MASTER'S PROGRAMME
BIOMEDICAL SCIENCES

FACULTY OF SCIENCE

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This report was finalized on 29 November 2017

REPORT ON THE MASTER'S PROGRAMME BIOMEDICAL SCIENCES OF THE UNIVERSITY OF AMSTERDAM

This report takes the NVAO's Assessment Framework for Limited Programme Assessments as a starting point (September 2016).

ADMINISTRATIVE DATA REGARDING THE PROGRAMME

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:	Biochemistry and Metabolic Diseases; Cell Biology and Advanced Microscopy; Experimental Internal Medicine; Infection and Immunity; Oncology; Cellular and Network Science; Cognitive Neurobiology and Clinical Neurophysiology; Molecular Neuroscience; Psychopharmacology and Psychopathology
Location(s):	Amsterdam
Mode(s) of study:	full time
Language of instruction:	English
Expiration of accreditation:	31-12-2018

The visit of the assessment panel Biomedical Sciences to the Faculty of Science of the University of Amsterdam took place on 14 and 15 September 2017.

ADMINISTRATIVE DATA REGARDING THE INSTITUTION

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

COMPOSITION OF THE ASSESSMENT PANEL

The NVAO has approved the composition of the panel on 27 July 2017. The panel that assessed the master's programme Biomedical Sciences consisted of:

- Prof. John Creemers (Chair), Department of Human Genetics, Faculty of Medicine, KU Leuven, Belgium;
- Prof. Dirk Snyders, Department of Biomedical Sciences, Faculty of Life Sciences, University of Antwerp, Belgium;
- Prof. Erik Boddeke, Department of Neuroscience, Faculty of Medicine, University of Groningen;
- Dr. Annik Van Keer, Educational policy adviser, Faculty of Science, Utrecht University;
- Dr. André Van de Voorde, Manager-Consultant, AVBioconsult BvbA;
- Karlijn Van Boxtel (student-member), master student Biomedical Sciences, Utrecht University.

The panel was supported by dr. Jetje De Groof, who acted as secretary.

Appendix 1 contains the curricula vitae of the panel members.

WORKING METHOD OF THE ASSESSMENT PANEL

Preparation
The project manager of QANU met with staff members of the master's programme Biomedical Sciences on April 4 for a preparatory meeting. QANU received the self-assessment report of the master's programme Biomedical Sciences on June 16 and made it available on a secure online website. The panel members read the self-assessment and prepared questions, comments and remarks prior to the site visit. The secretary collected these questions in a document and arranged them according to panel conversation and subject.

In addition, all panel members read recent Research Projects and Literature Reviews from the master's programme. In consultation with the chair, fifteen theses were selected from the academic years 2014-2015 and 2015-2016, covering the full range of marks given and all specializations. The panel members also received the grades and the assessment forms filled out by the examiners and supervisors. An overview of all documents and theses reviewed by the panel is included in Appendix 6.

The secretary drafted a programme for the site visit. This was discussed with the chair of the panel and the programme director. As requested by QANU, the programme director carefully selected discussion partners. A schedule of the programme for the site visit with all partners is included in Appendix 5.

Site visit
The site visit took place on 14 and 15 September 2017 at the University of Amsterdam. In a preparatory meeting the panel members discussed their findings based on the self-assessment and on the theses and formulated the questions and issues to be raised in the interviews with representatives of the programme and other stakeholders.

During the site visit, the panel studied a selection of documents provided by programme. They included course descriptions, course materials, written exams, assignments and other assessments.

The panel interviewed the programme management, students, alumni, staff members, members of the Programme Committee and members of the Examinations Board. Prior to the site visit, both staff members and students were informed about the opportunity to speak to the panel confidentially during the 'consultation hour'. No requests were received for the consultation hour.

After the final meeting with the management, the panel members extensively discussed their assessment of the programme and prepared a preliminary presentation of the findings. The site visit was concluded with a presentation of these preliminary findings by the chair.

Report
After the visit, the secretary produced a draft version of the report. She submitted the report to the panel members for comments. The secretary processed corrections, remarks and suggestions for improvement provided by the panel members to produce the revised draft report. This was then sent to the University of Amsterdam to check for factual errors. The comments and suggestions provided by the programme management were discussed with the chair of the assessment panel and, where necessary, with the other panel members. After incorporating the panel's comments, the secretary compiled the final version of the report.

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

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

Unsatisfactory
The programme does not meet the generic quality standard and shows shortcomings with respect to multiple aspects of the standard.

Satisfactory
The programme meets the generic quality standard across its entire spectrum.

Good
The programme systematically surpasses the generic quality standard.

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

SUMMARY JUDGEMENT

Standard 1: Intended learning outcomes
The panel concludes that the exit qualifications of the master's programme Biomedical Sciences (BMS) of the University of Amsterdam (UvA) properly reflect the requirements of the domain-specific reference framework (DSR) and the Dublin Descriptors at the master's level. It greatly appreciates the focus of the programme on a particular subfield of the discipline, i.e. the molecular basis of Biomedical Science, whilst still offering the students a choice between a wide range of specialization options. It also endorses the programme's focus on New Biology and research-oriented education in top research institutes. The start of a double master's degree Biomedical Sciences/Medicine from 2017-2018 is a clear added value. The panel appreciates that each track has additional, specific exit qualifications. Yet it is also of the opinion that the link between the humanities, natural sciences and social sciences in the profile of the Biomedical Scientist can be made more explicit, both in the DSR and the exit qualifications. It recommends formulating exit qualifications that are common to all Dutch programmes and strongly advises performing a thorough national and international benchmarking. This exercise can then also inspire the programme to translate more adequately in the exit qualifications the distinction between students who go in more depth during the Research Projects and those who opt to broaden their profile in the majors or minor. The panel found that the programme takes into account requirements from the professional field in its exit qualifications.

The panel assesses Standard 1 as satisfactory.

Standard 2: Teaching-learning environment
The panel finds that the master's programme BMS has a clearly structured curriculum. It established that the small size of the tracks and the regular meetings between track coordinators ensure that the curriculum is coherent, notwithstanding the individual trajectories that students follow. It found that the broad choice offered to students in the nine tracks is an important point in its appeal. However, some students are not able to enrol in the track of their choice due to limited capacity. In this context, combining less popular with more popular tracks is one strategy to consider, thus reducing the number of tracks. Another possible route is reorienting the profile of some of the less popular tracks. The panel found that this issue is clearly on the radar of the programme.

The panel established that the exit qualifications of the programme have been adequately translated into components of the curriculum. However, the content and amount of Bio-informatics and (Big) Data Science can be improved. The panel welcomes the idea to offer new trajectories that combine wet-lab with Data Science skills. In addition, elements that make up the broad profile of the biomedical scientist (e.g. ethics, IP-related issues, project management) need to be more structurally embedded, preferably in an à-la-carte module that leaves students the flexibility to choose specific topics. The panel recommends the programme intensify its career development policy and ensure initiatives are implemented in all tracks.

The panel greatly appreciates the activating teaching-learning environment. The emphasis is on research internships using a master-apprentice model. The research internships are well organized, and the rules and regulations are clear and known to students. Nonetheless, the feedback from students on the quality of supervision should be monitored in a more systematic way. The panel welcomes the plans of the programme to structurally gather this feedback in a database. It ascertained that the quality and quantity of the lecturers are up to standard.

The panel appreciates that the programme has several options available for students who want to broaden their profile, such as the majors and the Tesla minor. It is especially positive about the Tesla minor because it finds its interdisciplinary focus very relevant, but also due to its size of 30 EC. This allows students to be part of a large 'common core' of the programme, while still giving them the option to broaden their profile. Conversely, the panel is not convinced that embedding 60

EC majors allows for enough space to establish a solid common core. A possible solution based on the Tesla minor would be to provide a curriculum with a common core (e.g. 90 EC), and offer 30-EC trajectories that lead to clear profiles (e.g. research, education, science and society, entrepreneurship). This is an issue for most BMS programmes in the Netherlands.

The panel appreciates that students are required to take responsibility for their own programme. Still the study delay and dropout of students requires a more proactive follow-up. The first steps have been taken to understand the causes of delays and dropout. The panel commends the programme for already starting to monitor students more actively. Still, the programme needs to step up its analyses so that a comprehensive strategy can be formulated and implemented. In addition, the panel recommends the programme continue to find ways to adequately communicate to the students the initiatives it is taking to improve the quality of the master's programme. Finally, the panel recommends the programme continue its efforts to attract more international students.

The panel assesses Standard 2 as satisfactory.

Standard 3: Student assessment
The BMS programme has a very solid assessment system. There is an elaborate assessment plan, with clear procedures ensuring that the assessment is valid, reliable and transparent. Regarding the validity of the assessment, the panel has ascertained that the assessment is representative of the intended learning outcomes and the course contents. Test matrices reveal clearly which learning goals are being assessed in which course component. The panel appreciates that the programme works with diverse assessment formats and found that the assessment supports active learning. The reliability of the assessments is also assured in different ways. Peer-review among lecturers is obligatory for the production of all exams. In those cases where presentations and writing are being evaluated, the programme uses standardized models. The rubric that will be implemented in the near future will ensure further consistency in grading and will act as a means to provide high-quality feedback to students. The panel is of the opinion that working with examiners from within the programme is very conducive to ensuring consistent grading of students who carry out projects in different labs with different supervisors. Still the panel recommends giving more equal relative weight to the different criteria that determine the final score in order to leave a smaller portion of the final grade to be decided by the supervisor/assessor. The introduction of the electronic monitoring system Datanose has improved the transparency of the grading procedure.

The panel found that the Examinations Board (EB) independently and proactively checks the validity and reliability of assessment. It approves the fact that the EB systematically checks the quality of assessment by inspecting exams and structurally follows up on the grading of Research Projects and Literature Reviews. The procedure can be further improved by reconsidering the way the sample is determined. The panel appreciates that the EB makes the final decision about whether students pass, based on their Personal Education Plans.

The panel assesses Standard 3 as good.

Standard 4: Achieved learning outcomes
The quality of the Research Projects consulted is good to very good and clearly illustrates that the graduates of the programme have amply achieved the intended learning outcomes. The fact that many students are accepted for internships at top research institutes is also an indicator of the high standards of the programme. The high quality is confirmed by the fact that a large proportion of the Research Projects are published in top scientific journals.

Students are well-prepared for the trajectory after the master. This applies to students pursuing careers both inside and outside academia. For the former, the Research Project is central in achieving this result; for the latter, the option to do a major or a minor is crucial. That the

programme is geared towards making students self-directed leads to creative, independent alumni. This is demonstrated by the high percentage of employment soon after finishing the master.

There is a need to improve the broader professional orientation of students as even graduates who continue in research may eventually not end up in academia. The panel suggests that the career development policy should be further enforced over the broad range of specializations.

The panel assesses Standard 4 as good.

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

Master's programme Biomedical Sciences

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

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

Date: 29 November 2017

Prof. John Creemers

Dr. Jetje De Groof

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

Standard 1: Intended learning outcomes
The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements.

Explanation:
The intended learning outcomes demonstrably describe the level of the programme (Associate Degree, Bachelor's, or Master's) as defined in the Dutch qualifications framework, as well as its orientation (professional or academic). In addition, they tie in with the regional, national or international perspective of the requirements currently set by the professional field and the discipline with regard to the contents of the programme.

Findings
The panel studied the domain-specific reference framework of the programme (DSR), which delineates the scope and positioning of the Biomedical Sciences within the humanities, natural sciences and social sciences. During the site visit the panel discussed with the programme management why identical DSRs are used for the bachelor's and master's programmes and learned that both levels are considered as operating within the same larger context. The panel found in the self-assessment that, like the bachelor's programme, the master has a focus on the molecular basis of Biomedical Science. It appreciates that with its emphasis on 'New Biology' ('Omics') the programme is in line with current international developments in the field. The programme is organized in collaboration with top research institutes, such as the Swammerdam Institute of Life Sciences (SILS), the Academic Medical Center of the University of Amsterdam (AMC), the Netherlands Cancer Institute (NKI), the Netherlands Institute for Neuroscience (NIN) and Sanquin (Blood Supply Foundation). This cooperation provides the programme with expertise that ranges from basic molecular and cellular biology to cognitive neurobiology. This commendably translates into nine specialization tracks, divided over two thematic clusters (see standard 2). Another element that the programme puts forward as one of its distinguishing features is its emphasis on internships and immersion in academic research groups. During the site visit, alumni explained to the panel that this specific focus was an important reason for choosing the Biomedical Sciences (BMS) programme at the University of Amsterdam (UvA). The panel moreover learned that as from 2017-2018, the UvA is initiating a double master's programme Medicine/Biomedical Science that is targeted at excellent students.

The panel observed in the preparatory documents that the programme's focus has been translated into clear exit qualifications (Appendix 3). They cover various cognitive levels and follow the Dublin Descriptors. The panel confirmed that along with the general exit qualifications that are common for all students, additional qualifications have been formulated for each of the tracks. It discussed with the programme management why the recommendation of the 2009 panel to coordinate the learning outcomes of the master's programmes on a national level had not been followed up. It learned that at the master's level, programmes are more diverse, which makes the exercise more difficult than at the bachelor's level. The panel was reassured to find that the programme still aims to formulate these common exit qualifications.

The programme offers the students the option to broaden their profile in a 60 EC major in Science Communication, Science in Society or Teaching or in the 30 EC interdisciplinary Tesla minor. Both the majors and the minor are done on a full-time basis and are part of the 120 EC programme. Students following a major perform a single research project instead of the two research projects (30 EC minimum – 60 EC maximum) that students in the 'regular' curriculum do. Students doing a minor do two research projects, but with a maximum of 30 EC each (see standard 2). The panel values this option to broaden the profile. It discussed at length and with different groups of interviewees how the different trajectories are translated into the exit qualifications, thus making

an explicit distinction in the profile between students who go more in depth during the research projects and those who opt to broaden their profile. From the programme management the panel learned that there is one exit qualification specifying the extra qualification that students acquire who carry out two research projects. When checking the exit qualifications, the panel gathered that the final exit qualification (see Appendix 2) indeed describes that the graduate who has chosen to do a second track-specific research project has the ability to continue his/her career as a researcher able to pursue a PhD degree at top universities, as a scientist in research institutes worldwide, or as a research-skilled professional in a government or civil society organization or business and industry. The exit qualifications for the Tesla minor and the majors are described separately from the exit qualifications of BMS. The panel is of the opinion that the programme needs to make the different trajectories and the profiles these trajectories lead to more explicit in the exit qualifications. It was pleased that the programme has also identified this as an issue that requires further attention. The panel and the programme agreed that a more thorough national and international benchmarking of the programme could inspire the programme management about how best to proceed.

In its self-evaluation, the programme mentions that the recommendations of a 2014 study by the Netherlands Institute of Biologists (NIBI) on the requirements of graduates for the professional field are already present in the programme: BMS at UvA strives to train students who are independent, have a passion for Biomedical Sciences, are result-oriented, follow multiple internships, have a broad knowledge base and the ability to report complex data. The panel studied the programme's exit qualifications and found that only two of the general exit qualifications use elements from the humanities and/or social sciences domain (the ability to fulfil a position in society requiring an academic qualification as an independently operating professional with a good knowledge base and attitude towards a biomedical approach to relevant societal issues; and an attitude that enables critical reflection, see also Appendix 2).

Considerations

The panel concludes that the exit qualifications properly reflect the requirements of the domain-specific reference framework (DSR) and the Dublin Descriptors at the master's level. It greatly appreciates the programme's focus on a particular subfield of the discipline, i.e. the molecular basis of Biomedical Science, whilst still offering the students a choice among a wide range of specialization options. The panel moreover endorses the programme's focus on New Biology and research-oriented education in top research institutes. The start of a double master's degree Biomedical Sciences/Medicine as from 2017-2018 is a definite added value. The panel found that the specific focus of the programme has been translated into clear learning outcomes and that special attention has been paid to the additional learning outcomes of the tracks. But the panel is also of the opinion that the link between the humanities, natural sciences and social sciences in the profile of the Biomedical Scientist could be made more explicit, in both the DSR and the exit qualifications. Given this context, it recommends formulating exit qualifications that are common to all Dutch programmes and strongly advises performing a thorough national and international benchmarking. This exercise can then also inspire the programme to translate better in the exit qualifications the distinction between students who go more in depth during the Research Projects and those who opt to broaden their profile. The panel found that the exit qualifications contain generic skills that are required by the professional field.

Conclusion

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

Standard 2: Teaching-learning environment
The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

Explanation:
The intended learning outcomes have been adequately translated into educational objectives of (components of) the curriculum. The diversity of the students admitted is taken into account in this respect. The teachers have sufficient expertise in terms of both subject matter and teaching methods to teach the curriculum, and provide appropriate guidance. The teaching-learning environment encourages students to play an active role in the design of their own learning process (student-centred approach).

Findings

Curriculum
The master's programme has changed considerably since the 2009 evaluation. In 2009, four Biomedical Sciences tracks were available. The BMS programme now offers students a choice between nine specialization tracks, divided over two thematic clusters. The Medical Biology cluster contains five tracks: Biochemistry and Metabolic Disease; Cell Biology and Advanced Microscopy; Infection and Immunity; Oncology; and Experimental Internal Medicine. Tracks in this cluster are meant for those students who want to gain in-depth fundamental knowledge of the biochemical and molecular biological background of pathophysiological processes. The Neurobiology cluster contains four tracks: Molecular Neurosciences; Psychopharmacology and Pathophysiology; Cellular and Network Neuroscience; Cognitive Neurobiology and Clinical Neurophysiology. This cluster caters for students who are fascinated by the functioning of the human brain. The capacity of the tracks is limited to 20-30 students per track. For some of the tracks, the applications generally outnumber the number of available places. In those cases, students are ranked according to their GPA and motivation. As was confirmed by the students during the site visit, efforts are made to give students at least their second choice.

The curriculum of the master's programme Biomedical Sciences is a two-year programme of 120 EC that contains three basic components that students complete within their track. The taught courses generally comprise a study load of either 6 or 12 EC each. In the first year the courses are all compulsory, while there is room for electives in the second. A second part of the programme is the Literature Review (12 EC), in which the student writes an in-depth literature overview of a contemporary topic within the scope of the track in which he/she is participating. The third part, the Research Project, is considered to be the most important part of the programme, during which the student gains practical experience by designing and performing a scientific research project in a laboratory under the supervision of scientific staff. Students carry out two Research Projects, each with a minimum of 30 EC and a maximum of 60 EC. Students following a major only carry out a single research project of 30 EC in one of the previously mentioned nine tracks. Students doing the Tesla minor do two research projects of 30 EC each (60 EC in total).

The panel approves the fact that a broad range of tracks is offered for students to specialize in, and it learned from the students that this was a particular reason for choosing UvA, as was the fact that there is ample room in the curriculum to tailor their programme to their own interests. The panel observed that the BMS master at UvA offers a clear, structured curriculum. The core courses in each track ensure that students are brought to the same level of skills and knowledge before their trajectories become more individual when starting with the Literature Review and the Research Projects. The panel asked the programme management during the site visit about how they succeed in coordinating the programme with its various tracks and the students' individual trajectories. It learned that it is a conscious choice to have many, small tracks. This ensures that the lines of communication between students, lecturers and track coordinators are short. Notwithstanding the large diversity, there is a small body of staff that keeps control and

determines the content of the track, which guarantees coherence. Synchronization between tracks is maintained through regular meetings between the track coordinators.

The panel observed from the preparatory documents that the overlap between some of the tracks is considerable. Moreover, some of the tracks are less popular than others. Given these two findings, the panel explored with different groups of interviewees whether merging some less popular tracks with other tracks would be an option, as this would also provide a solution for the limited capacity of some of the tracks. It learned that these kinds of questions are already on the radar of the programme management. The programme management gave the example of how the existing overlap between the tracks Biochemistry and Metabolic Disease on the one hand and Cell Biology and Advanced Microscopy on the other will in the future be evened out by reorienting the biochemistry track more towards biotechnology, using the opportunities provided by the Science Park. The panel supports this initiative and appreciates that it also takes into account feedback from student evaluations that the 'hard' biochemistry was somewhat lacking from the programme.

The panel found that the learning outcomes of the programme have been adequately translated into learning goals for different components of the curriculum. From its review of course manuals and its conversations with the different groups of interviewees during the site visit, it learned that there is also room for improvement. In line with the focus on 'Omics' in the UvA programme, the panel discussed how (Big) Data Science and Bio-informatics are present in the curriculum. Lecturers mentioned the need for a bio-informatics toolbox that could be offered just before the internships; the programme management stated that there are plans to create a major that focuses on training students to combine wet-lab with bio-informatics skills.

The panel gathered from the preparatory documents that only about 40% of the alumni report having been 'well prepared' for their further career. Students, alumni and lecturers confirmed during the site visit that this is indeed an issue that needs more attention in the curriculum. Topics that were suggested to the panel included ethics, project management, IP-issues, and entrepreneurship. The programme management explained that most of these topics are touched upon in the taught courses but indeed could be elaborated more. The panel was reassured to find that in addition to this, the programme has plans to offer a skills lab to all students, irrespective of the track they attend. This lab would cover the above-mentioned topics. The programme and the panel agreed that this skills lab would have to be offered in an à-la-carte fashion, requiring students to obtain a certain number of credits, but leaving them the flexibility to choose the specific topics they are interested in. The panel observed that students are very enthusiastic about this idea, as it would also provide opportunities to get in touch again with fellow students, especially during the months of the research internships when students are working in different places. Students and alumni mentioned that this initiative could go hand in hand with some of the initiatives for alumni. Currently, the programme organizes a yearly career BBQ, during which students can meet alumni. In addition, in the Molecular Neurosciences track, students organize an annual track symposium to which alumni and enrolled students are invited. Students and alumni mentioned that many initiatives for alumni are organized bottom-up by the students. The panel agrees that the programme management should intensify its career development initiatives. The programme management explained that it aims to roll out the specific alumni initiatives of the Molecular Neurosciences track for the whole master.

Different groups of interviewees also stressed the Tesla minor and the majors as options for students who want to broaden their profile. The panel greatly appreciates that these choices are available to students but also took note of the fact from the self-assessments that in the cohorts graduating from 2014 to 2016, an average of 13.6% followed a major and an average of 2.7% followed the Tesla minor. The panel is of the opinion that this limited success may be in part due to the fact that the profiles of these different trajectories, leading to different areas of employment, are not sufficiently clear to the students. Also, it explored with different groups of interviewees whether the allocation of 60 EC within a 120 EC master to broaden the students' profile is advisable. The panel and the programme management agreed that, following the example of the

Tesla minor, a more optimal choice might be to work with a common core of 90 EC in the programme and then provide 30 EC for different profiles (e.g. research, science and society, Tesla (entrepreneurship), education). These different profiles could then be made more explicit in the exit qualifications (see standard 1).

The panel consulted the reports of the Programme Committee (OLC) and found that the quality control cycle of the programe works adequately. Actions that require further attention receive structural follow-up. The OLC and the students explained how in recent years, initiatives have been taken to communicate to the students the initiatives that have been implemented to improve the quality of the programme. Examples are the use of Blackboard as a communication channel of actions taken by the OLC, student representatives and social media. Nevertheless, students find that there is room for improvement in ensuring that students are kept up-to-date. During the discussions, the OLC convinced the panel that it is well aware of its new position since the Enhanced Governance Powers (Higher Education) Act became effective in September 2017.

Research internship
The panel consulted the Protocol for the Research Project and the Literature Review and found the rules and regulations concerning their approval and supervision to be clear. Students can take part in existing projects or they can write their own research project. The Protocol indicates that the first research project should preferably be done within one of the research institutes of the faculty or in one of the affiliated institutions. The second research project can be carried out elsewhere. All research projects are subject to prior approval by the track coordinator and the examiner. The Protocol clearly describes the roles of the different people involved in supervision and evaluation. It also provides a clear time schedule for the research projects and guidelines on the report writing. Students and alumni indicated during the site visit that they found the rules and regulations to be clear.

During the site visit, the panel explored how the guidelines described above are implemented in practice. It discussed how the programme keeps track of the quality of the supervision at the different national and international institutes students go to for their internships. It learned that students are sometimes refused permission to do an internship at certain places by the track coordinator or examiner, thus de facto limiting their flexibility. When students want to do an internship in a laboratory that has not been used before, track coordinators give them the advice to explore the modalities of supervision in advance with the Principal Investigator (PI). Students and lecturers mentioned that they also tap into the experiences of alumni when choosing a location for their internship. During the Research Internship, as the panel learned from the Protocol, an interim assessment is performed, the purpose of which is to monitor the student's progress and identify potential problems. The students explained that the examiner, who is a permanent member of staff of the Faculty of Science and is appointed by the Examinations Board (EB), also plays a crucial role. Some of the examiners check in with students on a regular basis to ensure that all is going as planned. Lecturers explained that, in line with the philosophy of the programme, students are expected to be self-directed and contact the examiner when necessary. The panel gathered that the students evaluate the quality of supervision on an informal and ad-hoc basis. Together with the students, it supports the current initiative of the programme management to formalize this procedure. The students' feedback would then feed into a database that can support future students with finding places for their internship that are known to provide high-quality supervision.

Didactic concept and staff
It is the ambition of the programme to organize a feasible and small-scale study programme in an inspiring academic environment with ample opportunities for students to pursue their own interests and develop the skills needed for a career within as well as outside academia. The panel learned from the self-assessment that the first mandatory courses of the programme contain lectures and assignments and prepare the students for the individual parts of the master, the Research Projects and Literature Review. Educational activities in the master are always small-scale. In the programme's vision, long internships that immerse students in an academic environment provide

the best way to achieve its goals. From the discussions with the lecturers, the panel gathered that in addition to standard classes, a large variety of interactive formats is used, like journal clubs, computer studies, etc. The panel consulted the course material of several courses and found that tutorials are offered that stimulate students to learn in a more active way. As an example, in some of the tutorials, students have to make a Powerpoint presentation in which they demonstrate how they have processed the educational material. Students also mentioned that they strongly appreciated the setup of the tutorials and the quality of the feedback they receive during them.

The programme management and lecturers stressed that an intrinsic part of the didactical concept is geared towards making the students independent and self-directed learners. This is achieved by providing them with a lot of independence and responsibility. Students and alumni alike appreciated how the learning environment had made them more independent and creative. A large majority of students reported a positive atmosphere in the programme. Nevertheless, the panel also learned from students and alumni that this way of working may not be optimal for all students. Given the elevated dropout rate, this is something the programme should take into account when optimizing its strategy for study guidance (see also 'Admission, dropout, time to completion').

The track coordinators of the master's programme are active researchers with ample experience in academic lecturing and the supervision of students and other researchers. The staff involved in the programme reflects the broad range of institutes that contribute to the master and varies from full-time basic researchers to medical doctors with clinical research interests. Most lecturers have at least a 'University Teaching Qualification' (BKO) and a PhD. The Research Project and Literature Review involve at least two persons (assessor and examiner) with a PhD degree or higher. When asked, students and alumni explained they were happy with the quality and availability of the staff. The panel talked about the work pressure with lecturers, as they observed from the self-assessment that especially the ones involved in the Neurobiology cluster report the work pressure to be high. Lecturers explained the pressure to be high but feasible. The reason why Neurobiology lecturers report a high pressure is that the specialization attracts many students but has a smaller staff of lecturers who are available for teaching duties.

The panel explored whether lecturers are offered professional training, helping them to establish a learning environment that activates students. Lecturers explained that they are happy with the workshops the faculty organizes on innovative teaching methods. Moreover, blended learning is a point of attention for the whole of the university. Also, in the BKO trajectory, tailor-made support of lecturers is offered for questions that are specific to the subjects they teach.

Admission, dropout, time to completion

The panel found in the preparatory documents that the dropout rate for the master's programme is high (almost 20% for the cohorts 2011-12 and 2012-13). Moreover, the panel noticed that many students take almost three years to complete the two-year master's programme. This observation stimulated the panel to discuss this matter further with different groups of interviewees, who stressed various possible reasons for the delay and dropout. Some alumni explained that the reasons for delay can be personal, e.g. students having a part-time job alongside their studies. A query that addressed delayed students revealed that this is the case for 33%. The same query revealed that 32% of the delayed students have problems in the writing phase of the Research Project or the Literature Review. From the preparatory documents the panel learned that enabling students to find help in this stage is an important part of future initiatives to improve academic guidance in the master. Several students and alumni also mentioned that delays in the internships are another potential reason for study delay. When confronted with this observation, lecturers explained that the role of the examiner is in principle to monitor the internships so that delays are prevented as much as possible (see also above, 'research internship'). The panel learned that Datanose has recently been added to help track coordinators, examiners and the study adviser to actively monitor students at risk for delay. In this way, the programme aspires to be more proactive in its guidance of students.

The panel gathered from the alumni that some students discover during the master trajectory that the extended research internships are either too difficult or do not completely match their interest. Some of the alumni stressed that they appreciate the option to follow one of the majors or the Tesla minor. Students and lecturers were especially positive about the concept of the Tesla minor. Students indicated that they might have dropped out as well had the option of doing a major or a minor not been present. They also mentioned that the master's programme prepares students predominantly for research careers and that more guidance towards these alternative trajectories is required for those students who do not aspire towards a research career. Students and alumni agreed that they would welcome (or would have welcomed) more initiatives to meet with alumni.

The panel discussed whether the admission policy is adequate to ensure that only students with the right qualifications enter the programme. It found that there are clear admission rules and requirements. From the Programme Committee (OLC), the panel learned that whereas bachelor students with eligible diplomas could formerly automatically proceed to the master, students now need a minimal GPA of 6.5 in the bachelor's programme in order to be eligible for acceptance. The panel explored why only 10-15% of the master students are international students, whereas the European norm is 20%. It took note of the fact that, in 2017-2018, the portion of international students has risen to 20%. The programme management explained that the admission procedure has changed in the sense that admissible students are contacted immediately, avoiding delays that occurred in the past which caused potential candidates to abort the admission procedure. Nevertheless, many students who are eligible do not start due to financial restrictions. This is why the programme is currently exploring options to support international students financially.

Considerations

The panel finds that the master's programme BMS has a clearly structured curriculum. It appreciates that the programme first provides mandatory courses to the students in order to bring them all to the same level before they start with their individual trajectories. It established that the small size of the tracks and the regular meetings between track coordinators ensure that the curriculum is coherent, notwithstanding the individual trajectories that students follow. Based on its consultation of the study guide and a selection of course materials, the panel moreover concludes that the programme succeeds in offering actual and relevant content.

The panel found that the broad choice that is offered to students in the nine tracks is an important point of appeal of the programme. However, some students are not able to enrol in their track of choice due to the limited capacity of some of the popular tracks. Merging less popular with more popular tracks is one strategy to consider, thus reducing the number of tracks. Another possible route is reorienting the profile of some of the less popular tracks, thus reducing the overlap that exists between tracks and creating new tracks that are more appealing to students. The panel has found that this issue is clearly on the radar of the programme.

The panel appreciates that the programme has several options available for students who want to broaden their profile, such as the majors and the Tesla minor. It is especially positive about the Tesla minor, as it finds its interdisciplinary focus very relevant, but also due to its size of 30 EC. This allows students to be part of a large 'common core' of the programme (including two research internships), while still giving them the option to broaden their profile. Conversely, the panel is not convinced that embedding 60 EC majors allows for enough space to establish a solid common core. A possible solution is based on the Tesla model, providing a curriculum with a common core (e.g. 90 EC), and offering 30 EC trajectories that lead to clear profiles (e.g. research, education, science and society, entrepreneurship). Providing clarity regarding the different profiles (see also standard 1) would then make alternative routes more attractive to students and could help the programme in improving its guidance towards these alternative trajectories. This is an issue for most Biomedical Sciences programmes in the Netherlands.

The panel has established that the exit qualifications of the programme have been adequately translated into components of the curriculum. Nevertheless, certain elements need to be given a

more solid basis in the curriculum. Because 'Omics' is a focus of the programme, the panel suggests that Bio-informatics and Data Science be given more attention. It endorses the idea of a Bio-Informatics toolbox that could be offered to students just before the internships. It is also of the opinion that the idea to offer new trajectories to students that combine wet-lab with (big) Data Science/Bio-informatics skills is an important initiative that would fill this gap. In addition, elements that make up the broad profile of the biomedical scientist, such as ethics, IP-related issues, and project management, need to be more structurally embedded. The panel and the programme agree that these topics are to be offered preferably in an à-la-carte module that obliges students to attend classes for a certain number of credits, but leaves them the flexibility to choose the specific topics. This would not only broaden the perspective of all students and highlight alternatives to an academically oriented career, but would also improve the sense of community, as students spend most of their master doing internships elsewhere. The panel has found that regarding career development, a lot is left to the initiative of the students, and many actions are limited to specific tracks or clusters. While recognizing the value of these bottom-up initatives, the panel recommends the programme step up its actions geared towards career development and ensure they are implemented in all tracks.

The panel strongly values the activating teaching-learning environment. The emphasis is on research internships using a master-apprentice model. The programme offers several opportunities to do this in top research institutes. The panel appreciates that students complete two research projects during their master's programme. It established that the research internships are well organized and that the rules and regulations are clear and known to students. Nonetheless, the feedback of students on the quality of supervision should be summarized and monitored in a more systematic way. The panel welcomes the plans of the programme to gather this feedback in a database, as this will lead to a more effective pre-selection of locations to do an internship.

The master's programme BMS also offers small-scale education outside the internship, with an adequate mix of learning approaches. Notwithstanding the reported high work pressure of lecturers, students indicated that they are available to answer questions. The panel ascertained that the professional training of the lecturers is adequate and prepares them for student-centred learning approaches. One strong point is that the programme has a broad contingent of active researchers at its disposal, e.g. for courses and supervision of research projects.

The panel appreciates that students are required to take responsibility for their own programme and agrees with the students that the environment created stimulates creativity and independence. However, it is of the opinion that the study delay and dropout of students require a more proactive follow-up. The programme has taken the first steps to understand the causes of delays and dropout. The panel approves that the programme has started to monitor students more actively using Datanose and to check in with students at risk of delay. Still, it advises the programme to step up its analyses so that a comprehensive strategy can be formulated and implemented. In addition, it asks the programme to continue to find ways to adequately communicate to the students the initiatives it is taking to improve the quality of the programme.

Finally, the panel asks the programme to continue its efforts to attract more international students. Although in former years the programme did not meet the European targets, the panel found that faster communication on admissibility is starting to bear fruit in 2017-18. The panel feels that the programme should put into practice its plans to provide financial incentives for international students.

In conclusion, the panel is of the opinion that the curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

Conclusion
Master's programme Biomedical Sciences: the panel assesses Standard 2 as 'satisfactory'.

Standard 3: Student assessment
The programme has an adequate system of student assessment in place.

Explanation:
The student assessments are valid, reliable and sufficiently independent. The requirements are transparent to the students. The quality of interim and final examinations is sufficiently safeguarded and meets the statutory quality standards. The tests support the students' own learning processes.

Findings
The panel consulted the assessment plan of the master's programme, which contains the rules and regulations regarding the organisation of student assessment. It observed that the programme uses various instruments to ensure that the assessment system is transparent, such as the course catalogue, the course manual and the course records in Datanose. Both lecturers and students reported that they actively use this information system. The panel found that the programme has composed clear protocols for the Literature Review and Research Project and that it is the programme director's responsibility to communicate them to students and staff.

The panel noted that diverse assessment forms are used. From the self-assessment it learned that the assessment of lectures is generally based on a written exam or weighted average of a written exam and other forms of assessment. This was confirmed in the selection of course material and assessments that the panel consulted during the site visit. Lecturers gave several examples of forms of assessment to test higher order cognitive skills and creativity, such as giving presentations and writing research proposals. Students appreciated the variety of forms of assessment. Moreover, they confirmed that assessments are representative of the content of the course. The panel came to the same finding on the basis of the selected course materials it consulted during the site visit.

From the assessment plan the panel gathered that the programme uses several strategies to ensure the consistency, validity and reliability of the assessment. One or more fellow staff members provide peer-review of the exam questions prior to the exam. Oral presentations and written reports are assessed using the standardised format employed for the Literature Review and Research Projects. The programme stresses that ensuring reliability and consistency in grading is a particular challenge during the master because the research and literature projects are conducted at a wide range of institutions. The panel learned during the site visit that consistent grading features prominently on the agenda of the joint meeting of the track coordinators. Decisions that are made in this group are communicated to the examiners.

The assessment of the Research Project and Literature Review involves at least two persons (assessor and examiner) with a PhD degree or higher. Examiners play a crucial role in ensuring a consistent evaluation of the Research Projects. They are appointed by the Faculty's Examinations Board (EB). The panel learned from the self-assessment report that examiners must not be involved in the research groups where the Research Project or Literature Review is conducted. The daily supervisor and assessor of the research internship (see also standard 2) suggest a grade to the examiner. The examiner reads and grades the report/review independently from the assessor, and checks the report/review for plagiarism using Ephorus. If the grading of the assessor and examiner differs by more than 1.0 point, a third assessor determines the grade based on the final report. If the grade is 8.0 or above (out of 10), a written statement from the assessor is required to justify the grade. Research Projects carried out abroad are sometimes graded rather high by the local supervisors due to differences in international grading systems. The examiner is responsible for determining the final grade and critically assesses low and high grades. The panel learned that grades are occasionally changed by the examiner. It is of the opinion that the role of the examiner is key in providing consistency across research internships and welcomes the possibility to override the grade given by the assessor. Yet it also noted that the evaluation forms do not always document this process in a transparent way. This was discussed with the programme management

and the Examinations Board, which commented that the electronic system Datanose is used now, which ensures that a strict and transparent procedure is consistently followed. The panel and the programme management agreed that the transparency in Datanose could be improved further by ensuring that all grades are visible in the system – both the grades given by the assessor and those of the examiner.

The final assessment of the Literature Review and Research Projects takes place according to standard evaluation forms that can be found in the assessment plan. Assessments of practical work (60%), written report (30%) and oral presentation (10%) are weighed to provide the final grade. Oral presentations are assessed using standardized formats. To standardize the assessment of the practical work, detailed checklists are provided. The panel learned from the lecturers that foreign supervisors are explicitly instructed on how to fill out the forms. The lecturers agreed with the panel that the current form is not sufficiently self-explanatory and that working with a rubric would make this process more reliable and consistent. The programme management explained it is currently working on an evaluation form that uses rubrics. The panel and the programme management agreed that implementing these rubrics could act as a lever to improve feedback to students.

The panel also explored the weighing of criteria on which the final mark is based (60-30-10). This weighing means that a large portion of the final grade is determined by the student's experimental work. The panel is not convinced that this is an accurate translation of the learning outcomes. Moreover, it leaves a large portion of the final grade to be decided by the supervisor/assessor, who is not independent. The panel is of the opinion that giving a more equal relative weight to each of the parts of the Research Project would be an answer to these issues. Another solution lies in ensuring that the examiners get to see the students' presentations, as is the case in the bachelor's programme.

The final examination represents the summative assessment to decide if the student has fulfilled all of the conditions set by the exit qualifications of the master's programme. The panel learned that the EB establishes that the students have passed all the components belonging to the programme and achieved all exit qualifications. This is especially important as students perform individual trajectories. The EB uses the student's Personal Education Plan (PEP) as a basis. In this PEP, the students list all study activities. The panel learned that the students draw up this PEP at different stages in their programme and that with the introduction of Datanose, the latter system is now primarily used to keep track of the individual trajectory.

The UvA has one EB for the Earth and Life Sciences. This Board has delegated responsibilities for the Biomedical Sciences to a Biomedical Sciences subcommittee. The panel learned that an external member is present at the level of the 'parent' Examinations Board. During the site visit the panel explored with the EB how it ensures the quality of assessments, Literature Reviews and Research Projects. It learned that the EB checks the assessment of any course that yielded a pass percentage below 50% as well as modules with a success rate higher than 90% with a mean grade above 8.5. If there are no alarming deviations in success rates, the EB checks two modules each year a posteriori and gives recommendations to the programme director if necessary.

Each year the EB randomly selects a sample of the Research Projects and Literature Reviews; two reports per grading (6, 7, 8, outlier). For each report, an appointed examiner (who was not involved in the project) is asked to give a rating and examine the assessment. Large discrepancies between the two assessments (more than one point) are investigated by discussions with the examiner. The panel consulted the annual report of the EB and the assessment of the yearly sample. It established on the one hand that the annual report contains information on the steps that have been taken, but not on the findings. The programme agreed that this is a point for improvement. Regarding the Research Projects and Literature Reviews, the panel found that for more than half of the samples it consulted, the independent examiner came to a different conclusion than the initial mark. This being a large proportion, the panel further explored this point

with the programme management and EB. It was agreed that if the EB finds there are many deviations, the sample should be made larger. Another option is that the EB receives administrative support to identify Research Projects and Literature Reviews in advance that would be candidates for an extra check and then focus on this selection.

Considerations
The panel is of the opinion that the master's programme Biomedical Sciences of UvA has a very solid assessment system. There is an elaborate assessment plan, with clear procedures ensuring that the assessment is valid, reliable and transparent. The students, lecturers and examiners have a very clear Protocol for the Literature Review and the Research Internships at their disposal. All information regarding assessment is digitally available to the students. The system that was designed to ensure the quality of exams is also applied adequately.

As regards the validity of the assessment, the panel ascertained that the assessment is representative of the intended learning outcomes and the course content. Test matrices reveal transparently which learning goals are being assessed in each course component. The panel appreciates that the programme works with diverse assessment formats and has found that the assessment supports active learning.

The reliability of the assessments is also assured in different ways. Peer-review among lecturers is obligatory during the preparation of all exams. In those cases where presentations and writing are being evaluated, the programme uses standardized models which are communicated to the students well before the assessment takes place. The panel is of the opinion that the programme has established a commendable system for the assessment of Research Projects and Literature Reviews. It found that working with examiners from within the programme is very conducive to ensuring consistent grading of students who perform projects in different labs with different supervisors. The panel appreciates that a control mechanism is in place to overrule poor grading, which is especially important for research projects conducted abroad. The fact that the local examiner can override the external score (with motivation) is good. The introduction of the electronic monitoring system Datanose has improved the transparency of this procedure, yet the panel suggests that the original scores remain visible on the (electronic) form to further promote transparency. Moreover, the panel finds that a 60-30-10 weighing for the experimental work, the report and the presentation of the Research Project, respectively, leaves a large portion of the final grade to be decided by the supervisor/assessor, who is not independent. It suggests giving a more equal relative weight to each of the parts. Also, it recommends that the examiners get to see the students' presentations. Finally, more explicit guidelines on what it means to award 'good' or 'average' for certain categories will improve consistency. The rubrics that will be implemented in the near future will ensure further consistency in grading. Moreover, they will act as a means to provide high-quality feedback to students. The panel is of the opinion that a motivation for the grade given should be offered to all students, not only those who perform exceptionally well.

The panel found that the EB independently and proactively controls the validity and reliability of assessment. It appreciates that the findings of the EB are discussed with the programme director but thinks there is room for improvement in the way in which the EB reports about this process. It approves the fact that the EB systematically checks the quality of assessment by inspecting exams of selected courses and having a sample of Research Projects and Literature Reviews checked by an independent examiner. The panel advises the EB to reconsider the way the sample is determined by either making it larger or choosing to focus on cases that are potentially problematic. The latter choice involves providing administrative support to the EB to identify those cases based on the evaluation forms. The panel appreciates that the EB makes the final decision about whether students pass based on their Personal Education Plans, and asks the programme to continue to do so, to ensure that all exit qualifications are achieved in a balanced way, regardless of the chosen trajectory.

Conclusion
Master's programme Biomedical 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 achievement of the intended learning outcomes is demonstrated by the results of tests, the final projects, and the performance of graduates in actual practice or in post-graduate programmes.

Findings
The panel learned from the preparatory documents that upon completion of the master's programme, graduates are expected to be in a perfect position to start an academic career as a PhD student, or pursue a career outside research, in line with the training provided by the majors and minor. The alumni survey revealed that indeed 62% of the programme's alumni starts a PhD after completion, 10% starts with a research-related position but not a PhD, and 28% chooses a profession outside research. 54% of the alumni find a paid position within a month, 76% within half a year and 92% within a year. The alumni gave the programme a mark of 7.45 for preparation for the job market. The panel spoke to alumni who were doing a PhD and those who had a career outside academia. While the former stressed that the emphasis on self-directedness in the programme had helped them to be creative and independent in their current jobs, the latter praised the minors and majors in that they had broadened their profile as well as their horizon on possible future careers.

The panel studied the Research Project and Literature Review of a sample of fifteen students and came to the conclusion that they are of a high scientific level. In the year 2015-2016 the average mark for Research Projects was 7.9, and 7.8 for Literature Reviews. The panel found the projects and reviews in the sample in general to be well structured and to use good academic English. The range of technologies employed was broad, leading to many interesting results with extensive and in-depth discussions. The panel is of the opinion that the fact that the Research Project allows students to work in a broad range of top institutes, giving them opportunities to choose research and literature projects that enable them to obtain higher order learning skills, while specializing in a wide variety of biomedical subjects, uderlies these excellent results.

The panel learned from the self-evaluation that 17% of the students who graduated since the 2012-2013 cohort have graduated Cum Laude, which is only given after very careful consideration. The panel greatly appreciates that many students become co-authors of papers based on their research projects or literature reviews; of the 2013-2014 to 2015-2016 cohorts, the percentage ranged between 47% and 54%. Another indicator of the quality of the students that was put forward by the programme is the percentage of students performing an internship in top institutes abroad. This amounted to 24% in 2015-2016.

To keep in contact with its alumni, the programme organises a yearly BBQ during which students can meet alumni. Additional activities are organized by some of the tracks and are best developed in the Neurobiology cluster. Alumni suggested to the panel that even more investments in the alumni society would be welcomed as this greatly helps professional orientation.

Considerations
The quality of the research projects consulted is good to very good and clearly illustrates that the graduates of the programme have amply achieved the intended learning outcomes. They reflect the fact that many of these projects are the result of internships at top international institutes. The fact that many students are accepted for internships at these institutes is also an indicator of the high standards of the programme for the panel. The large proportion of the Research Projects that are published in high-quality scientific journals amply illustrates the high quality of the master.

Students are well-prepared for their trajectory after the master. This applies to students pursuing careers both inside and outside academia. For the former, the Research Project is central in achieving this result; for the latter, the option to do a major or a minor is crucial. That the programme is geared towards making students self-directed leads to creative, independent alumni. This is demonstrated by the rapid employment of a large percentage of graduates.

There is a need to improve the broader professional orientation of students as not all of them will eventually end up in academia. The panel suggests that the career development policy should be further enforced over the broad range of specializations.

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

GENERAL CONCLUSION

The exit qualifications of the master's programme Biomedical Sciences (BMS) of the University of Amsterdam (UvA) properly reflect the requirements of the domain-specific reference framework (DSR) and the Dublin Descriptors at the master's level. The panel endorses the focus on New Biology and research-oriented education in top research institutes. The link between the humanities, natural sciences and social sciences in the profile of the Biomedical Scientist can be made more explicit, both in the DSR and in the exit qualifications. The panel recommends formulating exit qualifications that are common to all Dutch programmes and strongly advises performing a thorough national and international benchmarking.
BMS has a clearly structured and coherent curriculum that allows students to achieve the exit qualifications. The programme has several options available for students who want to broaden their profile, such as the majors and the Tesla minor. The panel is not convinced that embedding 60 EC majors allows for enough space to establish a solid common core. A possible solution would be to provide a curriculum with a common core (e.g. 90 EC), and offer 30 EC trajectories that lead to clear profiles. The content and amount of Bio-informatics and (Big) Data Science can be improved upon. In this sense, the programme's plan to offer new trajectories that combine wet-lab with Data Science skills is welcomed by the panel. In addition, elements that prepare students for future careers inside and outside academia need to be more structurally embedded. BMS has a strong and activating teaching-learning environment emphasizing research internships using a master-apprentice model, yet the quality of supervision should be monitored in a more systematic way. This issue is on the radar of the programme, and actions are being taken. The quality and quantity of lecturers are up to standard. The panel approves that BMS has started to monitor students more actively, yet the programme needs to step up its analyses so that a comprehensive strategy to tackle study delay and dropout can be formulated and implemented. Finally, the panel recommends the programme continue its efforts to attract more international students.
BMS has a very solid assessment system ensuring that the assessment is valid, reliable and transparent. Working with examiners from within the programme is very conducive to ensuring a consistent grading of students who perform projects in different labs with different supervisors. The introduction of the electronic monitoring system Datanose has improved the transparency of the grading procedure. The Examinations Board independently and proactively controls the validity and reliability of assessments. The system of assessment could function even better with the development and implementation of evaluation matrices and by reconsidering the relative weight of

each of the components in the final grade of the Research Project plus the reporting of the EB on its quality control mechanisms.
The quality of the research projects consulted is good to very good and clearly illustrates that the graduates of the programme have amply achieved the intended learning outcomes. The high quality of the master's programme is also demonstrated by the fact that a large proportion of theses end up being published in high-quality scientific journals. That the programme is geared towards making students self-directed leads to creative, independent alumni. This is demonstrated by the rapid employment of a large percentage of graduates. Nevertheless, the panel suggests that the career development policy should be further enforced over the broad range of specializations.

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

APPENDICES

APPENDIX 1: CURRICULA VITAE OF THE MEMBERS OF THE ASSESSMENT PANEL

John Creemers (chair) is professor of Biomedical Science at KU Leuven, Belgium. He teaches two courses for bachelor students of Biomedical Sciences, one of which is the bachelor's thesis. His laboratory for Biochemical Neuroendocrinology is part of the Department of Human Genetics, and his research focusses on protein folding, maturation and trafficking in the secretory pathway (regulated). In particular, he specializes in inherited disorders in which these processes are disturbed. He is also director of the Doctoral School of Biomedical Sciences. He is the KU Leuven representative to the League of European Research Universities (LERU) Doctoral Studies Community and a member of the executive committee of ORPHEUS, a network of universities that is committed to developing and disseminating best practices within PhD training programmes.

Erik Boddeke is professor of Medical Physiology/Neurophysiology at the Department of Neuroscience at the University of Groningen/University Medical Center Groningen, The Netherlands. He finished his PhD thesis at the Department of Pharmacology at the University of Amsterdam. During 1988-1996 he was the laboratory head and group leader for Neuro-immunology at Sandoz, in Basle, Switzerland. From 1996-1998 he was Vice Head of the Department of Neuro-genetics at Novartis Research in Basle, Switzerland. In 1998 he became Professor of Physiology at the Medical Physiology Department at the University Medical Center in Groningen (UMCG). Since 1998 he has been professor of Physiology and Head of the Department of Neuroscience at the UMCG and professor of Medical Biology at the Department of Molecular Neuroscience at the Faculty of Sciences at the University of Groningen. He also is dean of research of the University Medical Center Groningen.

Dirk Snyders is professor of Biomedical Sciences at the University of Antwerp. His research interests of the past ten years have focused on the molecular structure-function relations in Kv-channels, analyses of LQT mutations and the study of 'silent' Kv subunits. Next to his teaching and research activities, he has been active in administrative functions inside (e.g. member of the Board of Directors of the University of Antwerp) and outside the university (e.g. member of the Physiology review panel of the Research Foundation – Flanders) and is a member of various professional organizations. In 2012 he was a member of the evaluation panel for the Biomedical Sciences programmes in The Netherlands.

André van de Voorde obtained his PhD degree in molecular biology from Ghent University (Belgium). Until 1987 he pursued an academic career as senior staff member ('Werkleider') in different laboraties at Ghent University. From 1987 onwards he was active in Innogenetics NV (Belgium), first als Laboratory Manager and from 1996 as CSO. In 2011 he became manager of AVBioConsult Bvba, and specialized in biotech-health care. Presently, he is still acting as an in-house consultant for Amatsi-Q-Biologicals NV, external expert for Vlaams Agenschap Innoveren & Ondernemen) and provides consultancy for SME, biotech/health care companies and investment companies. He is the author and co-author of over 60 research papers, co-inventor of 7 patents, and has served as external expert on various (advisory) boards.

Annik Van Keer obtained her PhD at KU Leuven, Belgium, in the Quantum Chemistry Laboratory. She is currently educational adviser at the Betasciences Faculty and programme manager of the master programme Chemical Sciences at Utrecht University. Her main area of expertise is quality assurance. She has solid experience in programme accreditations and the preparation of institutional reviews. Moreover, she has been actively involved in curriculum changes and changes in the organization of education at the Faculty. Before working at Utrecht University, she worked at the Vrije Universiteit Brussel (Brussels, Belgium), where she helped design innovative tutorials.

Karlijn van Boxtel (student-member) is a student of the Master's program 'Infection and Immunity' at Utrecht University. She started her master in September 2015 after having finished

the bachelor's programme 'Biomedical Sciences' at Utrecht University. During her bachelor's programme, she participated in many committees of her study association and functioned as treasurer of the study association. During her master's program, she was a member and vice-chair of the Life Sciences Representatives, a student initiative to represent the interests and rights of all master students of the Graduate School of Life Sciences (GSLS). Also, she was a member of the Educational Committee of the GSLS at Utrecht University.

APPENDIX 2: DOMAIN-SPECIFIC FRAMEWORK OF REFERENCE

The biomedical sciences at bachelor and master level focus on a multidisciplinary approach of research questions pertaining to the maintenance of health and prevention of disease in man and animals. They integrate elements of the natural sciences, in particular man-associated areas of biology, chemistry, pharmacy, physics and mathematics, with the medical sciences. A continuous mutual interaction between elements from these disciplines provides the biomedical sciences with their translational character. Obtaining insight in processes at the molecular, cellular, organ and organism level both in the healthy as well as disease state is the foremost driver of biomedical sciences research. The field also encompasses studies at the population level where epidemiological qualitative approaches as well as society directed γ- approaches may be used. Furthermore, elements from the α-sciences play a role in degree programs in the biomedical sciences domain (see Figure 1).

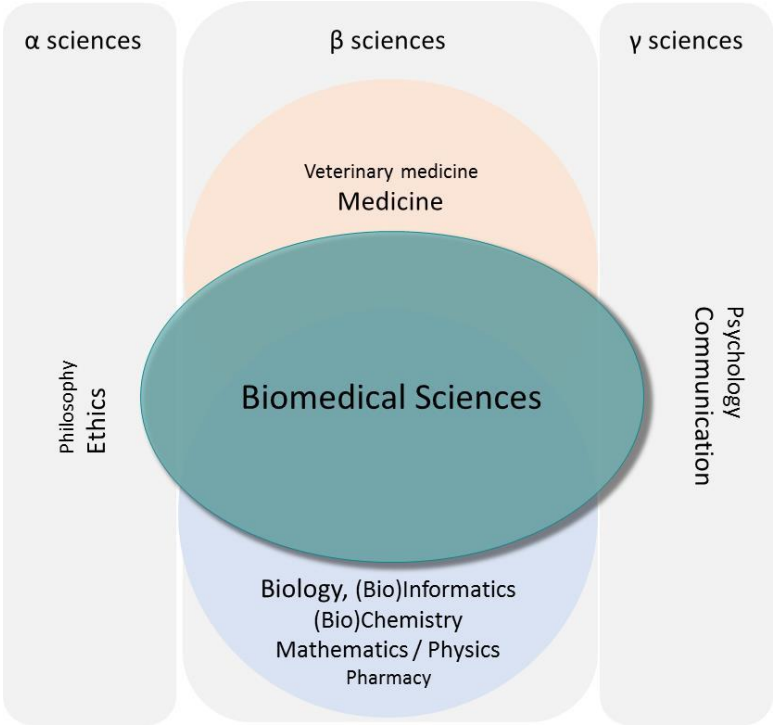


Figure 1. The multidisciplinary field of biomedical sciences. Text size correlates with the position of the indicated discipline within Biomedical Sciences.

For each scientific discipline the proper demarcation is nowadays a challenge given the rising importance of interdisciplinary approaches to address scientific and societal challenges. The multidisciplinary field of the biomedical sciences is no exception to this. Due to its translational character, the strength of the biomedical sciences lies in seamlessly connecting parts of the different core-disciplines. Hence the biomedical domain covers many elements from different disciplines and is primarily characterised by a profound integration of these elements.

Biomedical research thus provides innovative options for health maintenance and disease prevention based on developing insight in the biological processes that govern life. This is for instance seen in research areas such as cell division mechanisms, the interaction between man and microbe as well as aging.

In addition, biomedical sciences focus on the translation of clinical challenges or challenges in the field of public health to experimental research approaches that aim at the provision of a deep understanding of the biological mechanisms that are at the basis of these challenges.

The overall aim is to provide a scientific mechanistic basis for optimal health maintenance throughout life, as well as the improvement of diagnosis and treatment of disease.

At some of our universities the 2-year master's programmes in the field of biomedical sciences have specializations in Management, Communication and Education. Within the current reference framework these specializations focus on respectively (research) management in a commercial setting, societal aspects of research and knowledge acquisition.

APPENDIX 3: INTENDED LEARNING OUTCOMES

The graduate of the Master's programme Biomedical Sciences has [between brackets the most associated Dublin descriptor(s)]:

- the ability to read up on and master current scientific research developments and have knowledge of current scientific developments within relevant biomedical research [Knowledge and understanding];
- the analysing, problem-solving and synthesising abilities in order to deal with current scientific knowledge in medical biology and/or neurobiology and apply this knowledge in new and continuously changing practical situations, also in broader, multidisciplinary contexts [Applying knowledge and understanding];
- both a broad basic medical biological and/or neurobiological as well as specialist knowledge of one or more sub-areas of biomedical sciences, as basis or opportunity for originality in developing and/or applying ideas [Knowledge and understanding];
- the ability to formulate questions on the frontline of scientific research [Knowledge and understanding, Applying knowledge and understanding, Making judgements];
- the ability to formulate realistic and falsifiable (research) hypothesis, based on incomplete, limited or complex information and translate this into a research proposal [Knowledge and understanding, Applying of knowledge and understanding, Making judgements];
- the ability to independently set up and conduct biomedical experiments and laboratory measurements contributing to a line of research [Applying of knowledge and understanding, Learning skills];
- the skills to present research plans and results, orally or written, in English, at various scales and levels of abstraction, and communicate these to specialist and non-specialist audiences [Communication];
- the skills to analyse and interpret biological patterns and processes in both a qualitative and quantitative sense [Applying of knowledge and understanding];
- the ability to get acquainted with a field of study in a short period of time by self-study, to form one's own opinion and to write a critical essay in a set period of time [Making judgements];
- the ability to integrate the many hierarchical levels present in medical biology and/or neurobiology, and understands the interactions between biomedical sciences and other sciences [Making judgements];
- the ability to fulfil a position in society requiring an academic qualification as an independently operating professional that has a good knowledge base and attitude towards a biomedical approach to relevant societal issues [Learning skills];
- an attitude that enables critical reflection [Making judgements, Learning skills]. Exit qualifications track Biochemistry and Metabolic Diseases In addition to the paragraph with the general exit qualifications of the MSc Biomedical Sciences, the student finishing track Biochemistry and Metabolic Diseases has obtained the following track-specific qualifications:
- the ability to interpret and evaluate current state-of-the-art research in the fields of biochemistry and metabolic diseases and to start an independent research project in this direction;
- Has the know-how and research experience to act as a self-directed professional in an environment in which understanding of biochemical processes is required.

Exit qualifications track Cell Biology and Advanced Microscopy

In addition to the paragraph with the general exit qualifications of the MSc Biomedical Sciences, the student finishing the track Cell Biology and Advanced Microscopy has obtained the following track-specific qualifications:

- the ability to interpret and evaluate current state-of-the-art research in the fields of cell biology and microscopy and to start an independent research project in this direction;
- Has the know-how and research experience to act as a self-directed professional in an environment in which understanding of cell biological processes and visualise these processes through microscopy is required.

Exit qualifications track Experimental Internal Medicine
In addition to the paragraph with the general exit qualifications of the MSc Biomedical Sciences, the student finishing the track Experimental Internal Medicine has obtained the following track-specific qualifications:

- the ability to interpret and evaluate current state-of-the-art research in the field of experimental internal medicine and to start an independent research project in this direction;

- Has the know-how and research experience to act as a self-directed professional in an environment in which understanding of human organ physiology is required.

Exit qualifications track Infection and Immunity
In addition to the paragraph with the general exit qualifications of the MSc Biomedical Sciences, the student finishing the track Infection and Immunity has obtained the following track-specific qualifications:

- the ability to interpret and evaluate current state-of-the-art research in the fields of infection and immunity and to start an independent research project in this direction;
- Has the know-how and research experience to act as a self-directed professional in an environment in which understanding of infectious and immunological processes is required.

Exit qualifications track Oncology
In addition to the paragraph with the general exit qualifications of the MSc Biomedical Sciences, the student finishing the track Oncology has obtained the following track-specific qualifications:

- the ability to interpret and evaluate current state-of-the-art research in the field of oncology and to start an independent research project in this direction;
- Has the know-how and research experience to act as a self-directed professional in an environment in which understanding of oncological processes is required.

Exit qualifications track Basic and Applied Neuroscience
In addition to the paragraph with the general exit qualifications of the MSc Biomedical Sciences, the student finishing the track Basic and Applied Neuroscience has obtained the following track-specific qualifications:

- a solid knowledge of the basic disciplines that together form Neuroscience with a focus on the cellular and system level: neurophysiology, anatomy, neurogenetics and molecular neuroscience;
- has learned how to employ his/her fundamental scientific knowledge in translational neuroscience.

Exit qualifications track Cognitive Neurobiology and Clinical Neurophysiology
In addition to the paragraph with the general exit qualifications of the MSc Biomedical Sciences, the student finishing the track Cognitive Neurobiology and Clinical Neurophysiology has obtained the following track-specific qualifications:

- has obtained a solid knowledge of the basic and advanced disciplines that together form Neuroscience with a focus on the neural mechanisms underlying behavior and cognition;
- has obtained the ability to interpret and evaluate current state-of-the-art research on clinical neurophysiology, in particular on the field of brain imaging and neurophysiology of neuropsychiatric disorders.

Exit qualifications track Molecular Neuroscience
In addition to the paragraph with the general exit qualifications of the MSc Biomedical Sciences, the student finishing the track Molecular Neuroscience has obtained the following track-specific qualifications:

- a solid knowledge of the basic and advanced disciplines that together form Neuroscience with a focus on the molecular biology of neuronal systems, midbrain and cortex development and signal transduction;

- solid understanding of neurodevelopment and neurodevelopmental disorders and a deepened understanding of relevant technologies applied within the field of molecular neuroscience.

Exit qualifications track Psychopharmacology and Pathophysiology

In addition to the paragraph with the general exit qualifications of the MSc Biomedical Sciences, the student finishing the track Psychopharmacology and Pathophysiology has obtained the following track-specific qualifications:

- a solid knowledge of the basic and advanced disciplines that together form Neuroscience with a focus on putative neuronal substrates, mechanisms of action and deficits underlying the most important and/or common neuropsychiatric and neurological disorders.
- has performed an internship where he/she obtained a deeper understanding of, and at least some practical experience with, some of the most commonly used research tools, models and approaches and analytical methods to study the potential substrates, behavioural responses and disease mechanisms implicated in these brain disorders.

Exit qualifications MSc Biomedical Sciences combined with a minor or major

In addition to the previous paragraphs, the graduate who has chosen to do a second track- specific research project has the ability to continue his/her career either as a researcher able to pursue a PhD degree at world's best universities, as a scientist in research institutes worldwide, or as a research-skilled professional in an organisation of government, civil society or business and industry. Furthermore, the graduate who has chosen to do a major obtains the exit qualifications that are listed fort his major.

APPENDIX 4: OVERVIEW OF THE CURRICULUM

Curriculum Overview Normal Programme Medical Biology Tracks

BIOMEDICAL SCIENCES 2016/2017 - Medical Biology Tracks										
	Period 1		Period 2		Period 3	Period 4		Period 5		Period 6
	September	October	November	December	January	February	March	April	May	June
YEAR 1										
BMD	**Molecular Biology of the Cell (6EC)** Maike Stam	**Biomedical Systems Biology (6EC)** Stanley Brul	**Gastrointest. Disease and Cardiovascular Disease (6EC)** Anje te Velde (AMC) / **Advanced Medical Microbiology (6EC)** Bas Zaat (AMC)		**Microbial Genomics (6EC)** VU	**Current Issues in Developmental Biology (6 EC)** Renee van Amerongen				**Laboratory Animal Course [art. 9](6EC)** Rob de Heus
CBAM	**Molecular Biology of the Cell (6EC)** Maike Stam	**Advanced Microscopy (6EC)** Mark Hink	**Clinical Cell Biology (6EC)** Ron van Noorden (AMC)		**Microbial Genomics (6EC)** VU	**Current Issues in Developmental Biology (6 EC)** Renee van Amerongen				**Laboratory Animal Course [art. 9](6EC)** Rob de Heus
EIM	**Molecular Biology of the Cell (6EC)** Maike Stam	**Pathology, Neurogenetics and Endocrinology (6EC)** Dries Kalsbeek (AMC)	**Gastrointestinal Disease and Cardiovascular Disease (6EC)** Anje te Velde (AMC)		**Microbial Genomics (6EC)** VU	**Current Issues in Developmental Biology (6 EC)** Renee van Amerongen				**Laboratory Animal Course [art. 9](6EC)** Rob de Heus
I&I	**Molecular Biology of the Cell (6EC)** Maike Stam	**Advanced Immunology (6EC)** Marieke van Ham (AMC/Sanquin)	**Advanced Medical Microbiology (6EC)** Bas Zaat (AMC)		**Microbial Genomics (6EC)** VU	**Current Issues in Developmental Biology (6 EC)** Renee van Amerongen				**Laboratory Animal Course [art. 9](6EC)** Rob de Heus
ONC	**Molecular Biology of the Cell (6EC)** Maike Stam	**Experimental Oncology (6EC)** Jannie Borst (NKI)	**Clinical Cell Biology (6EC)** Ron van Noorden (AMC)		**Microbial Genomics (6EC)** VU	**Current Issues in Developmental Biology (6 EC)** Renee van Amerongen				**Laboratory Animal Course [art. 9](6EC)** Rob de Heus
YEAR 2										
All tracks	**Research Projects 1 and 2 (78-96 EC)*** Individual projects, each 30 - 60 EC									**Literature Review (12 EC)*** Individual project

* RP1, RP2 and LR are individual projects that are each planned in year 1 and/or 2 by the student individually.

Compulsory course
Elective course

Curriculum Overview Normal Programme Neurobiology Tracks

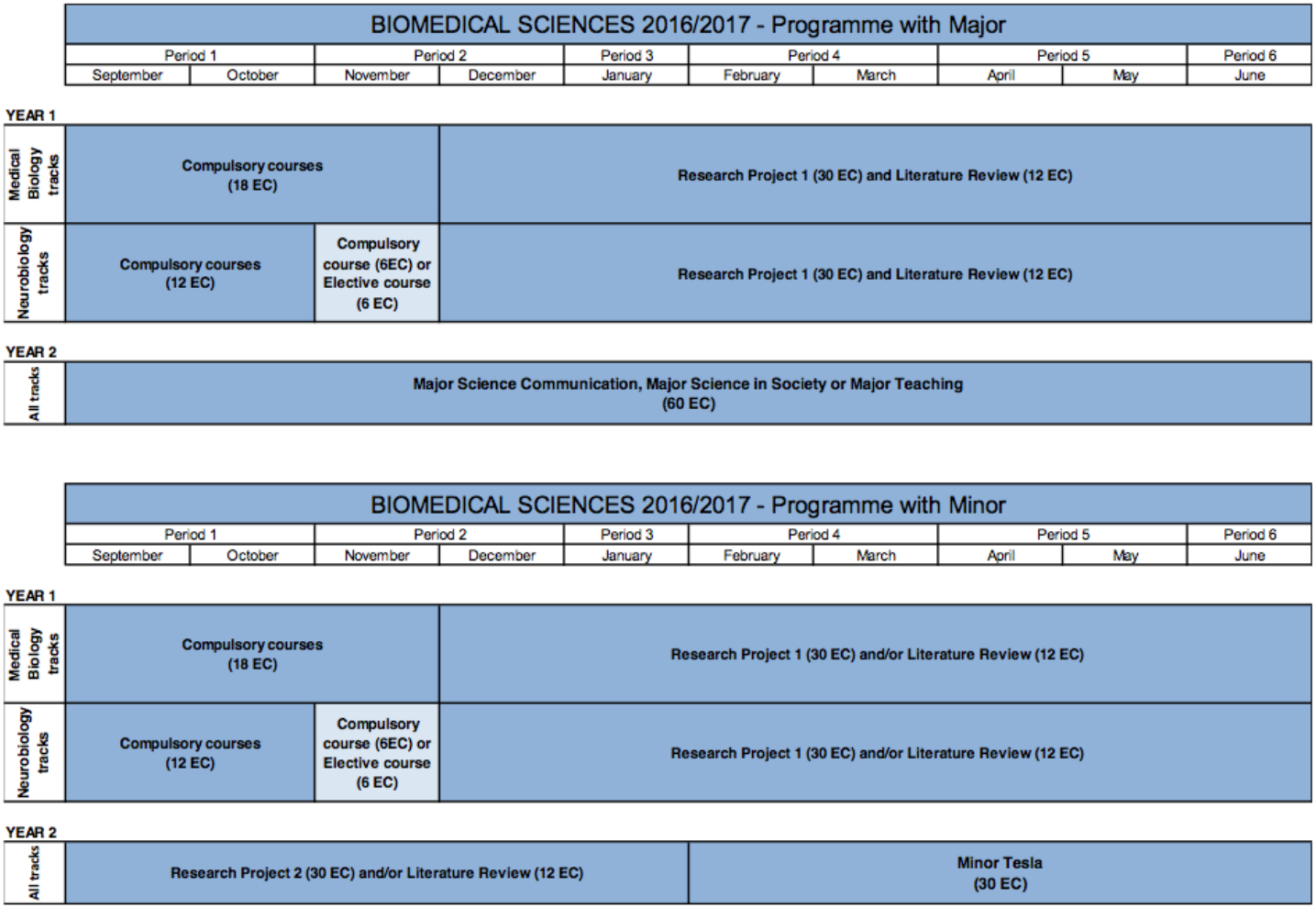
BIOMEDICAL SCIENCES 2016/2017 - Neurobiology Tracks

	Period 1		Period 2		Period 3	Period 4		Period 5		Period 6
	September	October	November	December	January	February	March	April	May	June
YEAR 1										
BAN	**Advanced Neuroscience (12EC)** Natalie Cappaert		**Advanced Neuroscience 2 (6EC)** Natalie Cappaert							**Laboratory Animal Course [art. 9](6EC)** Rob de Heus
CN2	**Advanced Cognitive Neurobiology and Clinical Neurophysiology (12EC)** Umberto Olcese		**MATLAB Applied to Neural Data (6 EC)** Conrado Bosman	**Neural Models, Representation [...] (6EC)** Cyriel Pennartz						**Laboratory Animal Course [art. 9](6EC)** Rob de Heus
MNS	**Neurodevelop-ment/Specifica-tion of Neuronal Systems (6EC)** Lars van der Heide	**Stem Cell Fate and Cortical Genesis (6 EC)** Lars van der Heide	**Neuronal Signaling Transduction Pathways (6 EC)** Lars van der Heide							**Laboratory Animal Course [art. 9](6EC)** Rob de Heus
PPP	**Advanced Psychopathology (12 EC)** Aniko Korosi		**Methods and Techniques in Neurobiology (6EC)** Aniko Korosi	**Brain Programming; Early-Life, [...] (6EC)** Aniko Korosi						**Laboratory Animal Course [art. 9](6EC)** Rob de Heus
YEAR 2										
All tracks	**Research Projects 1 and 2 (78-96 EC)*** Individual projects, each 30 - 60 EC									**Literature Review (12 EC)*** Individual project

* RP1, RP2 and LR are individual projects that are each planned in year 1 and/or 2 by the student individually.

Compulsory course
Elective course

Curriculum Overview Programme with Major or Minor



APPENDIX 5: PROGRAMME OF THE SITE VISIT

14 september		
8.45	9.00	Aankomst panel
9.00	11.00	Voorbereidend overleg en inzien documenten panel
11.00	11.45	Gesprek met management (BSc en MSc) Prof. dr. Jan de Boer: directeur onderwijs FNWI Dr. Jeroen Goedkoop: directeur College of Science Dr. Hans van de Spek: directeur Graduate School of Life and Earth Sciences Dr. Jurgen Seppen: opleidingsdirecteur master BMS Dr. Lars van der Heide: programme developer master BMS Prof. dr. Stanley Brul: opleidingsdirecteur bachelor BMW
11.45	12.30	Gesprek met studenten Bsc Anne-Fleur Gähler: 3de jaars BMW studente Bouke Bentvelsen: 2de jaars BMW studente (honours) Janneke Hummelink: 1ste jaars BMW studente Niels Reijner: 1ste jaars BMW student Pjotr van der Jagt: 1ste jaars BMW student (honours) Sabine Straathof: 2de jaars BMW studente (honours) Nicolaas Boon: 3de jaars BMW student (honours en excellentietraject) Pjotr van der Jagt: 1ste jaars BMW student (honours)
12.30	13.30	Lunch en rondleiding faciliteiten
13.30	14.15	Gesprek met docenten Bsc Dr. André Heck: Wiskunde (Jaar 1) Prof. dr. Marieke van Ham Immunologie theorie en praktijk (Jaar 1, 2 en 3) Dr. ir. Paul Fransz: Moleculaire Celbiologie en Bachelorproject (Jaar 3) Ing. Richard de Boer: Practicum (Jaar 2) Dr. Renée van Amerongen: Ontwikkelingsbiologie (Jaar 3) Dr. Monique Quaedackers: adjunct opleidingsdirecteur BMW/ / Academische vaardigheden (Jaar 1)/ Dubbele Bachelor vanuit BMW Prof. dr. Roelof Jan Oostra: Anatomie en embryologie (Jaar 1)/ Dubbele Bachelor vanuit Geneeskunde
14.15	15.00	Gesprek met studenten MSc Camiel Mannens: MNS track Cathelijn te Koppele: BAN track Boas van der Putten: EIM track Quincy Krijger: CN2 track Rebecca McIntyre: BMD track Sanne Lith: CBAM track Ronak Shah: ONC track
15.00	15.15	Pauze

15.15	16.00	Gesprek met docenten MSc Dr. Anje te Velde: trackcoördinator EIM Dr. Marco Hoekman: docent moleculaire neurobiologie Dr. Natalie Cappaert : trackcoördinator CNN Dr. Aniko Korosi : trackcoördinator PPP Prof. dr. Dorus Gadella-Johannes: trackcoördinator CBAM Prof. dr. Jannie Borst: trackcoördinator ONC
16.00	16.45	Gesprek met Opleidingscommissies BSc en MSc (OLC) Dr. Martijs Jonker: voorzitter Dr. ir. Huub Hoefsloot: docent Dr. Frans Hochstenbach: docent Laura Kummer (Duba): student Hajar Taârnit: student Roan van Scheppingen: student
16.45	17.30	Alumni van BSc en MSc Amber Berdenis van Berlekom: MNS track, PhD Utrecht Katinka Rus: MNS track, NTR Marleen Rodenburg: MNS track, Elsevier Reuben Smith: Medical Biochemistry track (nu BMD), post doc AMC Anna van Beek: I&I track, Phd Sanquin Tanit Lizama Gabriel: EIM track, postdoc Gut Research Tytgat Institute/GSK
17.30	18.00	Korte nabespreking dag 1/benoemen aandachtspunten dag 2

15 september		
9.00	9.45	Aankomst panel, inzien documenten, voorbereiding gesprekken, inloopspreekuur
09.45	10.30	Gesprek met Examencommissies BSc en MSc Dr. Martijn Rep: voorzitter Dr. Erik Manders: lid en beoogd voorzitter vanaf 2e helft 2017 Dr. Carlos Fitzsimons: lid Dr.ir. E.E. van Loon: lid Drs. Annemarie Tasseron: ambtelijk secretaris
10.30	11.30	Overleg panel/ Voorbereiden eindgesprek (pauzemoment)
11.30	12.15	Eindgesprek management (inclusief decaan)
12.15	13.00	Lunch (=pauze)
13.00	15.00	Opstellen voorlopige bevindingen
15.00	15.30	Mondelinge rapportage voorlopige bevindingen

APPENDIX 6: THESES AND DOCUMENTS STUDIED BY THE PANEL

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

5872901	6030629	6088295
6116817	10002048/6286240	10002148/6286992
100557036/275125	10629610	10070680/6326188
10076409/6333478	10096744	10099298/6360467
10115277/6376215	10272070	10758046

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):

Course materials of the following courses
- Molecular Biology of the Cell
- Experimental Oncology
- Advanced Immunology
- Advanced Psychopathology
- MATLAB Applied to neural data
- Advanced Neurobiology

Course evaluations

Documentation Research Project and Literature Review

Examination Board
- Annual report
- Documentation on quality control

Reports Programme Committee

Communication materials master Biomedical Sciences