accreditation framework and the programme of the upcoming assessments. Furthermore, the panel discussed its working methods in preparation to and during the site visits. A vice chair was appointed and the Domain Specific Frameworks for Biology and Psychobiology were discussed.

In preparation to the site visits, the coordinator first checked the quality and completeness of the critical reflections prepared by the programmes. After establishing that the reports met the demands, they were forwarded to the participating panel members. The panel members read the reports and formulated questions and findings on their contents.

Besides the critical reflections, the panel read a selection of six theses per programme. The theses were selected by the chair of the panel from a list of graduates of the last two completed academic years within a range of grades. For the master's programme Ecology and Evolution, the panel read an additional selection of nine theses.



### *Site visit*

A preliminary programme of the site visit was made by the coordinator and adapted after consultation of representatives of the University of Groningen. The time table for the visit to Groningen is included as Appendix 5.

Prior to the site visit, the panel asked the programmes to select representative interview partners. During the site visit, meetings were held with panels representing students and teaching staff, institute management, programme management, alumni, the Programme Committees and the Boards of Examiners.

During the site visit, the panel examined material it had requested. An overview of this material is given in Appendix 6. The panel provided students and lecturers with the opportunity – outside the set interviews – to speak informally to the panel during a consultation hour. No requests were received for this option.

The panel used the final part of the visit to discuss its findings in an internal meeting. The visit was concluded with a public presentation of the preliminary impressions and general observations by the panel's chair.

### *Decision rules*

In accordance with the NVAO's Assessment framework for limited programme assessments, the panel used the following definitions for the assessment of both the separate standards and the programme as a whole.

#### **Generic quality**

The quality that can reasonably be expected in an international perspective from a higher education bachelor's or master's programme.

#### **Unsatisfactory**

The programme does not meet the current generic quality standards and shows serious shortcomings in several areas.

#### **Satisfactory**

The programme meets the current generic quality standards and shows an acceptable level across its entire spectrum.

#### **Good**

The programme systematically surpasses the current generic quality standard.

#### **Excellent**

The programme systematically well surpasses the current generic quality standard and is regarded as an international example.



## Summary judgement

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### *Master's programme Biology*

According to the panel, the intended learning outcomes of the master's degree programme Biology are in line with (inter)national requirements and show a strong focus on research. The programme harbours one or more distinguishing features in its profile and/or in its tracks' profiles. However, the different sets of learning outcomes are quite generic and do not yet reflect the development towards New Biology. The panel encourages the programme to develop learning outcomes that more adequately reflect the programme's ambitions, distinct character and adaptation of current interdisciplinary developments in biology research.

The curriculum consists of 120 EC, divided over two years. The panel judges the programme to be well-structured, with a research profile leading to a PhD entry level and a Science Business and Policy (SBP) profile oriented towards a career outside academia. Students take several courses. Academic skills are acquired through the first research project. Later on, the presentation skills of the students are assessed during the colloquium which is about an unrelated topic. Students with a research profile also write an essay and carry out a second research project. Students with an SBP profile take SBP-specific modules and participate in an SBP internship.

The panel appreciates the freedom of choice students have in the Biology programme. They can combine knowledge from different disciplines and develop as generalist biologists. However, an introductory module providing an overview of the broad field which specifically contains lectures focussing on current trends in this field could strengthen this profile and at the same time help students choose a relevant and coherent study path. According to the panel, the Behaviour and Neuroscience track has a good balance between freedom and pre-structured course options that are provided by top researchers.

The panel assesses the mentoring system that guides students throughout their master's programme by a staff member, as uniquely suited to prevent study delay. The mentors combine strong didactic and research expertise. The panel is also pleased with the choice to 'embed' students in a research group during their first research project. It has noted with pleasure that the ethical and societal dimensions of the Life Sciences are markedly present in the curriculum. Academic skills are clearly taught, though the panel would recommend paying attention to these from the start of the first semester.

The panel concludes that the assessment system functions well. The formalisation of the assessment policy through the use of CUAOs, standardized assessment forms and other means to guarantee the quality of assessment is a major improvement. Safeguarding the quality of a research project gets sufficient attention. Moreover, the policy is shared and supported by the teaching staff. The panel is particularly impressed with the performance of the Board of Examiners, which it qualifies as professional and effective. The BoE evaluates the assessment practice and initiates necessary changes. Its proactive approach contributes to lasting improvement and fine-tuning of the assessment system.

The panel concludes that the level achieved in the second research project is adequate but does not seem to systematically surpass the expected level of Biology master graduates. The theses demonstrate a markedly academic attitude and understanding. They also testify to considerable skill in executing research and reporting on it. The panel also observes that the awarded grades generally match its own evaluations..

### *Master's programme Ecology & Evolution*

According to the panel, the intended learning outcomes of the master's degree programme Ecology & Evolution are in line with (inter)national requirements and show a strong focus on research. The programme harbours one or more distinguishing features in its profile and/or in its tracks' profiles. However, the different sets of learning outcomes are quite generic and do not yet reflect the development towards New Biology. The panel encourages the programme to develop learning outcomes that more adequately reflect the programme's ambitions, distinct character and adaptation of current interdisciplinary developments in biology research.

The curriculum consists of 120 EC, divided over two years. The panel judges the programme to be well-structured, with a research profile leading up to a PhD entry level and a Science Business and Policy (SBP) profile oriented towards a career outside academia. Students take several courses. Academic skills are acquired through the first research project. Later on, the presentation skills of the students are assessed during the colloquium which is about an unrelated topic. Students with a research profile also write an essay and carry out a second research project. Students with an SBP profile take SBP-specific modules and participate in an SBP internship.

In the eyes of the panel, Ecology & Evolution distinguishes itself through the breadth of subjects offered in the regular programme. Above all, it praises the Top and MEME programmes, which give students the unique opportunity to be educated in an international setting. The Ecology & Evolution staff members are leading in their field, and the research institute GELIFES offers a cross-disciplinary research environment for staff and students alike. Feasibility within this necessarily flexible programme, where field research frequently has a seasonal dimension, is ensured by the mentoring system. The panel considers this master's programme unique in the Netherlands and of high quality.

The panel assesses the mentoring system, where students are guided throughout their master's programme by a staff member, as uniquely suited to prevent study delay. The mentors combine strong didactic and research expertise. The panel is also pleased with the choice to 'embed' students in a research group during their first research project. It has noted with pleasure that the ethical and societal dimensions of the Life Sciences are markedly present in the curriculum. Academic skills are clearly taught, though the panel would recommend paying attention to these from the start of the first semester. In addition, a state-of-the-art course at the beginning of the life science programmes would strengthen insight into width and developments of the biological field and serve to reinforce the students' identity as modern biologists.

The panel concludes that the assessment system functions well. The formalisation of the assessment policy through the use of CUAOs, standardized assessment forms and other means to guarantee the quality of assessment is a major improvement. Safeguarding the quality of a research project gets sufficient attention. Moreover, the policy is shared and supported by the teaching staff. The panel is particularly impressed with the performance of the Board of Examiners, which it qualifies as professional and effective. The BoE evaluates the assessment practice and initiates necessary changes. Its proactive approach contributes to lasting improvement and fine-tuning of the assessment system.

The panel concludes that the level achieved in the second research project is generally high. The theses demonstrate a markedly academic attitude and understanding. They also testify to



considerable skill in executing research and reporting on it. The panel also observes that the awarded grades generally match its own evaluations.

#### *Master's programme Marine Biology*

According to the panel, the intended learning outcomes of the master's degree programme Marine Biology are in line with (inter)national requirements and show a strong focus on research. The programme harbours one or more distinguishing features in its profile and/or in its tracks' profiles. However, the different sets of learning outcomes are quite generic and do not yet reflect the development towards New Biology. The panel encourages the programme to develop learning outcomes that more adequately reflect the programme's ambitions, distinct character and adaptation of current interdisciplinary developments in biology research.

The curriculum consists of 120 EC, divided over two years. The panel judges the programme to be well-structured, with a research profile leading up to a PhD entry level and a Science Business and Policy (SBP) profile oriented towards a career outside academia. Students take several courses. Academic skills are acquired through the first research project. Later on, the presentation skills of the students are assessed during the colloquium which is about an unrelated topic. Students with a research profile also write an essay and carry out a second research project. Students with an SBP profile take SBP-specific modules and participate in an SBP internship.

The panel applauds the Marine Biology master's programme for the restructuring it has initiated since the last assessment in 2009 and for its incorporation into a national framework. Staffing issues have been solved at least temporarily, and the curriculum has been strengthened by three introductory courses transferred from the bachelor's programmes to this master's programme. The panel has noted that these courses still seem to reflect their origins: they can gain in depth. It recommends the programme to adapt them accordingly. It is positive, however, about the addition of these courses, since they provide structure to the students' programme and increase feasibility. The panel is glad to see that new teaching staff has been attracted through a collaboration with the NIOZ institute. However, it is not convinced that staffing issues now entirely belong to the past, and stimulates the programme to design a permanent solution. The panel finds Marine Biology in Groningen a uniquely broad programme with excellent facilities both on campus and abroad. It is confident that the new direction it has chosen will lead to even greater improvement in the near future.

The panel assesses the mentoring system, where students are guided throughout their master's programme by a staff member, as uniquely suited to prevent study delay. The mentors combine strong didactic and research expertise. The panel is also pleased with the choice to 'embed' students in a research group during their first research project. It has noted with pleasure that the ethical and societal dimensions of the Life Sciences are markedly present in the curriculum. Academic skills are clearly taught, though the panel would recommend paying attention to these from the start of the first semester. In addition, a state-of-the-art course at the outset of the life science programmes would strengthen insight into width and developments of the biological field and serve to reinforce the students' identity as modern biologists.

The panel concludes that the assessment system functions well. The formalisation of the assessment policy through the use of CUAOs, standardized assessment forms and other means to guarantee the quality of assessment is a major improvement. Safeguarding the

quality of a research project gets sufficient attention. Moreover, the policy is shared and supported by the teaching staff. The panel is particularly impressed with the performance of the Board of Examiners, which it qualifies as professional and effective. The BoE evaluates the assessment practice and initiates necessary changes. Its proactive approach contributes to lasting improvement and fine-tuning of the assessment system.

The panel concludes that the level achieved in the second research project is generally adequate. The panel found the theses to be overly descriptive. It is confident that the newly made changes will make themselves felt in the future. The panel also observes that the awarded grades generally match its own evaluations.

#### *Master's programme Molecular Biology & Biotechnology*

According to the panel, the intended learning outcomes of the master's degree programme Molecular Biology & Biotechnology are in line with (inter)national requirements and show a strong focus on research. The programme harbours one or more distinguishing features in its profile and/or in its tracks' profiles. However, the different sets of learning outcomes are quite generic and do not yet reflect the development towards New Biology. The panel encourages the programme to develop learning outcomes that more adequately reflect the programme's ambitions, distinct character and adaptation of current interdisciplinary developments in biology research.

The curriculum consists of 120 EC, divided over two years. The panel judges the programme to be well-structured, with a research profile leading up to a PhD entry level and a Science Business and Policy (SBP) profile oriented towards a career outside academia. Students take several courses. Academic skills are acquired through the first research project. Later on, the presentation skills of the students are assessed during the colloquium which is about an unrelated topic. Students with a research profile also write an essay and carry out a second research project. Students with an SBP profile take SBP-specific modules and participate in an SBP internship.

The panel concludes that the Molecular Biology & Biotechnology programme offers students excellent opportunities to develop themselves as independent researchers in a field that with its interdisciplinary character is exemplary of New Biology. The curriculum is well-structured, and the international character of the programme is enforced by the Top programme that attracts a lot of international students. Staff members of this programme are active researchers of international top level. Accordingly, the quality of the courses and research projects is high.

The panel assesses the mentoring system, where students are guided throughout their master's programme by a staff member, as uniquely suited to prevent study delay. The mentors combine strong didactic and research expertise. The panel is also pleased with the choice to 'embed' students in a research group during their first research project. It has noted with pleasure that the ethical and societal dimensions of the Life Sciences are markedly present in the curriculum. Academic skills are clearly taught, though the panel would recommend paying attention to these from the start of the first semester. In addition, a state-of-the-art course at the outset of the life science programmes would strengthen insight into width and developments of the biological field and serve to reinforce the students' identity as modern biologists.

The panel concludes that the assessment system functions well. The formalisation of the assessment policy through the use of CUAOs, standardized assessment forms and other

means to guarantee the quality of assessment is a major improvement. Safeguarding the quality of a research project gets sufficient attention. Moreover, the policy is shared and supported by the teaching staff. The panel is particularly impressed with the performance of the Board of Examiners, which it qualifies as professional and effective. The BoE evaluates the assessment practice and initiates necessary changes. Its proactive approach contributes to lasting improvement and fine-tuning of the assessment system.

The panel concludes that the level achieved in the second research project is generally high. The theses demonstrate a markedly academic attitude and understanding. They also testify to considerable skill in executing research and reporting on it. The panel also observes that the awarded grades generally match its own evaluations.

#### *Master's programme Biomedical Sciences*

According to the panel, the intended learning outcomes of the master's degree programme Biomedical Sciences are in line with (inter)national requirements and show a strong focus on research. The programme harbours one or more distinguishing features in its profile and/or in its tracks' profiles. However, the different sets of learning outcomes are quite generic and do not yet reflect the development towards New Biology. The panel encourages the programmes to develop learning outcomes that more adequately reflect the programme's ambitions, distinct character and adaptation of current developments in biomedical research. It recommends incorporation of systems biology and research which specialises in acquisition and analysis of big data.

The curriculum consists of 120 EC, divided over two years. The panel judges the programme to be well-structured, with a research profile leading up to a PhD entry level and a Science Business and Policy (SBP) profile oriented towards a career outside academia. Students take several courses. Academic skills are acquired through the first research project. Later on, the presentation skills of the students are assessed during the colloquium which is about an unrelated topic. Students with a research profile also write an essay and carry out a second research project. Students with an SBP profile take SBP-specific modules and participate in an SBP internship.

According to the panel, Biomedical Sciences offers its students a coherent programme in a solid research environment. It considers the programme's master courses to be rather traditional in nature, lacking clear coherence or a more integrative approach. In the eyes of the panel, the recently added Biology of Ageing track causes the programme to really distinguish itself, unfolding its full potential and choosing an approach exemplary of New Biology. Biomedical Sciences benefits from the state-of-the-art facilities of the ERIBA institute and offers students in this track a unique preparation in health research. The panel is convinced that the Nutrition and Health track, which is now being added, will be set up along similar lines and will thus contribute to the quality of the programme as a whole.

The panel assesses the mentoring system, where students are guided throughout their master's programme by a staff member, as uniquely suited to prevent study delay. The mentors combine strong didactic and research expertise. The panel is also pleased with the choice to 'embed' students in a research group during their first research project. It has noted with pleasure that the ethical and societal dimensions of the Life Sciences are markedly present in the curriculum. Academic skills are clearly taught, though the panel would recommend paying attention to these from the start of the first semester. In addition, a state-of-the-art course at the beginning of the life science programmes with specific attention to current topics and developments in the field of biomedical research would strengthen insight



into width and developments of the biological field and serve to reinforce the students' identity as biomedical scientists.

The panel concludes that the assessment system functions well. The formalisation of the assessment policy through the use of CUAOs, standardized assessment forms and other means to guarantee the quality of assessment is a major improvement. Safeguarding the quality of research project gets sufficient attention. Moreover, the policy is shared and supported by the teaching staff. The panel is particularly impressed with the performance of the Board of Examiners, which it qualifies as professional and effective. The BoE evaluates the assessment practice and initiates necessary changes. Its proactive approach contributes to lasting improvement and fine-tuning of the assessment system.

The panel concludes that the level achieved in the second research project is generally high. The theses demonstrate a markedly academic attitude and understanding. They also testify to considerable skill in executing research and reporting on it. The panel also observes that the awarded grades generally match its own evaluations.

#### *Master's programme Medical Pharmaceutical Sciences*

According to the panel, the intended learning outcomes of the master's degree programme Medical Pharmaceutical Sciences are in line with (inter)national requirements and show a strong focus on research. The programme harbours one or more distinguishing features in its profile and/or in its tracks' profiles. However, the different sets of learning outcomes are quite generic and do not yet reflect the development towards New Biology. The panel encourages the programme to develop learning outcomes that more adequately reflect the programme's ambitions, distinct character and adaptation of current interdisciplinary developments in biology research.

The curriculum consists of 120 EC, divided over two years. The panel judges the programme to be well-structured, with a research profile leading up to a PhD entry level and a Science Business and Policy (SBP) profile oriented towards a career outside academia. Students take several courses. Academic skills are acquired through the first research project. Later on, the presentation skills of the students are assessed during the colloquium which is about an unrelated topic. Students with a research profile also write an essay and carry out a second research project. Students with an SBP profile take SBP-specific modules and participate in an SBP internship.

The panel is impressed with the fact that Medical Pharmaceutical Studies combines a core curriculum of courses with a distinctly innovative and integrative approach, connecting Biology to Pharmacy and Medicine. It finds the programme both coherent and challenging, which it considers quite an accomplishment. Students are introduced to the field and to their cohort through an obligatory course. They acquire the necessary knowledge through a limited set of courses and develop their research skills within the facilities of pharmacy research groups or the university hospital's quality research framework. However, the panel is concerned about the low number of students entering this programme. This appears to be caused by the presence of Pharmacy as a competing master's programme. The panel advises the programme to reconsider its identity within the field of Life Sciences and, for example, to intensify collaborative research activities with related Life Science groups in order to attract the attention of non-pharma students.

The panel assesses the mentoring system, where students are guided throughout their master's programme by a staff member, as uniquely suited to prevent study delay. The



mentors combine strong didactic and research expertise. The panel is also pleased with the choice to 'embed' students in a research group during their first research project. It has noted with pleasure that the ethical and societal dimensions of the Life Sciences are markedly present in the curriculum. Academic skills are clearly taught, though the panel would recommend paying attention to these from the start of the first semester. In addition, a joint state-of-the-art course at the beginning of the life science programmes would strengthen insight into principles and developments of the broad biological field and serve to reinforce the students' identity as life scientists, prior to specializing in their own programme.

The panel concludes that the assessment system functions well. The formalisation of the assessment policy through the use of CUAOs, standardized assessment forms and other means to guarantee the quality of assessment is a major improvement. Safeguarding the quality of research project gets sufficient attention. Moreover, the policy is shared and supported by the teaching staff. The panel is particularly impressed with the performance of the Board of Examiners, which it qualifies as professional and effective. The BoE evaluates the assessment practice and initiates necessary changes. Its proactive approach contributes to lasting improvement and fine-tuning of the assessment system.

The panel concludes that the level achieved in the second research project is generally high. The theses demonstrate a markedly academic attitude and understanding. They also testify to considerable skill in executing research and reporting on it. The panel also observes that the awarded grades generally match its own evaluations.

*Master's programme Biology*

|   |              |
|---|--------------|
| Standard 1: Intended learning outcomes    | satisfactory |
| Standard 2: Teaching-learning environment | satisfactory |
| Standard 3: Assessment                    | good         |
| Standard 3: Achieved learning outcomes    | satisfactory |
| General conclusion                        | satisfactory |

*Master's programme Ecology & Evolution:*

|   |              |
|---|--------------|
| Standard 1: Intended learning outcomes    | satisfactory |
| Standard 2: Teaching-learning environment | good         |
| Standard 3: Assessment                    | good         |
| Standard 4: Achieved learning outcomes    | good         |
| General conclusion                        | good         |

*Master's programme Marine Biology:*

|   |              |
|---|--------------|
| Standard 1: Intended learning outcomes                | satisfactory |
| Standard 2: Teaching-learning environment             | satisfactory |
| Standard 3: Assessment and achieved learning outcomes | good         |
| Standard 4: Achieved learning outcomes                | satisfactory |
| General conclusion                                    | satisfactory |

*Master's programme Molecular Biology & Biotechnology*

|   |              |
|---|--------------|
| Standard 1: Intended learning outcomes                | satisfactory |
| Standard 2: Teaching-learning environment             | excellent    |
| Standard 3: Assessment and achieved learning outcomes | good         |
| Standard 4: Achieved learning outcomes                | good         |
| General conclusion                                    | good         |

*Master's programme Biomedical Sciences*

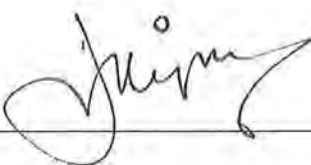
|   |              |
|---|--------------|
| Standard 1: Intended learning outcomes                | satisfactory |
| Standard 2: Teaching-learning environment             | good         |
| Standard 3: Assessment and achieved learning outcomes | good         |
| Standard 4: Achieved learning outcomes                | good         |
| General conclusion                                    | good         |

*Master's programme Medical Pharmaceutical Sciences*

|   |              |
|---|--------------|
| Standard 1: Intended learning outcomes                | satisfactory |
| Standard 2: Teaching-learning environment             | good         |
| Standard 3: Assessment and achieved learning outcomes | good         |
| Standard 4: Achieved learning outcomes                | good         |
| General conclusion                                    | good         |

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

Date: 25 February 2016



Prof. dr. Jan Kijne



Drs. José van Zwieten

## Description of the standards from the Assessment Framework for Limited Programme Assessments

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### *Organization of the degree programmes*

The six master's degree programmes discussed in this report belong to the Graduate School of Science (GSS) of the University of Groningen's Faculty of Mathematics and Natural Sciences (FMNS). Each programme has a deputy director who reports to the GSS director. The GSS director in turn reports to the Faculty's vice dean. Nine research institutes contribute to the master's programmes: the Stratingh Institute for Chemistry (Stratingh), the Groningen Biomolecular Sciences and Biotechnology Institute (GBB), the Energy and Sustainability Research Institute Groningen (ESRIG), the Royal Netherlands Institute for Sea Research (NIOZ), the Groningen Institute for Evolutionary Life Sciences (GELIFES), the Groningen University Institute for Drug Exploration (GUIDE), the Groningen Research Institute of Pharmacy (GRIP), Science in Healthy Ageing & healthcaRE (SHARE), and the Cancer Research Center Groningen (CRCG). The informal organ OVO is composed of staff members of these institutes as well as the programme coordinators, a didactic expert and a student member. OVO acts as an advisory board to the Programme Committees.

### **Standard 1: Intended learning outcomes**

The intended learning outcomes of the programme have been concretised with regard to content, level and orientation; they meet international requirements.

#### **Explanation:**

As for level and orientation (bachelor's or master's; professional or academic), the intended learning outcomes fit into the Dutch qualifications framework. In addition, they tie in with the international perspective of the requirements currently set by the professional field and the discipline with regard to the contents of the programme. Insofar as is applicable, the intended learning outcomes are in accordance with relevant legislation and regulations.

### **Findings**

The Consultative Body of Higher Educational Teaching in Biology ('Overlegorgaan Hoger Onderwijs Biologie', OHOB), in which all academic degree programmes in the Netherlands are represented, has drawn up the Domain-Specific Frameworks of Reference (hereafter the Frameworks) for academic bachelor's and master's programmes in Biology. This document demarcates the domain of Biology, and touches upon the transition towards New Biology. The past focus on mono-subdisciplines has shifted towards integration of scientific disciplines and requires competence in dealing with the dynamics and complexity of life as a network, from molecules to ecosystems. The Frameworks provide a set of general requirements for academic bachelor's and master's programmes in Biology.

The panel has studied the Frameworks, and notes that their general requirements correspond with the internationally accepted Dublin descriptors. In terms of contents, the requirements also encompass what might be expected of an academic bachelor's or master's programme in Biology. The panel appreciates the fact that New Biology is mentioned in the Frameworks. However, it notes that New Biology and the corresponding scientific attitude have not yet been translated into concrete requirements for academic degree programmes. The panel expects that in the next revision of the document, the integrative and interdisciplinary nature of Biology will be recognized in the general requirements.

According to the critical reflection of the six master's programmes in Life Sciences of the University of Groningen, the focus in these master's programmes is on the development of an active learning attitude and a multidisciplinary awareness. After completing their

programme, students should be able to function as independent researchers conscious of their own position within the field of biology.

Students can choose between a research profile and a Science Business and Policy profile. The Science Business and Policy profile is organized collectively for all master's programmes within the Graduate School of Science. Alternatively, students can opt for a separate master's programme Education & Communication, which lies beyond the scope of the current assessment.

The programmes have developed nine intended learning outcomes, the first of which (describing the body of knowledge) is formulated separately for each programme. The other eight learning outcomes are identical for each of the six programmes.

After studying the intended learning outcomes (see Appendix 3), the panel concludes that they are in agreement with the domain-specific framework as well as the international Dublin descriptors. The outcomes are therefore in accordance with national as well as international standards. The panel established that their orientation is clearly academic: they include the ability to design and conduct scientific research as well as the ability to participate in societal debates concerning the ethics and implications of their research. Moreover, the panel is pleased to note that the outcomes refer explicitly to multidisciplinary teamwork and acquisition of new knowledge. In the opinion of the panel, these aspects are particularly urgent in the field of biology, where participating in new developments taking place across scientific boundaries is currently one of the greatest challenges. The panel also concludes that the outcomes are appropriate to a master's programme: after graduating from one of these programmes, the students have become academics able to set up and conduct research both independently and within a team. They display an academic attitude in dealing with societal and ethical demands placed on their work and position.

The intended learning outcomes are in line with the domain-specific framework, yet they do not refer to New Biology. The panel feels that incorporation of such an important development within the academic field would strengthen the research profile of the programmes. Furthermore, it points out that the majority of the six programmes (cf. the discussion of Standard 2 in this report) actually do include elements of New Biology in their content and methods. The panel therefore recommends adaptation of the intended learning outcomes of all six programmes in such a way that New Biology is addressed more explicitly.

In the case of *Biology*, the panel observes that the learning outcomes apply well to the programme's multidisciplinary and broad nature. According to the critical reflection, this master's degree programme allows students to combine various domains within the field of Life Sciences. However, the panel noticed that the programme did not develop a distinct profile that sets it apart from the other programmes in the field. Additionally, it suggests that mentioning track-specific learning outcomes for the research track Behavioural and Neurosciences could make this track more visible and distinctive.

The panel observes that the intended learning outcomes of *Ecology & Evolution* do not differentiate with regard to the two tracks embedded in this master's degree programme: the Top Programme and the Erasmus Mundus Programme in Evolutionary Biology (MEME). According to the critical reflection, the intended learning outcomes of these embedded tracks are the same as those of the regular track, in spite of the Top Programme's curriculum being more constrained in time and more challenging in content. The panel suggests translating those differences in ambition and scope into track-specific learning outcomes. Also, it



concludes that the master's programme *Ecology & Evolution* as a whole could make a stronger effort to incorporate its distinct profile in its learning outcomes.

The intended learning outcomes of the master's programme *Marine Biology* are appropriately wide in range, yet the panel feels that more attention could be paid to the crossdisciplinary nature of this field in the learning outcomes. Marine Biology combines disciplines in order to study the marine environment. As a consequence, the master's programme combines methods and approaches from a large number of subdisciplines in the field of biology. According to the panel, this specific nature could be better captured in the learning outcomes.

The panel established that the intended learning outcomes of the master's programme *Molecular Biology & Biotechnology* are appropriate, but quite generic. The Top programme and the Chemical Biology track offered by this master's programme are not referred to in the learning outcomes. Nonetheless, the panel concludes that the programme has a unique and international profile of *Molecular Biology & Biotechnology*. It advises to capture the profiles of the mentioned tracks and the programme as a whole more fully in the intended learning outcomes.

The panel is positive about the programme-specific intended learning outcome (outcome 1) of *Biomedical Sciences*. This master's degree programme focuses on understanding the mechanism and cure of disease. The panel is glad to see the interdisciplinary approach which is a consequence of this specialization outlined in learning outcome 1. There, the molecular and cellular biology from which the students depart are linked to medical as well as pharmaceutical sciences. The panel regrets, however, that the Biology of Ageing track within this programme is not mentioned in the intended learning outcomes. In the eyes of the panel, this track is innovative both in structure and in content, representing a New Biology approach and engaging with societal concerns in a very direct way. The panel recommends the programme to include track-specific learning outcomes. It considers it a distinguishing feature well worth mentioning.

The master's degree programme in *Medical Pharmaceutical Sciences* deals with the therapeutic intervention of diseases by drugs and is, according to the critical reflection, interdisciplinary in nature. In the eyes of the panel, this interdisciplinarity is expressed clearly in the programme-specific learning outcome (outcome 1), which mentions medical and pharmaceutical science as well as a wide range of drug development disciplines. Nevertheless, the panel observes that the two specialization tracks, Toxicology & Drugs Disposition and Pharmaco-epidemiology, are referred to in a rather implicit manner. It points out that the Toxicology & Drugs Disposition track is described as unique and highly relevant in the critical reflection, whereas Pharmaco-epidemiology touches on New Biology in its statistical database research and its focus on ageing. The panel recommends that the expected learning outcomes be revised so that they highlight the tracks' unique approach and their innovative academic content.

### Considerations

According to the panel, the intended learning outcomes of all six master's degree programmes are in line with (inter)national requirements and show a strong focus on research. All programmes harbour one or more distinguishing features in their profiles and/or in their tracks' profiles. However, the different sets of learning outcomes are quite generic and do not yet reflect the development towards New Biology. The panel encourages the programmes to develop learning outcomes that more adequately reflect each programme's ambitions, distinct character and adaptation of current developments in biology research.

### Conclusion

*Master's programme Biology:* the panel assesses Standard 1 as **satisfactory**.

*Master's programme Ecology & Evolution:* the panel assesses Standard 1 as **satisfactory**.

*Master's programme Marine Biology:* the panel assesses Standard 1 as **satisfactory**.

*Master's programme Molecular Biology & Biotechnology:* the panel assesses Standard 1 as **satisfactory**.

*Master's programme Biomedical Sciences:* the panel assesses Standard 1 as **satisfactory**.

*Master's programme Medical Pharmaceutical Sciences:* the panel assesses Standard 1 as **satisfactory**.

## **Standard 2: Teaching-learning environment**

The curriculum, staff and programme-specific services and facilities enable the incoming students to achieve the intended learning outcomes.

### **Explanation:**

The contents and structure of the curriculum enable the students admitted to achieve the intended learning outcomes. The quality of the staff and of the programme-specific services and facilities is essential to that end. Curriculum, staff, services and facilities constitute a coherent teaching-learning environment for the students.

## **Findings**

### *Curricula: general composition*

The panel studied the curriculum of each master's degree programme in Life Sciences of the University of Groningen. It discussed its composition with the programme management, students and teaching staff. The panel also examined course materials and course information provided through the university's digital environment, Nestor.

The six master's programmes share a general setup. Each programme consists of 120 EC, divided over two years. Students can either opt for a research profile or, if they prefer a master's degree more clearly directed at the non-academic working field, for the Science Business and Policy (SBP) profile. All students are required to take programme-specific master courses and electives. Students with a research profile typically take up to 40 EC in courses, and students with an SBP profile take up to 15 EC, although these numbers vary slightly per master's programme. Academic skills are acquired through the first research project (at least 40 EC). Later on, the presentation skills of the students are assessed during the colloquium which is about an unrelated topic (5 EC). Students with a research profile also write an essay (5 EC) and execute a second research project (at least 30 EC). Students with an SBP profile take SBP-specific modules (20 EC) and participate in an SBP internship (40 EC). A concise overview of each programme's curriculum can be found in Appendix 4.

The panel considers this programme setup, which requires students to conduct research in an increasingly independent fashion, to be in line with the intended learning outcomes of the master's programmes. The research profile is clearly designed to prepare students for a PhD position in the field: it was previously named PhD profile. In the eyes of the panel, the distinction between the SBP and the research profile is clear. It is positive about the availability of a business and society-oriented option within all master's programmes. Moreover, the panel is pleased to see that the Faculty management has acted upon the concern voiced by the previous panel, in 2009, about certain SBP courses being taught in Dutch. The SBP track is now fully taught in English.

The master courses are chosen by each student from a list provided in the programmes' study guides. They are organized by the various research institutes linked to the programmes. For each course, the study guides indicate to which master's programme(s) it is best suited. Some programmes prescribe one or more master courses, whereas others leave the choice up to the individual student. In all cases, students compose their study path with the aid of an experienced mentor, and their individual programme is approved by the Board of Examiners. The panel considers this an adequate way of ensuring that each student follows a logical and well-structured trajectory.

The elective courses, of which students take between 10 and 20 EC, serve in some cases to train students in appropriate techniques. For example, students can follow basic Excel and

Access courses or Modern Laser Microscopy. Students can also opt for courses from the other master's programmes as electives, and thereby broaden their knowledge. However, a large number of the elective courses distinguish themselves through their focus on society, communication and/or journalism. The panel is pleased to see that this societal occupation, which it considers central to developing an academic attitude, is part of the curriculum.

The first research project performed by students of any of these master's programmes takes place within a research group in or related to the Faculty. Students select their own topic and group based on their own interest and specialization. They are typically supervised on a day to day basis by a PhD student, but a permanent staff member of the research group is ultimately responsible. This supervisor is directly involved in the project, and frequently acts as mentor to the student throughout the master's programme. Ideally, the student is embedded in the research group and becomes a 'real' member. The critical reflection refers to this practice as a master-apprentice structure: students work *with* rather than *for* or *under* the institute staff and thus learn how to conduct research. In the context of this approach, students present their work to the entire research group as a part of their project. In the eyes of the panel, this master-apprentice structure allows students to acquire the necessary research experience in a setting that is both safe and challenging. From its conversations with students, the panel has learned that some research groups are more successful in making the students feel like active members than others.

The second research project of students with a research profile allows students to move to other institutes. It is frequently performed abroad. Students choose a new topic unrelated to their previous project as well as a new supervisor within the Faculty, who is responsible for the project. The panel considers this final project an important opportunity for students to experience the scope of their own field. The panel is also positive about the internship, which replaces the second project for SBP students. The internship takes place in companies within the relevant field, selected by the students. It prepares the students for the professional practice awaiting them upon graduation.

The panel observes that academic skills are a clearly marked part of the curricula: they are taught through individual literature study resulting in an essay (for research profile students) and through participation in a colloquium. The panel appreciates the integration of these two courses into the curricula, but it voices a concern as to their timing. Students can only participate in the colloquium when they have completed their first research project. Therefore, they can't profit from their presentation skills training of the colloquium in their final presentation of the research project. Similarly, the precise moment of the writing of the essay may vary according to the student's individual curriculum and his or her choice for a master's programme. It is therefore not unthinkable that this writing assignment is completed after the first research report is written. The panel advises the programme management to consider the introduction of academic skills education at an early moment in the schedule, in order to allow the students to benefit from it in each of their research projects or in their research project and internship.

In the 2009 evaluation, the question was raised whether the students' individual trajectories allowed them to receive proper training regarding the ethical dimension of the Life Sciences. The panel highly appreciates the programmes' solution to this issue. At the start of their first research project, students are confronted with the Netherlands Code of Conduct for Scientific Practice, and they have to commit themselves to following this guideline. The panel is impressed with the fact that students are asked to consider ethical aspects so early on in their master's programme. It sees this as a way of ensuring an academic and responsible



attitude throughout – and after – their studies. The panel also looks positively upon a new elective course introduced in 2015-2016: 'Professionalism and Ethics in Science'. All in all, the panel characterises the attention to ethical issues in these six programmes as exemplary.

#### *Programme-specific curricula*

Students from the master's programme *Biology* can choose courses from all other Life Sciences programmes. There are no compulsory courses, as this programme intends to offer students with a broad interest in Life Sciences the freedom to compose their own programme. Students do so with a mentor, who advises them on the coherence and feasibility of their programme. The panel appreciates this opportunity for students to combine different aspects of the Life Sciences. In general, the quality of the courses that are offered is good. However, according to the panel it would be good for these students to also participate in one or two compulsory courses at the beginning of their programme. On the one hand, this offers them the opportunity to get to know the other students in this programme. Cohort cohesion is conducive to study progress and success. On the other hand, a compulsory introduction to the programme can give students an overview of new developments across the broad domain of biology, thereby addressing New Biology and helping them to choose their study path afterwards. Students mentioned to the panel that they would benefit from an introduction to the different research groups in order to prepare and apply for their research projects. Finally, this introductory course can give the programme a clearer profile, namely that of 'generalist biologists'.

Within the Biology programme, students can opt for the Behaviour & Neurosciences specialisation track. This track still offers a lot of freedom, but the list of courses students can choose from is limited to topics related to behavioural biology and neurosciences. The panel considers this a good way of ensuring coherence within the individual study paths. The panel is positive about the content of this track: it offers students adequate knowledge and experience in these specific sub-disciplines of Biology.

Since the previous evaluation in 2009, the master's programme in *Ecology & Evolution* has come to include an international track. Students can now opt for the regular programme, the Top Programme or the new Erasmus Mundus (MEME) international programme in Evolutionary Biology.

The regular programme holds four tracks: Evolutionary Ecology & Genetics, Behavioural Ecology & Ecophysiology, Conservation Biology and Community Ecology. The students select their master courses from a list shared by the four non-medical master's programmes, where they find indicated which courses match the Ecology & Evolution master's programme. The panel applauds the programme for offering a wide range of subjects and is positive about their content and level. It is pleased to note that plant physiology, an area which has lost prominence within the field of Biology, is still present in the curriculum.

Students complete their first research project within their Faculty or a related research group. Since 2015, the research groups have been united in the new research institute GELIFES, a combination of the Centre for Ecological and Evolutionary Studies (CEES) and the Centre for Behaviour and Neurosciences (CBN). The panel considers this merger to be potentially beneficial for students of the genetic and behavioural tracks, who now have easy and natural access to groups previously linked to CBN. The combined approach is yet to be made manifest in the revised master courses organized by GELIFES, but the panel is confident that a more cross-disciplinary perspective will enhance the master course curriculum.

The Top Programme students follow the same programme as the students of the regular track, but they do not choose master courses. Instead, they follow three obligatory top programme courses of 10 EC each: Ecology & Evolution Research, Evolutionary Theory and Genomics in Ecology & Evolution. Also, they are required to select two 'current themes' lecture seminars, which are accessible to all master's students in biology in Groningen. After looking at the course material of these obligatory courses, the panel concludes that they are characterized by a distinctly innovative and challenging content and approach. The panel is particularly impressed with the Evolutionary Theory course, where students are asked to fill out a research grant proposal form. They complete the course with a concrete proposal, which can be put to use after their graduation.

The MEME students who choose to start their Erasmus Mundus Programme in Groningen (Uppsala being the other option) follow the same master courses as the Top Programme students. They then move on to Montpellier or Munich for the second semester. They perform their research projects at one of the partner universities. Eight students are offered the opportunity to conduct research at Harvard University. The students end up obtaining a double degree within two of the participating universities. The Groningen programme has ensured that the students fulfil all the local programme requirements. The panel concludes that this MEME programme is a unique opportunity for students who want to distinguish themselves in an international context, and it considers the quality of the programme outstanding due to its firm embedding in the context of leading international Ecology programmes.

Master students in *Marine Biology* enrol in a programme which has radically changed since the last visitation, in 2009. A critically low number of students in the master's programme (nine in 2013) caused the programme to redesign its curriculum. New, introductory master courses were added, enabling all students with a biology background to enter unproblematically. The panel appreciates the large effort spent in altering the programme. It considers the changes necessary and is pleased with the logical and straightforward structure the programme has now acquired. The new setup requires students to follow a fixed core curriculum of master courses. In the eyes of the panel, this is a positive development, since it limits the students in developing individual learning trajectories that are less coherent or relevant, thus ensuring a common basis for all students within the diverse and interdisciplinary field of Marine Biology.

The content of the newly introduced master courses is not entirely new: they were previously taught as part of the Biology and Life Science & Technology bachelors, in the Marine Biology major. This major has now been closed, which allows the Marine Biology staff to focus on the master's degree programme. The panel considers this choice a fortunate one. However, it notices that the programme has not yet entirely succeeded in adapting some of the new courses to a master's level. The panel especially considers Principles of Biological Oceanography to be more superficial than might be expected of a master course. It therefore advises the programme to adapt these courses correspondingly.

The master's programme in *Molecular Biology & Biotechnology* offers students three paths of specialization in this subdomain of biology. Students in the 'regular' programme choose from a selection of relevant courses and perform at least one of their research projects in a research group of the Groningen Biomolecular Sciences and Biotechnology Institute or the Stratingh Institute for Chemistry. Students in the Top Programme choose six courses from a list of eight. This track attracts a lot of students from abroad and thereby adds to the international character of the programme. Finally, students can follow the Chemical Biology track. The panel is positive about this structured curriculum, which ensures that all students follow

similar paths. The panel established that all tracks of this master's programme are embedded in and organized by excellent research departments, which perform at international top level. The courses give students insights into state-of-the art research on the application of structure biology to living cells. As a consequence of the collaboration with chemistry departments, this research has an interdisciplinary character which fits well into the New Biology paradigm. During their research projects, students participate in leading research groups. Students and teachers of this programme won the International Genetically Engineered Machine (iGEM) Competition; which according to the panel is a remarkable proof of the high academic level and motivation of teachers and students.

The master's programme in *Biomedical Sciences* offers its students a core curriculum of master courses: students can choose their courses from a more limited list compared to the non-medical master's programmes discussed above. The panel considers this a good way of maintaining unity and logic within the master's programme, ensuring that all students follow equivalent paths. Also, the particularly biomedical profile is strengthened and reinforced in this way. The panel finds that these courses themselves are adequate, though rather traditional, in form and content. However, it detects a lack of coherence between them. The courses do not explicitly refer to one another or build up in a consistent way. Students choose subjects based on their themes, such as immunology or neurodegenerative diseases, but they are not encouraged to select them in a particular order or combination. The panel advises the programme to adjust the courses so that their coherence becomes more evident and/or to add an introductory course that creates coherence and focusses on new developments, such as systems biology of big data, in the overall field of biomedical research.

Students who opt for the newly integrated Biology of Ageing track within Biomedical Sciences are restricted in their choice of master courses. They are required to follow 'Current Themes in Healthy Ageing' (5 EC), 'Molecular Biology of Ageing & Age-Related Diseases' (5 EC) and two 5 EC-courses from a list of four. The programme is therefore both more limited and more focussed. The panel appreciates this solid structure. Moreover, it considers the quality of the track's curriculum to be exceptionally good. The track is topical and highly relevant in its focus, and its cross-disciplinary approach is clearly representative of New Biology. A variety of techniques, approaches and methods from the field of Biology and related areas is integrated into a multifaceted yet solidly biological approach. In the eyes of the panel, this makes the track exemplary and unique within the Netherlands. The panel is convinced that the students educated in this track are well-prepared to face future challenges in biology and health research. It is confident that the new Nutrition & Health-track that is currently being implemented will be developed along similar lines, and will thus contribute to the quality of the Biomedical Sciences programme.

The *Medical Pharmaceutical Sciences* programme has a core curriculum of master courses. With the exception of 'Drug Development', these are not obligatory but enable the students to compose a coherent programme. In the 2009 programme assessment, this structure was held up as a model to be followed by the other master's programmes. The panel is pleased with the stability and logic this setup entails and considers the content of the programme to be good. The two specialization tracks are coherent and contain all necessary techniques and themes. Moreover, they do so in a non-traditional, multidisciplinary and integrative way representative of New Biology. The Pharmaco-epidemiology track combines biology, pharmacy, statistics and medicine, whereas Toxicology and Drug Disposition integrates biology, pharmacy and medicine. The panel is pleased with the renewal of the compulsory, introductory 'Drug Development' course, which now includes a visit to the Dutch Medicine Evaluation Board so that students gain insight into the process of new drug registration. In



the eyes of the panel, this shared introduction allows the students to settle into their field of specialization immediately.

#### *Study Load and Feasibility*

The curricula of the master's programmes have been set up in such a way that students can enter into their programme of choice at any moment during the academic year. The critical reflection lists four reasons for this: the students are enabled to follow their own, unique educational path; they can easily go abroad for their research project or internship; they can perform fieldwork dependent on seasonal timing; and they can start their master's degree immediately after finishing a bachelor's degree. The panel acknowledges the importance of flexibility in study planning, yet stresses the need to monitor the consistency and feasibility of the individual students' programmes.

In order to make sure that all students follow a consistent set of courses, they are required to find a mentor. Students receive a list of possible mentors and usually select a mentor from the research group in which they perform their first research project.

In order to be included on the list of mentors, staff members need to have over 10 years' experience in teaching. They need to be internationally oriented scientists with a wide network outside their university. The panel is impressed with the profile of the mentors: the programmes purposefully select their most experienced and prominent staff members for this task. The panel applauds the fact that the students are thus paired with scientists who are well-experienced in teaching and who function within a solid research environment. The mentor's expertise can help shape the student's individual curriculum, since the mentor is well equipped to judge its content and structure. Also, the student benefits from the mentor's network when initiating projects abroad or outside university. Students confirmed the importance of these mentors to the panel during its site visit: their mentor plays a central role in overseeing the feasibility and execution of their own particular programme. The panel considers the mentors' uniquely pivotal role in study success worthy of recognition. It advises the programmes to offer the mentors some form of compensation and acknowledgement (for example, in the form of a specific parameter for academic output) for the time and effort they spend on their students.

The panel judges that the freedom students have in determining their own curriculum does not threaten study feasibility. While the panel considers a core curriculum an advantage in preventing delay, it is convinced that students are enabled to complete a coherent programme within the period of two years. It does, however, note that the students specialize immediately, which makes it unlikely that students of the various masters' degree programmes run into each other. In the light of the multidisciplinary direction in which biology is heading and the consequent need to establish a clear biological identity, the panel suggests a general introduction course for all students of the master's programmes assessed in this report, addressing new developments and advanced research topics in the broad spectrum of Life Sciences.

Students generally do not experience problems in obtaining a research project fitting to their interests. Although availability of research projects in Groningen may be limited, the extended (inter)national networks of the lecturers provide enough possibilities for research projects outside of Groningen. Students can usually work in the research groups and institutions they choose. The panel finds this a commendable achievement. In the case of projects abroad, issues concerning practicalities or local supervision are limited.

As far as SBP internships are concerned, the panel learned from students and staff that a list of preferred and suggested companies is lacking. Students arrange their own internships. The panel agrees that students ought to develop an independent attitude and take initiative, but it recommends recording past experiences to the benefit of future students and supervisors.

According to the critical reflection, a majority of students needs over two years to obtain a master's degree, and many take over three years to graduate. Figures are influenced by the introduction of the *harde knip*, disallowing bachelor students to enter into a master's programme before officially obtaining their bachelor's degree. The critical reflection mentions that the results may be flattered as a result and voices a concern about graduation rates. It also mentions that measures have already been taken to improve them: study delays are now closely monitored and a thesis support seminar has been introduced. During the site visit, the panel discussed graduation rates and study delay with the programme management, teaching staff and students. Frequently mentioned as a cause for delay was the writing process of the research and internship reports. It appears that the reporting on the results after completing the project itself receives relatively little attention from mentors and supervisors. The panel therefore advises the programmes to monitor students more closely in the writing phase and to encourage students to start writing during the research period. It approves of the newly started thesis seminar and recommends the programmes to build on it when attempting to improve graduation rates.

Another point of concern mentioned in the critical reflection, which was confirmed by the teaching staff and management of the programmes, is the limited influx into the master's programmes of students with a bachelor's degree in Biology or Life Science & Technology of the University of Groningen. Apparently, students expect more job opportunities 'down South', which explains why they often move on to a master's degree programme elsewhere. The panel feels that mobility in itself is not a bad thing. Also, the loss of these students is partly compensated by Dutch and international students coming to Groningen for a master's degree. Nevertheless, the panel fully supports the programmes' efforts in highlighting job opportunities in the North of the Netherlands, as well as their attempts at establishing links with local companies in order to work together. Improving the information on and marketing of the programmes is another identified point of improvement to which the panel subscribes.

Students in the *Biology* programme do not encounter major problems with the feasibility of their programme. They do, however, point out that the large amount of freedom in their programme demands that they have a clear picture of what they want as well as good planning skills. Mentors help them, yet the panel stresses that for these students, a proactive mentor is even more important.

Within *Ecology & Evolution*, feasibility of the regular track is increased by the distinction of four tracks, allowing students to specialize accordingly within the broad scientific field. Feasibility of their individual programmes is guaranteed by the Board of Examiners and promoted by the advising mentor. The panel considers these measures adequate.

In the case of *Ecology & Evolution*, many students conduct research which is dependent on seasonal variables. The timing of their projects may be impacted by this. The master's programme allows for flexibility, so that study duration does not get affected negatively. The panel sees this as a necessary concession to the programme's characteristics.

The panel appreciates the fact that the Top and MEME Programmes have a core curriculum, which ensures students a consistent and straightforward educational path. It finds this all the

more important since the study load is larger than that of the regular programme: the Top and MEME Programmes have been designed for 'excellent students'. The courses are more demanding: students interact constantly with one another, their professors, fellow students and PhD researchers, while actively participating in projects and presentations. A clear structure facilitates such a diversity of work forms.

Students wishing to enter the Top Programme may apply freely. However, in many cases potential Top Programme students are approached by their teachers during their bachelor's programme. In some cases, they still prefer the regular track, for instance when their wish to specialise in a certain area leads them away from the Top Programme's focus. If they do decide to apply, they address the Admissions Board. The Admissions Board judges each application according to past results and motivation, yet without strictly adhering to predetermined criteria. The panel is pleased to note that this task is no longer performed by the Board of Examiners, following a recommendation of the 2009 commission. It considers this selection process, in spite of its limited transparency, adequate.

Most often, MEME applicants are international students. In 2015-2016, only three out of over 20 students were Dutch. Their application is judged by the Admissions Board according to motivation, proficiency in English and academic background. In its conversations with students and alumni during the site visit, the panel gathered that some Top Programme students regretted having missed out on the opportunity to participate in the MEME programme due to its very early deadline (January). The panel considers it the responsibility of the individual student to investigate the options their own university offers. However, it stresses that these options should be communicated clearly to the students.

In *Marine Biology*, feasibility is one of the more challenging aspects of the programme. One reason for this is the broad and multidisciplinary nature of the field itself, which requires a wide variety of topics to be dealt with in the master courses. According to the panel, the various obligatory introductory courses at the start of the semester are a valuable addition. They provide a clear point of departure and help students get their bearings in the field. Another reason why feasibility is challenged is the fact that Marine Biology research often requires travel, in many cases across wide distances. Marine biologists also frequently depend on seasons and tides. All of these aspects can compromise study progress. The panel considers the master-apprentice setup very helpful in preventing such delays. Supervisors help establishing contacts and monitor progress in the case of a research project abroad. The panel considers this a sufficient guarantee of the feasibility of the programme.

The panel is positive about the feasibility of *Molecular Biology & Biotechnology* and *Biomedical Sciences*. Students follow a clearly outlined curriculum with limited options for variation.

Students in the 'Chemical Biology' track seem to encounter some problems in scheduling their study path: chemistry courses are spread throughout the programme, and students need to combine course work with research projects in order to finish their programme within two years. This demands a lot of planning from students and seems to be a factor in study delays.

The critical reflection notes an increase of student numbers due to the 'Biology of Ageing' track; a similar effect may occur after the new Nutrition and Health track has been unfolded entirely. The panel is confident that the programme will have no problem in handling this new influx, since the student-to-staff ratio is excellent (9:1). However, it suggests that the programme take care that the three tracks should not translate into three entirely separate blood groups within Biomedical Sciences. In order to stimulate the programme's coherence,



the panel suggests an obligatory master course for all students at the beginning of the first semester (see above).

In the case of *Medical Pharmaceutical Studies*, the panel highly appreciates the coherent and structured curriculum. It notes to its satisfaction that innovation, cross-disciplinarity and New Biology can clearly go hand in hand with feasibility and structure. Its one concern is the limited number of students opting for this master's programme. According to the critical reflection, this is due to the fact that the programme has to compete with the master's programme in Pharmacy. Students who follow the Pharmacy programme qualify to practice as a pharmacist in the Netherlands and can also enter into pharmaceutical research, whereas only the research option is open to students of Medical Pharmaceutical Sciences. MPS therefore draws students who are certain they do not want to become pharmacists, whose bachelor degree does not allow them to enter into the Pharmacy master's programme, or who are not sufficiently proficient in Dutch. The panel considers these issues, which were not entirely solved by the introduction of a tuition fee waiver, to be a consequence of the programme's tendency towards Pharmacy rather than Biology. It recommends the programme to reconsider its identity vis-à-vis both fields.

#### *Teaching staff*

The teaching staff of all master's degree programmes in Biology is embedded in research institutes. Almost all examiners hold a PhD degree, and half of them are full professors. Students are educated by active researchers within a research group, so that an academic environment is ensured. The student-to-staff ratio is 15:1 for Biology, Ecology & Evolution, Marine Biology, and Molecular Biology & Biotechnology, and 9:1 for Biomedical Sciences and Medical Pharmaceutical Sciences. Between the start and the end of 2015, the percentage of teaching staff holding a teaching qualification (BKO) was set to increase from 66 to 80%. All in all, the panel considers the teaching staff of the master's programmes a true asset.

For the *Biology* programme, the staff is mainly recruited from the other Life Sciences programmes. According to the panel, the track-specific behavioural biology staff is embedded in high quality research.

*Ecology & Evolution* staff has been operating within an enhanced international framework due to the recently added MEME programme. Based on a recent QANU research assessment, the panel concludes that the staff in the Ecology & Evolution programme is internationally renowned.

In the *Marine Biology* programme, the low number of staff was an important issue during the previous programme assessment. An impending retirement threatened the continuity of the programme. These issues have been solved. Marine Biology has formalised its relation with the Netherlands Institute for Sea Research (NIOZ), and has hired extra staff members from the NIOZ for a period of four years. Furthermore, the programme is embedded in a national framework. The didactic quality of staff members is ensured by the obligation to obtain a BKO at the outset. The panel appreciates these efforts. At the same time, it advises the programme to stay alert. Although tenure track staff members, who are now constrained in the time they can dedicate to teaching, should be free to teach more in the near future, another retirement is around the corner. The panel urges the programme to continue its search for a lasting solution to its staffing issues.

As mentioned before, staff members of the *Biomolecular and Biotechnology* programme are excellent researchers. The panel considers them – in line with the recent research review – to

be at the top of their discipline. At the same time, staff members are very willing to contribute to the education in their research domain.

The panel established that the teaching staff of *Biomedical Sciences* and *Medical Pharmaceutical Sciences* is adequate and firmly embedded in research institutes. It concludes that the staff of these programmes possesses the quality and expertise to provide a solid biomedical education and prepare students for a future in research.

#### *Facilities*

The panel considers the facilities for students of the six biology master's programmes to be good. The students of *Medical Pharmaceutical Sciences* and *Biomedical Sciences* have access to all the equipment and facilities of the UMCG university hospital. Moreover, the students of the Biology of Ageing track of Biomedical Sciences benefit from the research environment of the European Research Institute for the Biology of Ageing (ERIBA) and the students of *Medical Pharmaceutical Sciences* have access to the facilities of pharmacy research at the FMNS. During the site visit, the panel was taken on a guided tour through their 2013 building, attached to the UMCG. It was pleased to note its state-of-the-art facilities in open-plan surroundings.

In 2010, the staff of the other four programmes moved from the Biological Centre in Haren to the Zernike campus. The panel appreciates this move, since it eliminates the physical distance between Biology and other, neighbouring disciplines and stimulates interdisciplinarity. The panel praises the facilities biologists have access to at the Zernike campus.

The panel is pleased with the existence of the field station on Schiermonnikoog, which enables students of *Ecology & Evolution* and *Marine Biology* to conduct field research nearby. It is particularly impressed with the facilities for Marine Biology students. An international structure is in place which enables them to go abroad for their research, thanks to the programme's excellent connections. Students can be certain of the necessary equipment being available when they venture abroad. Research facilities and international connections for students from Molecular Biology and Biotechnology are excellent as well.

### **Considerations**

#### *General*

The panel judges the Groningen master's programmes to be well-structured, with a research profile leading up to a PhD entry level and a Science Business and Policy (SBP) profile oriented towards a career outside academia. It assesses the mentoring system, where students are guided throughout their master's programme by a staff member, as uniquely suited to prevent study delay. The mentors combine strong didactic and research expertise. The panel is also pleased with the choice to 'embed' students in a research group during their first research project. It has noted to its enthusiasm that the ethical and societal dimensions of the Life Sciences are markedly present in the curriculum. Academic skills are clearly taught, though the panel would recommend paying attention to these from the start of the first semester. It also thinks a general joint course at the outset of the programmes would strengthen insight into width and developments of the biological field and serve to reinforce the students' identity as modern biologists, prior to specializing in their own programme.

#### *Biology*

The panel appreciates the freedom students have in the Biology programme. They can combine knowledge from different disciplines and develop as generalist biologists. However,



an introductory module demonstrating to them the broad impact of and current trends in this field could strengthen this profile and at the same time help students choose a relevant and coherent study path. According to the panel, the Behaviour and Neuroscience track has a good balance between freedom and pre-structured course options that are provided by top researchers.

#### *Ecology & Evolution*

In the eyes of the panel, Ecology & Evolution distinguishes itself through the breadth of subjects offered in the regular programme. Above all, it praises the Top and MEME programmes, which give students the unique opportunity to be educated in an international setting. The Ecology & Evolution staff is leading in this field, and the research institute GELIFES offers a cross-disciplinary research environment for staff and students alike. Feasibility within this necessarily flexible programme, where field research frequently has a seasonal dimension, is ensured by the mentoring system. The panel considers this master's programme unique in the Netherlands and of very high quality.

#### *Marine Biology*

The panel applauds the Marine Biology master's programme for the restructuring it has initiated since the last assessment in 2009. Staffing issues have been solved at least temporarily, and the curriculum has been strengthened by three introductory courses which were transferred from the bachelor's programmes to this master's programme. The panel has noted that these courses still seem to reflect their origin and can gain in depth. It recommends the programme to adapt them accordingly. It is positive, however, about the addition of these courses, since they provide structure to the students' programme and increase feasibility. The panel is glad to see that new teaching staff has been attracted through a collaboration with the NIOZ institute. However, it is not convinced that staffing issues now belong to the past entirely, and urges the programme to design a permanent solution. The panel considers Marine Biology in Groningen to be a uniquely broad programme with excellent facilities both on campus and abroad. It is confident that the new direction it has chosen will lead to even greater improvement in the near future.

#### *Molecular Biology & Biotechnology*

The panel concludes that the Molecular Biology & Biotechnology programme is offering students excellent opportunities to develop themselves as independent researchers in a field that through its interdisciplinary character is exemplary of New Biology. The curriculum is well-structured, and the international nature of the programme is reinforced by the Top programme that attracts a lot of international students. Staff members of this programme are active researchers whom the panel considers internationally leading. Accordingly, the quality of the courses and research projects is high.

#### *Biomedical Sciences*

According to the panel, Biomedical Sciences offers its students a coherent programme in a solid research environment. It considers the programme's master courses to be rather traditional in nature, lacking coherence or a more integrative approach. Due to the recently added Biology of Ageing track, the programme really distinguishes itself, unfolding its full potential and choosing an approach exemplary of New Biology. Biomedical Sciences benefits from the state-of-the-art facilities of the ERIBA ageing institute and offers students in this track a unique preparation in health research. The panel is convinced that the Nutrition and Health track, which is now being added, will be set up along similar lines and will thus contribute to the quality of the programme as a whole.

### *Medical Pharmaceutical Sciences*

The panel is impressed with the fact that Medical Pharmaceutical Studies combines a core curriculum of courses with a distinctly innovative and integrative approach, connecting Biology to Pharmacy and Medicine. It finds the programme both coherent and challenging, which it considers quite an accomplishment. Students are introduced to the field and their cohort through an obligatory course. They acquire the necessary knowledge through a limited set of courses and develop their research skills within the university hospital's quality research framework. However, the panel is concerned about the low number of students entering this programme. This appears to be caused by the presence of Pharmacy as a competing master's programme. The panel advises the programme to reconsider its identity within the field of Life Sciences and, for example, to intensify collaborative research activities with related Life Science groups in order to attract the attention of non-pharma students.

### **Conclusion**

*Master's programme Biology:* the panel assesses Standard 2 as **satisfactory**.

*Master's programme Ecology & Evolution:* the panel assesses Standard 2 as **good**.

*Master's programme Marine Biology:* the panel assesses Standard 2 as **satisfactory**.

*Master's programme Molecular Biology & Biotechnology:* the panel assesses Standard 2 as **excellent**.

*Master's programme Biomedical Sciences:* the panel assesses Standard 2 as **good**.

*Master's programme Medical Pharmaceutical Sciences:* the panel assesses Standard 2 as **good**.

**Standard 3: Assessment**

The programme has an adequate assessment system in place.

**Explanation:**

The tests and assessments are valid, reliable and transparent to the students. The programme's examining board safeguards the quality of the interim and final tests administered.

**Findings**

In 2013, the Faculty of Mathematics and Natural Sciences adopted its current assessment policy. Following this policy, all programmes in the Faculty formulated an assessment plan. In the assessment plan, each of the master's degree programmes discussed in this report provided an overview of their learning objectives, intended learning outcomes, examiners, and assessment modes, and described the relationship between all of these elements. The plan also specified the persons and parties responsible for the various aspects. The panel is positive about this policy. It is particularly pleased with the fact that a Course Unit Assessment Overview (CUAO) has to be provided for each course by the responsible lecturer. This CUAO describes the relationship between course content, learning objectives, assessment mode and final qualifications. The Faculty has hired an assessment expert to support teachers in the creation of CUAOs. Students have access to relevant information from the CUAOs in the online study guide.

The master's programmes have two separate Boards of Examiners (BoE). One is shared by Biology, Ecology & Evolution, Marine Biology and Molecular Biology & Biotechnology. This BoE has four members, representing the four programmes, as well as a chair and a secretary. A separate BoE exists for Biomedical Sciences and Medical Pharmaceutical Sciences. This BoE also consists of members representing the programmes, a chair and a secretary. The BoEs appoint both the examiners and the study mentors, and approve the students' individual curricula. They also grant the students approval to carry out research projects, based on the quality and feasibility of the proposals they hand in. The panel is glad to see that this procedure has also been adopted for the SBP internships following a recommendation from the 2009 assessment. The BoEs also guarantee the quality of assessment through sampling and evaluating theses and research reports, and discussing their grading.

The panel is impressed with the formalization of assessment procedures which has been undertaken since the previous assessment, in 2009. The system is now uniform and comparable for all of the separate programmes. Moreover, the panel observes that the assessment policy has not merely been formulated; it has been implemented in full. The system functions well and the teaching staff has internalised the underlying principles. Staff members have embraced the use of assessment forms and complete them conscientiously and in detail. A second supervisor has become the standard in assessing research papers and theses.

The panel finds that the forms of assessment (written assignments or essays, reports, oral presentations) match the level of the master's programmes. The quality of assessment of research projects and internships outside the university is guaranteed through placing responsibility with a staff member rather than the external supervisor. The Board of Examiners oversees the procedure and checks the results. In the eyes of the panel, this method is sufficient to guarantee the correct assessment of these projects.

The panel applauds the BoEs of the Groningen Life Sciences master's programmes for their proactive attitude. They perform checks on theses during regular one-day board sessions.

Problematic cases are thoroughly examined and the result of these deliberations is communicated to the lecturer involved. If necessary, the BoE informs the Faculty or programme management.

The BoEs' sessions and meetings also give rise to discussion and evaluation of procedures and practices. The panel appreciates this proactive attitude of continuous improvement. In a recent example, the Boards found assessment forms to be deficient. Individual research projects were assessed using rather unspecific forms which did not require the examiners to motivate their assessment in full detail. These forms are now being redesigned. Another issue, raised by the non-medical Board of Examiners, has been the compatibility of the Erasmus Mundus (MEME) programme with the requirements of a Groningen master's degree. MEME students were not obliged to participate in a colloquium, the status of the essay was unclear and the summer school programme preceding the first semester was still part of the curriculum. The BoE asked for an appendix to the Teaching and Examination Regulations to mend the ensuing inequality in diplomas. Now, the programmes run parallel, so that all MEME students who gain a degree in Groningen have reached the intended learning outcomes of the E&E programme.

### **Considerations**

The panel concludes that the assessment system functions well. The formalisation of the assessment policy through the use of CUAOs, standardized assessment forms and other means to guarantee the quality of assessment is a major improvement. Safeguarding the quality of a research project gets sufficient attention. Moreover, the policy is shared and supported by the teaching staff. The panel is particularly impressed with the performance of the Boards of Examiners, which it qualifies as professional and effective. The BoEs evaluate the assessment practice and initiate necessary changes. Their proactive approach contributes to lasting improvement and fine-tuning of the assessment system.

### **Conclusion**

*Master's programme Biology:* the panel assesses Standard 3 as **good**.

*Master's programme Ecology & Evolution:* the panel assesses Standard 3 as **good**.

*Master's programme Marine Biology:* the panel assesses Standard 3 as **good**.

*Master's programme Molecular Biology & Biotechnology:* the panel assesses Standard 3 as **good**.

*Master's programme Biomedical Sciences:* the panel assesses Standard 3 as **good**.

*Master's programme Medical Pharmaceutical Sciences:* the panel assesses Standard 3 as **good**.



#### **Standard 4: Achieved learning outcomes**

The programme demonstrates that the intended learning outcomes are achieved.

##### **Explanation:**

The level achieved is demonstrated by interim and final tests, final projects and the performance of graduates in actual practice or in post-graduate programmes.

#### **Findings**

The achieved learning outcomes of the six master's programmes in Life Sciences are made insightful through the results of the second research project and for SBP students in their report of the internship. The panel initially read six final reports for each of the master's programmes. The theses take the form of research reports or internship reports. The panel also studied the accompanying assessment forms, which provide grades for the written report, the oral presentation and the practical and theoretical work. The final grade is the average of these grades.

The panel established that the level demonstrated in the final reports of *Biology* students is adequate. All students demonstrate the ability to conduct research at a master's level. According to the panel, one report of very high quality, written by a student from the Behaviour & Neuroscience track, demonstrates that this track offers students the possibility to excel. Although one thesis was over-graded in the eyes of the panel, the other grades the examiners gave the final products match the grades of the panel.

After reading the theses of *Ecology & Evolution*, the panel concluded that in most cases the achieved level is good and in many cases in line with or exceeding the level expected at the completion of a master's degree. The hypotheses are clearly formulated, the structure is logical and the analysis tends to show in-depth understanding of the subject under discussion. However, the panel encountered one thesis it judged to be clearly deficient. An extraordinarily concise description of a highly traditional research project performed abroad was awarded an excellent grade. After being informed about the panel's findings, the BoE investigated this matter and agreed with the panel that the report was not sufficient. The BoE concluded in this case that the external supervisor's grade had been accepted uncritically. It could find no similar cases among the theses supervised by the internal examiner in question. In order to verify whether the case should be considered as an incident, the panel read nine additional theses and concluded their level was unequivocally satisfactory and in many cases high. It therefore looks upon the deficient thesis as a non-representative outlier. The panel even encountered a MEME thesis graded with a 10. The panel found this exceptionally high score to be fully justified, and was pleased to learn that the thesis had led to a publication in a leading peer reviewed journal.

The panel finds that the *Marine Biology* theses achieve the required level and that their grading is generally correct. However, it considers the methods employed to be rather traditional. It also noted that the theses tend to favour description over analysis. The panel feels that those theses reflect the difficult period Marine Biology has been experiencing. It is fully confident that the curricular and organizational reforms, which have only just been completed, will lead to improvement of the achieved learning outcomes.

The theses of *Molecular Biology and Biotechnology* generally demonstrate the high level that could be expected from students functioning in the excellent research environment this programme provides. The panel read an excellent thesis, but also a few theses that did not quite live up to the high expectations. Those theses were based on research carried out respectively at the

UMCG and at a company. According to the panel, their level is satisfactory, but they lack the depth and thoroughness of the others. The panel concludes that in general, the final level of the master's programme is high.

The second research reports of *Biomedical Sciences* demonstrate a high level, which the panel finds all the more impressive since many of them were written based on a research project abroad. The theses are generally well-written and coherent, presenting in-depth analysis and a clear awareness of the current developments in the field. The panel agrees with the grades they received.

The theses of *Medical Pharmaceutical Sciences* impressed the panel in general due to their decidedly academic and analytical approach. It notes that in many cases, students apply statistical methods without explaining their choice of method. However, the panel considers the methods and results used to be well-chosen and well-executed. The panel agrees with the grading of the projects. It finds that the achieved learning outcomes both reflect and confirm the quality of the programme.

According to the critical reflection, about half of the programmes' alumni end up as PhD students. The panel considers this a high percentage, which is indicative of the overall impressive achieved learning outcomes of all the programmes.

### Considerations

The panel concludes that the level achieved in the second research projects is adequate and in most programmes high in general. The theses demonstrate a markedly academic attitude and understanding. They also testify to considerable skill in executing research and reporting on it. The panel also finds that the awarded grades generally match its own evaluations. According to the panel, students from the Biology programme do not seem to systematically surpass the expected level of Biology master graduates. In the case of Marine Biology, the panel found the theses to be overly descriptive. It is confident that the newly made changes will make themselves felt positively in the future.

### Conclusion

*Master's programme Biology*: the panel assesses Standard 4 as **satisfactory**.

*Master's programme Ecology & Evolution*: the panel assesses Standard 4 as **good**.

*Master's programme Marine Biology*: the panel assesses Standard 4 as **satisfactory**.

*Master's programme Molecular Biology & Biotechnology*: the panel assesses Standard 4 as **good**.

*Master's programme Biomedical Sciences*: the panel assesses Standard 4 as **good**.

*Master's programme Medical Pharmaceutical Sciences*: the panel assesses Standard 4 as **good**.

### General conclusion

The panel concludes that the learning outcomes of all programmes meet the (inter)national demands, but are rather generic. However, the panel is impressed with the assessment system in place for all programmes, and particularly with the proactive and professional attitude of the Boards of Examiners. For all programmes, it assesses Standard 1 as satisfactory and Standard 3 as good.

The teaching-learning environment of the master's programme *Biology* meets the quality standards in all respects, but apart from the track Behaviour and Neurosciences, it lacks a structure which provides students with the focus they need to reach a high level. This is reflected by the merely decent quality of the theses the panel studied – again, with the

exception of one thesis from the B&N track. In line with the decision rules for limited programme assessments, the panel assesses the quality of this programme as satisfactory.

Due particularly to the MEME and Top programmes, the master's programme *Ecology and Evolution* provides students with good opportunities to pursue their research interests in ambitious, international environments, embedded in a very good research environment. The resulting theses live up to the high expectations. In line with the decision rules for limited programme assessments, the panel assesses the quality of this programme as good.

The master's programme *Marine Biology* has successfully reformed its curriculum and found at least temporary solutions to staffing issues. The panel is convinced that these efforts will allow students to reach a higher level in the near future. Currently, the achieved learning outcomes as shown by theses is adequate, but does not surpass expectations. In line with the decision rules for limited programme assessments, the panel assesses the quality of this programme as satisfactory.

The panel was particularly impressed with the teaching-learning environment of the master's programme *Molecular Biology & Biotechnology*. Its specializations are excellent expressions of New Biology; it succeeds in attracting a substantial number of students from abroad; and its Top programme creates a stimulating environment for students. Its staff is internationally recognized as leading. Accordingly, the theses show a high level of achievement, although they do not reach the excellence that might be expected. Therefore, the panel assesses Standard 2 as excellent, Standard 4 as good and the programme as a whole as good.

The panel assesses the teaching-learning environment of the master's programme *Biomedical Sciences* as satisfactory, based on its solid but traditional courses and the fact that the programme is in want of a more integrative approach. However, it also notes that the curricula are currently evolving in exciting new directions, thanks to the introduction of the Biology of Ageing track and the Nutrition and Health currently being added. Furthermore, the panel is impressed with the quality of the second research reports it studied, which show the students' ability to provide in-depth analysis, their awareness of current developments in the field and their ability to independently perform research in an international environment. The panel assesses Standard 4 as good and, in line with the decision rules, also assesses the programme as a whole as good.

The master's programme *Medical Pharmaceutical Sciences* has developed a distinctive and integrative approach, connecting Biology to Pharmacy and Medicine. The panel assesses the programme's teaching-learning environment as good: given its interdisciplinary nature, the programme succeeds in providing a coherent and challenging curriculum that deserves to attract more students. The programme's achieved learning outcomes confirm its quality: students show a strong academic and analytical approach, resulting in theses that are well executed based on well-chosen methods. In accordance with the decision rules, the panel assesses the programme as a whole as good.

## Conclusion

The panel assesses the *master's programme Biology* as **satisfactory**.

The panel assesses the *master's programme Ecology & Evolution* as **good**.

The panel assesses the *master's programme Marine Biology* as **satisfactory**.

The panel assesses the *master's programme Molecular Biology & Biotechnology* as **good**.

The panel assesses the *master's programme Biomedical Sciences* as **good**.

The panel assesses the *master's programme Medical Pharmaceutical Sciences* as **good**.





## Appendices



## Appendix 1: Curricula vitae of the members of the assessment panel

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**Prof. dr. J.W. (Jan) Kijne** is Professor emeritus of BioScience at Leiden University. He studied Biology in Leiden and obtained his PhD in 1979 under supervision of Prof. Ton Quispel. In his dissertation, Kijne studied the symbiotic nitrogen-fixing root nodules of the pea, a theme which remained a main focus in his further research. He was Professor of Fytotechnology (in collaboration with TNO, 1994-1997), Plant Physiology (1997-2006) and BioScience (2006-2010) in Leiden, and visiting Professor of Microbiology at the University of Tromsø, Norway (1995-2000). At Leiden University, Kijne also acted as programme director of Biology (1996-2002), as vice-dean of the Faculty of Science holding the Education Portfolio (2002-2008), and as Academic Director of the Pre-University College (2004-2008). In 2009-2010, Kijne was chair of the panel which assessed nineteen programmes in Biology at five Dutch universities. Students named him Teacher of the Year in Biology and Life Science & Technology.

**Prof. dr. A.H.J. (Ton) Bisseling** is Full Professor and head of the Laboratory of Molecular Biology at Wageningen University. He studied Biology in Nijmegen and obtained his PhD at the Department of Molecular Biology of Wageningen University. After holding a number of scientific positions there, he was appointed to his current chair in Molecular Biology in 1998. Bisseling is member of numerous Editorial Boards of international journals, including *Plant Biology* and *Science*. He is a member of the Royal Netherlands Academy of Arts and Sciences, and member of its Council for Earth and Life Sciences.

**Prof. dr. S.M. (Marieke) van Ham** is Professor of Biological Immunology at the University of Amsterdam and Head of the Department of Immunopathology at Sanquin Blood Supply, Amsterdam. She studied Medical Biology at the University of Amsterdam, where she subsequently obtained a PhD for her research on bacterial vaccine components. After holding scientific positions at the Imperial Cancer Research Fund in London, the Netherlands Cancer Institute in Amsterdam and VU University Medical Center Amsterdam, she joined Sanquin in 2003. In 2005, she was appointed Head of the Department of Immunopathology, with a staff of about 60 people. She has occupied her current chair in Biological Immunology at the University of Amsterdam since 2010. In that capacity, she designs and coordinates immunology curricula for the bachelor's and master's programmes in Biomedical Sciences.

**Prof. dr. M.J. (Joost) Teixeira de Mattos** is Professor of Quantitative Microbial Physiology at the University of Amsterdam and co-founder of Photanol BV. Teixeira de Mattos studied Chemistry at the University of Amsterdam, and obtained his PhD in Chemistry there in 1984. He held a number of scientific positions before being appointed Full Professor in 2007. Throughout his career, Teixeira de Mattos has been actively involved in education, teaching subjects in biochemistry, microbiology and biotechnology in programmes ranging from Chemistry to Computer Science. He received the Dupont Award for Higher Education, and was chosen by students as Teacher of the Year in Chemistry (twice) and in Biology. Teixeira de Mattos has also been a member of the Education Advisory Boards in Chemistry and Biology/Biotechnology and of the Boards of Examiners in Chemistry and Life Sciences.

**Prof. dr. H.A. (Herman) Verhoef** is Professor emeritus of Soil Ecology at VU University Amsterdam. He holds a master's grade and a PhD in Biology, both obtained at VU University, where he was appointed Associate Professor in Animal Ecophysiology in 1986. In 1992, he changed to an Associate Professorship in Soil Ecology, and was subsequently appointed Full Professor in this specialisation in 2003. Next to his academic career, Verhoef has held a number of social positions at VU University, chairing the Advisory Board on Higher Education HOVO and the Advisory Board on Internationalisation, and acting as auditing member of several Faculty Audits.

**Dr. M.J. (Maarten) van der Smagt** is Associate Professor at the Experimental Psychology division of the Faculty of Social and Behavioural Sciences at Utrecht University. He studied Biology at Utrecht University, where in 1999 he obtained his PhD (cum laude) for his research on *Integration and Segregation Mechanisms of Human Motion Vision*. He was post-doctoral research associate at the Vision Center Laboratory of the Salk Institute for Biological Studies in La Jolla, California (US) until his appointment as Assistant Professor at the Experimental Psychology division in Utrecht (2002). In 2012, he was made Associate Professor. Van der Smagt was a member of the Education Committee of the Helmholtz Research School for Brain and Cognition, and coordinator of the PhD programme in Cognition and Behaviour at the Graduate School for Life Sciences. In his current position, his duties include educational management and coordination. He is currently co-director of the master's programme Artificial Intelligence and Educational Coordinator of the Experimental Psychology division.

**Dr. A. (Andries) Ter Maat** is research scientist and group leader in Neurophysiology of the Departement of Behaviour Neurobiology at the Max Planck Institute for Ornithology in Seewiesen (Germany). He studied Biology at VU University Amsterdam, where he also obtained a PhD in Neurosciences. After holding a position as researcher at ZWO (predecessor of the Netherlands Organisation for Scientific Research NWO) and several scientific positions at VU University, he was appointed in his current position at the Max Planck Institute in 2005. Ter Maat is experienced in academic education, both in the Netherlands and Germany. In Seewiesen, he currently teaches master's level courses and supervises master and PhD projects.

**J. (Jeffrey) Verhoeff BSc.** Is a master's student in Biology and Animal Sciences at Wageningen University. In 2013, he obtained his bachelor's degree in Biology, also at Wageningen University. Verhoeff has been a member of the Dutch national council of Biology students (Landelijk Overleg Biologie Studenten, LOBS) since 2013, and has acted as its chair since 2015. He is member of the Board of the Dutch Institute for Biology (Nederlands Instituut voor Biologie, NIBI). Since 2012, Verhoeff has been working as a student-assistant at Wageningen University, acting as a teaching assistant in a number of courses and co-organizing Open Days for prospective students.



## Appendix 2: Domain-specific framework of reference

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### Domain-specific framework of the masters' programme in Biology

The domain of biology concerns life and its environment: the complete integrated system of biological entities in which regulation, interaction, communication, heredity and evolution are the central concepts. The coherence and dynamics of all these entities, therefore, should be the central themes in every Biology programme. Recently (or the last two decades), biological sciences have experienced tempestuous (booming) developments that have led to a more profound understanding of the dynamics of life and the structural and functional mechanisms that lie at its basis. In this process, integration with other disciplines such as mathematics, physics, chemistry, informatics, and earth sciences has shown to be crucial. Moreover, biology has become an integral science indispensable in the practice of resolving societal issues such as sustainable food production, conservation of biodiversity and the development of "green energy" resources. Biology in the Netherlands plays a key role in the preservation and further reinforcement of the strong international position of the top sectors.

The rapid development of the biological sciences and the plethora of positions for which biologists are required, force biological educational programmes to prepare students for jobs in fundamental research, applied research and technology, communication and policy; both in biology as well as in adjacent scientific fields. More than ever, biology demands the competence to deal with the dynamics and complexity at various levels of organization, such as molecules, cells, organisms, populations, communities and ecosystems. Furthermore, students need to achieve excellent academic skills in scientific writing, oral presentation, critical reading of scientific literature, self-reflection and teamwork.

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. In each of these specialisations at least one research component is incorporated. After completion of the masters' programme, students are well equipped to follow a biologically oriented PhD trajectory or to obtain other positions of academic level related to biology.

#### Demands of (international) colleagues and the professional environment

Biological master programmes have a long and world-wide tradition as a central discipline. In the course of time, attention has shifted from capitalizing factual knowledge in mono-disciplines to the integration of the levels of organization and disciplines. 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 his or her choice for a specialized PhD trajectory, or for another position at the labour market within the area of policy/administration, management, education or communication.

The institutions offering a biologically oriented MSc in the Netherlands participate in the 'Overlegorgaan Hoger Onderwijs Biologie' (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. Dutch masters' programmes in biology have a good international reputation. 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;
- 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 specialisation.

### Appendix 3: Intended learning outcomes

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After completion of the master's degree programme, the student:

1. Biology (B): has acquired in depth knowledge on one or more scientific disciplines within the general field of Biology and can use this knowledge to explain in detail the relevant concepts, using the appropriate terminology.

1. Ecology & Evolution (EE): has acquired in depth knowledge on one or more scientific disciplines within the field of Ecology and Evolution and can use this knowledge to explain in detail the relevant concepts, using the appropriate terminology.

1. Marine Biology (MB): has acquired in depth knowledge on one or more scientific disciplines within the field of Marine Biology and can use this knowledge to explain in detail the relevant concepts, using the appropriate terminology.

1. Molecular Biology & Biotechnology(MBB) has acquired in depth knowledge on one or more scientific disciplines within the field of Molecular Biology & Biotechnology and can use this knowledge to explain in detail the relevant concepts, using the appropriate terminology.

1. BioMedical Sciences (BMS): can explain in detail, using appropriate terminology, how molecular and cellular biology or integrative physiology and behaviour, and/or medical or pharmaceutical sciences interrelate, and use this to acquire in depth knowledge on the etiology and pathophysiology of disease and maintenance of health.

1. Medical Pharmaceutical Sciences (MPS): can explain in detail, using appropriate terminology, how molecular and cellular biology or integrative physiology and behaviour, and/or medical or pharmaceutical sciences interrelate, and use this to acquire in depth knowledge on applying therapeutic drug intervention, covering the whole range of drug development disciplines from basic drug and target discovery, to pharmacoepidemiology and post marketing surveillance.

2. can design and conduct scientific research.

3. can independently investigate and critically evaluate scientific literature.

4. can identify new developments in the relevant disciplines, and can become familiar with these developments.

5. can systematically organize his/her work in scientific research and formulate realistic and original solutions to complex problems.

6. can participate in and contribute to a multidisciplinary team.

7. can effectively communicate acquired knowledge, insights and skills to others, both in writing and in oral presentation.

8. can identify societal and ethical implications of scientific research and is able to critically reflect on his/her actions in this context.

9. can independently acquire new knowledge and skills that are relevant for his/her professional career, in science, in policy & management or society.





## Appendix 4: Overview of the curriculum

All programmes:

Schematic overview:

|                  |  |                        |                        |               |
|------------------|--|------------------------|------------------------|---------------|
| 3                | Teaching qualification   | Teaching qualification | MSc                    |               |
| 2                | SBP profile  | Research profile       | Teaching qualification | Communication |
| 1                | All programmes: research project:<br>40 EC                      40 and 30 EC                      30 EC  |                        |                        |               |
| Year             |  |                        |                        |               |
| Degree Programme | <ul style="list-style-type: none"> <li>- Biology Ecology and Evolution</li> <li>- Marine Biology</li> <li>- Molecular Biology &amp; Biotechnology</li> <li>- Biomedical Sciences</li> <li>- Medical Pharmaceutical Sciences</li> </ul> |                        | EC master              |               |

Overview of the SBP-profile:

| Study elements                          | Credits |
|---|---------|
| Research project                        | ≥ 40 EC |
| Module science & policy                 | 10 EC   |
| Module science & business               | 10 EC   |
| Internship science, business and Policy | 40 EC   |
| Master courses*                         | 5 EC    |
| Colloquium                              | 5 EC    |
| Electives*                              | ≤ 10 EC |

Master's programme Biology (Research-profile):

| Study Elements   | Credits |
|------------------|---------|
| Research project | ≥ 40 EC |
| Research project | ≥ 30 EC |
| Master courses   | 20 EC   |
| Essay            | 5 EC    |
| Colloquium       | 5 EC    |
| Electives        | ≤ 20 EC |

Master's programme Marine Biology (Research profile):

| Study elements                                     | Credits |
|--|---------|
| Research project                                   | ≥ 40 EC |
| Research project                                   | ≥ 30 EC |
| Master courses:                                    | 20 EC   |
| - Principals of Biological Oceanography, 5 EC      |         |
| - Principals of Marine Biology, 5 EC               |         |
| - Principals of Marine Conservation, 5 EC          |         |
| - Master courses from the list in chapter B8, 5 EC |         |
| Essay  | 5 EC    |
| Colloquium   | 5 EC    |
| Electives  | ≤ 20 EC |

Master's programme Ecology and Evolution

*Research profile:*

| Study elements   | Credits |
|------------------|---------|
| Research project | ≥ 40EC  |
| Research project | ≥ 30 EC |
| Master courses   | 20 EC   |
| Essay            | 5 EC    |
| Colloquium       | 5 EC    |
| Electives        | ≤ 20 EC |

*Top Programme Ecology and Evolution:*

Students within the Top programme Evolutionary Biology generally follow the R-profile scheme but have to pass the following Top programme courses which are challenging both in content and time constraints:

|                                    |       |
|------------------------------------|-------|
| Evolutionary ecology research;     | 10 EC |
| Evolutionary theory;               | 10 EC |
| Genomics in ecology and evolution; | 10 EC |

In addition to these courses, two seminar series of 2 EC each are required.

*Erasmus Mundus programme Evolutionary Biology (MEME) (Research profile):*

| Study elements  | Credits |
|---|---------|
| Compulsory set of master courses Groningen (or Uppsala) | 30 EC   |
| Master courses Munich/Montpellier                       | 15 EC   |
| Electives   | ≤ 10 EC |
| Research project 1                                      | ≥ 30 EC |
| Research project 2                                      | ≥ 30 EC |
| Colloquium  | 5 EC    |
| Summer schools (2*2.5) extracurricular                  |         |
| Total:  | 120     |

Master's programme Molecular Biology and Biotechnology

*Research profile:*

| Study elements   | Credits |
|------------------|---------|
| Research project | ≥ 40 EC |
| Research project | ≥ 30 EC |
| Master courses   | 20 EC   |
| Essay            | 5 EC    |
| Colloquium       | 5 EC    |
| Electives        | ≤ 20 EC |

*Top programme Biomolecular Sciences:*

Students within the Top programme Biomolecular sciences generally follow the R-profile scheme but have to pass 6 out of the following Top programme courses which are challenging both in content and time constraints:

- Advances in signal transduction; 5 EC
- Advanced Genomics and proteomics; 5 EC
- Organelle and membrane biogenesis; 5 EC
- Molecular dynamics and modelling of membranes and proteins ; 5 EC
- Protein and enzyme engineering by mutagenesis and directed evolution; 5 EC
- Advanced protein crystallography; 5 EC
- DNA microarray analysis; 5 EC
- Tools and approaches of systems biology; 5 EC

*Specialization Chemical biology:*

Students within the specialization Chemical biology generally follow the R-profile scheme but have to pass 4 of the following courses:

- Advanced protein crystallography; 5 EC
- Protein and Enzyme Engineering by Mutagenesis and Directed Evolution; 5 EC
- Advances in Chemical Biology; 5 EC
- Synthetic Biology & Systems Chemistry; 5 EC



## Master's programme Biomedical Sciences

### *Research profile:*

| Study elements   | Credits |
|------------------|---------|
| Research project | ≥ 40 EC |
| Research project | ≥ 30EC  |
| Master course    | 20 EC   |
| Essay            | 5 EC    |
| Colloquium       | 5 EC    |
| Electives        | ≤ 20 EC |

### *Biology of Aging track:*

| Study elements  | Credits |
|---|---------|
| Research project in ageing                                  | ≥ 40EC  |
| Research project in ageing                                  | ≥ 30EC  |
| Master courses:   | 20 EC   |
| - Current themes in healthy ageing (5 EC)                   |         |
| - Molecular biology of ageing & age-related diseases (5 EC) |         |
| - 10 EC of a selection of courses from list A               |         |
| Essay   | 5 EC    |
| Colloquium  | 5 EC    |
| Electives   | ≤ 20 EC |

### *Course list A (Biology of Aging track):*

| Master Courses                             | Credits |
|--|---------|
| Advanced metabolism & nutrition            | 5 EC    |
| Neurodegenerative diseases                 | 5 EC    |
| Immunology: from bench to bedside and back | 5 EC    |
| Stem cells and regenerative medicine       | 5 EC    |

## Medical Pharmaceutical Sciences:

### *Research profile:*

| Study elements           | Credits |
|--------------------------|---------|
| Research project         | ≥ 40 EC |
| Research project         | ≥ 30 EC |
| Master courses:          | 20 EC   |
| - Drug development (5EC) |         |
| Essay                    | 5 EC    |
| Colloquium               | 5 EC    |
| Electives                | ≤ 20 EC |



*Toxicology and drug disposition track:*

| Study elements                     | Credits |
|------------------------------------|---------|
| Research project in ADME-Tox       | ≥ 40 EC |
| Research project in ADME-Tox       | ≥ 30 EC |
| Colloquium                         | 5 EC    |
| Essay                              | 5 EC    |
| Electives                          | ≤ 20 EC |
| Master courses:                    | 20 EC   |
| - Drug development (5 EC)          |         |
| - Molecular toxicology (5 EC)      |         |
| - Advanced pharmacokinetics (5 EC) |         |
| - 5 EC selected from list A        |         |

*List A (Toxicology and drug disposition track):*

| Master courses  | Credits |
|---|---------|
| Animal & human experimentation'<br>(or <sup>2</sup> handling laboratory animals for 4 ECTS) | 5 EC    |
| Innovative dosage forms   | 5 EC    |
| Pharmacovigilance   | 5 EC    |
| Clinical toxicology   | 5 EC    |
| Reproductive toxicology   | 5 EC    |

*Pharmaco-epidemiology track:*

| Study elements                            | Credits |
|---|---------|
| Research project in pharmaco-epidemiology | ≥ 40 EC |
| Research project                          | ≥ 30 EC |
| Colloquium                                | 5 EC    |
| Essay                                     | 5 EC    |
| Electives (preferably from list B)        | ≤ 10 EC |
| Master courses:                           | 30 EC   |
| - Drug development (5 EC)                 |         |
| - Medical statistics (3 EC)               |         |
| - Basics in medicine (8 EC)               |         |
| - Pharmacoepidemiology UK' (5 EC)         |         |
| - Pharmacoepidemiology in practice (5 EC) |         |

*List B (Pharmaco-epidemiology track):*

| Master courses                | Credits |
|-------------------------------|---------|
| Advanced pharmacoepidemiology | 5 EC    |
| Pharmaco-economics            | 5 EC    |
| Pharmacovigilance             | 5 EC    |
| Reproductive toxicology       | 5 EC    |



## Appendix 5: Programme of the site visit

| Maandag 16 november |       |   |  |
|---------------------|-------|---|--|
| 8.45                | 9.00  | <b>Aankomst panel (Linnaeusborg):</b><br>De heren M.H.K. Linskens en L.P.W.G.M. van de Zande  |  |
| 9.00                | 12.30 | Voorbereidend overleg en inzien documenten, lunch   |  |
| 12.30               | 13.00 | <b>Gesprek met inhoudelijk verantwoordelijken Biologie-opleidingen</b><br>Adjunct-directeuren: de heren L.P.W.G.M. van de Zande, B.D.H.K. Eriksson, J. Kok<br>Opleidingscoördinatoren: de dames M. van Rijssel en G. Vasse<br>Studieadviseur: mevr. C.E.M. Weel   |  |
| 13.00               | 13.30 | <b>Gesprek met inhoudelijk verantwoordelijken Medisch-biologische opleidingen</b><br>Adjunct-directeuren: dhr. P. de Vos, mevr. G.M.M. Groothuis<br>Opleidingscoördinatoren: mevr. A. Kohl-Menage<br>Coordinator Science, Business & Policy profile: dhr. G.J.W. Euverink<br>Studieadviseur: dhr. W.N. van Egmond |  |
| 13.30               | 14.00 | <b>Gesprek met inhoudelijk verantwoordelijken Behavioural and Cognitive Neurosciences.</b><br>Adjunct-directeur: dhr. D.G.M. Beersma<br>Opleidingscoördinator: mevr. I.A. Neven<br>Studieadviseur: mevr. R.M. van der Kaaij   |  |
| 14.00               | 14.15 | Overleg panel   |  |
| 14.15               | 15.00 | <b>Gesprek met studenten bacheloropleiding Biologie</b><br>Mevr. W.E.A. van Guldener<br>Mevr. C.H. Lijcklama a Nijeholt<br>Mevr. J.R. Smit<br>Dhr. E.S. van Haeringen<br>Mevr. A.W. Jager   | <b>Gesprek met studenten bacheloropleiding Life Science and Technology</b><br>Mevr. I. Frenzt<br>Mevr. V. Snippe<br>Mevr. L.M. Wesselink<br>Dhr. J.H.D. de Boer<br>Dhr. S. Dantuma   |
| 15.00               | 15.30 | Overleg panel   |  |
| 15.30               | 16.15 | <b>Gesprek met docenten beide bacheloropleidingen</b><br>Dhr. B. Buwalda<br>Mevr. J. Falcao Salles<br>Dhr. M.H.K. Linskens<br>Dhr. R. Gosens<br>Dhr. G.J. Verkerke<br>Dhr. P. Heeringa  |  |
| 16.15               | 16.30 | Overleg panel   |  |
| 16.30               | 17.15 | <b>Gesprek met studenten research master BCN</b><br>Mevr. L. de Wit<br>Dhr. M.T. Egle<br>Mevr. J. Akkerman<br>Mevr. M.J. de Boer<br>Mevr. L. Nothdurft  | <b>Gesprek met studenten M Biomedical Sciences, Medical Pharmaceutical Sciences</b><br>Mevr. C.E. Hoeve<br>Mevr. A. Asselman<br>Dhr. M. Pratt<br>Dhr. T. Schut<br>Mevr. J.A. Reurink<br>Mevr. S. Mavrova<br>Mevr. J.E.M. Linneman<br>Mevr. B.H. Troost |
| 17.15               | 18.00 | <b>Alumni BCN</b><br>Mevr. A.S. Ramsteijn<br>Mevr. T. Buwalda<br>Mevr. M. Koopman<br>Mevr. S. Conroy<br>Dhr. F. Sense<br>Mevr. T. Beking  | <b>Overige Alumni</b><br>Dhr. M.A. Schenkel<br>Dhr. T.A. Middelburg<br>Dhr. C.P.M. Goedegebure<br>Mevr. M.B.G. Kiewiet<br>Mevr. V.Y. Starokozhoko<br>Mevr. S.A. Zwarthoff  |
| 18.30               |       | Diner panel   |  |

| <b>Dinsdag 17 november</b> |       |  |  |
|----------------------------|-------|--|--|
| 8.45                       | 9.00  | Aankomst panel   |  |
| 9.00                       | 9.45  | Inzien documenten, voorbereiding gesprekken  | Spreekuur  |
| 9.45                       | 10.30 | <b>Gesprek met docenten research master BCN</b><br>Dhr. H.W.G.M. Boddeke<br>Dhr. D.H. van Rijn<br>Dhr. A. Sarampalis<br>Mevr. M.E. Maan  | <b>Gesprek met docenten M Biomedical Sciences, Medical Pharmaceutical Sciences</b><br>Dhr. G.J. Poelarends<br>Mevr. I.A.M. de Graaf<br>Dhr. R.P.H. Bischoff<br>Mevr. M.M. Faas<br>Dhr. J.A.A.M. Kamps<br>Dhr. M.C. Nawijn<br>Mevr. E.A.A. Nollen |
| 10.30                      | 11.00 | Overleg panel  |  |
| 11.30                      | 12.15 | <b>Gesprek met studenten M Biology, M Molecular Biology and Biotechnology</b><br>Mevr. R. Schaake<br>Mevr. N.S. Eilander<br>Dhr. S. Heijningen<br>Dhr. B.M.H. Bruinink<br>Dhr. J.G. Edens<br>Dhr. S. Pontalti      | <b>Gesprek met studenten M Ecology and Evolution, M Marine Biology</b><br>Dhr. T. Ausma<br>Mevr. S.E. Galema<br>Dhr. R.J. Hein<br>Mevr. P. van der Werf<br>Mevr. S.L. Bedolfe<br>Mevr. M. van der Snoek<br>Dhr. T. Oosting                       |
| 12.15                      | 13.00 | Lunch, overleg panel   |  |
| 13.00                      | 13.45 | <b>Gesprek met docenten M Biology, M Molecular Biology and Biotechnology</b><br>Dhr. M.W. Fraaije<br>Dhr. P. Meerlo<br>Dhr. S. Verhulst<br>Dhr. P.J.M. van Haastert<br>Mevr. I.J. v.d. Klei<br>Dhr. L.W. Beukeboom | <b>Gesprek met docenten M Ecology and Evolution, M Marine Biology</b><br>Mevr. J.L. Olsen<br>Dhr. E.J. Stambuis<br>Dhr. F.J. Weissing<br>Mevr. B. Wertheim<br>Dhr. C. Both   |
| 13.45                      | 14.00 | Overleg panel  |  |
| 14.00                      | 14.45 | <b>Gesprek Opleidingscommissie BCN</b><br>Dhr. U.L.M. Eisel<br>Dhr. A.J.W. Scheurink<br>Dhr. K.S.F. Klaver<br>Mevr. H.F. Godthelp<br>Mevr. C.M. de Blecourt  | <b>Gesprek Opleidingscommissies</b><br>Dhr. P.K. Sharma<br>Dhr. C. Kapinga<br>Dhr. J.S. Lolkema<br>Mevr. L. Hielkema<br>Dhr. G. van Dijk<br>Mevr. A.L. Robijn  |
| 14.45                      | 15.30 | <b>Gesprek Examencommissie BCN</b><br>Dhr. M.R. Nieuwenstein<br>Dhr. W.F.A. den Dunnen<br>Dhr. J.C. Billeter<br>Mevr. I.A. Neven   | <b>Gesprek Examencommissies Biologie</b><br>Dhr. A.J.W. Scheurink<br>Dhr. D.J. Slotboom<br>Mevr. A.G.J. Buma<br>Dhr. E. Hak<br>Dhr. H.J. Haisma  |
| 15.30                      | 16.00 | Overleg panel  |  |



|       |       |  |
|-------|-------|--|
| 16.00 | 17.00 | <b>Gesprek met formeel verantwoordelijken + adjunct-directeuren</b><br><b>Formeel verantwoordelijken</b><br>Mevr. P. Rudolf, directeur Graduate School of Science<br>Dhr. J.T.M. Elzenga, directeur Undergraduate School of Science<br>Dhr. J. Knoester, decaan<br>Dhr. K. Poelstra, vice-decaan, portefeuillehouder onderwijs<br><b>Adjunct-directeuren</b><br>Dhr. L.P.W.G.M. van de Zande<br>Dhr. B.D.H.K. Eriksson<br>Dhr. J. Kok<br>Dhr. P. de Vos<br>Dhr. D.G.M. Beersma<br>Mevr. G.M.M. Groothuis |
| 17.00 | 17.45 | <b>Rondleiding Zernike-campus</b><br>De heren M.H.K. Linskens en L.P.W.G.M. van de Zande   |

|                             |       |  |
|-----------------------------|-------|--|
| <b>Woensdag 18 november</b> |       |  |
| 9.00                        | 9.45  | <b>Rondleiding UMCG</b><br>De heer P. de Vos |
| 9.45                        | 10.00 | Reistijd naar Zernike                        |
| 10.00                       | 15.00 | Opstellen voorlopige bevindingen             |
| 15.00                       | 15.30 | Mondelinge rapportage                        |



## Appendix 6: Theses and documents studied by the panel

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Prior to the site visit, the panel studied the theses of the students with the following student numbers:

### *Master's programme Biology*

|         |         |         |
|---------|---------|---------|
| 1687425 | 1813072 | 1648454 |
| 1618482 | 1487167 | 1616080 |

### *Master's programme Ecology & Evolution*

|         |         |         |
|---------|---------|---------|
| 2205602 | 1732498 | 1905384 |
| 2201925 | 2260743 | 2385554 |
| 2199270 | 1708058 | 2198118 |
| 2199440 | 1691368 | 1659367 |
| 1787284 | 1781499 | 2191628 |

### *Master's programme Marine Biology*

|         |         |         |
|---------|---------|---------|
| 1427032 | 2149656 | 1768646 |
| 1544152 | 1908731 | 1542478 |

### *Master's programme Molecular Biology & Biotechnology*

|         |         |         |
|---------|---------|---------|
| 1895567 | 2059460 | 2174480 |
| 1704338 | 2339900 | 2066726 |

### *Master's programme Biomedical Sciences*

|         |         |         |
|---------|---------|---------|
| 1275607 | 1764764 | 1683136 |
| 1771175 | 1871064 | 1815334 |

### *Master's programme Medical Pharmaceutical Sciences*

|         |         |         |
|---------|---------|---------|
| 1627791 | 2150794 | 2124327 |
| 1822500 | 2383942 | 2254867 |

During the site visit, the panel studied, among other things, the following documents (partly as hard copies, partly via the institute's electronic learning environment):

- Annual report of the Board of Examiners 2013-2014;
- Annual report of the Programme Committee 2013-2014;

- Literature, course manuals, exams and evaluation results of the following courses:
  - M Ecology & Evolution
    - Evolutionary Theory (MLBIB101B)
    - Molecular Methods in Ecology & Evolution (MLBI1201)
    - Genetics in Conservation & Ecology (WMLS13002)
  - M Marine Biology
    - Principles of Biological Oceanography (WMLS15007)
    - Mathematical Models in Ecology & Evolution (MLBIE08c)
    - Radioisotopes in Experimental Biology (MLAA03)
  - M Molecular Biology & Biotechnology
    - Synthetic Biology & Systems Chemistry (WMCH13002)
    - Advanced Imaging Techniques (MLBI0901)
    - Advanced Genetic Engineering (WMLS13003)
  - M Biomedical Sciences
    - Molecular Biology of Ageing and Ageing-related diseases (MLBMS08)
    - Immunology: From Bedside to Bench and Back (MLBMS05)
    - Tools & Approaches of Systems Biology (MLBB010)
  - M Medical Pharmaceutical Sciences
    - Pharmacoepidemiology (WMMP13001)
    - Molecular Toxicology (MLMPS06)
    - Farmaceutische biotechnologie (WMFA13002)