

Advisory report
Limited Framework Programme Assessment

Bachelor and Master Nanobiology (joint degree)

Delft University of Technology and Erasmus University Rotterdam

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1. Executive summary

In this executive summary, the panel presents the considerations which led to the assessment of the quality of the bachelor programme (BSc) and master programme (MSc) of Nanobiology of the Delft University of Technology (Faculty of Applied Sciences) and Erasmus University of Rotterdam (Erasmus Medical Centre). The programme was assessed according to the standards of the NVAO Assessment framework for the higher education accreditation system of the Netherlands (version September 2018) and the '*Protocol voor Nederlandse aanvragen accreditatie leidend tot een joint degree*' (version 2011/7 June 2010).

Standard 1 - Intended learning outcomes

The bachelor and master programmes of Nanobiology are steadily growing into mature programmes with a distinctive, unique profile. The ILOs are relevant for the field, are of bachelor, respectively master level and are evaluated in an international perspective. Therefore, the panel concludes that both programmes meet the criteria of standard 1.

The panel sees room for improvement regarding the involvement of work field representatives and alumni when it comes to tailoring (some of) the ILOs to the field of industry, policy making, education etc. This applies in particular to the master programme, since 40% of the master graduates pursue a career outside academia.

Standard 2 - Teaching-learning environment

The courses of both programmes are linked to the ILOs of both programmes. The programmes enable achieving the ILOs and reaching the intended end level (see standard 4). The programmes have a clear structure, students know what to expect. Different working methods are used, tailored to the goals of the courses.

Both programmes are challenging, completion rates within the nominal study duration are low. Most students do complete their studies but take one or two additional years. Teachers and management are aware of this and have successfully addressed some of the underlying problems.

Both programmes are taught in English, because of the international staff and research field. The English-taught bachelor programme has the additional advantage of attracting international students, thereby creating an international teaching-learning environment right from the start.

Both programmes are strongly student-oriented in its broadest sense. Students have a lot of freedom and a lot of options to choose from. Even in the bachelor, which is a fundamental programme focused on covering the basics of several disciplines, it is still possible to tailor the programme to individual needs. Teachers are dedicated, they all have a passion for education.

The panel therefore concludes that both programmes meet the criteria of standard 2.

The panel thinks that merging some of the small courses would improve the studyability of the programmes and would at the same time enhance the coherence. It will also stimulate co-teaching (between teachers from Delft and Rotterdam) and interdisciplinary approaches.

Standard 3 - Assessment

Bachelor and master assessments are valid, outcomes are reliable, and procedures and criteria are transparent. The Board of Examiners (*examencommissie*) operates properly and has a clear picture of the achieved end level of both programmes, through a well-structured and carefully executed re-assessment strategy of theses. Therefore, the panel concludes that both programmes meet the criteria of standard 3.

There is room for improvement regarding policy matters. Principles for formative and summative assessment, a straightforward procedure for executing the plagiarism check, and a procedure for appointing internship examiners, should be addressed in the programme's assessment policy. The Board of Examiners could grow in its role of steering and influencing these policy matters.

Standard 4 - Achieved learning outcomes

The theses are relevant for the field and are of bachelor, respectively master level. Especially the master theses are of exceptional quality. The programme delivers top level alumni. The panel concludes that both programmes meet the criteria of standard 4.

For a quick overview of strengths and points of attention, see chapter 5.

Based on these outcomes, the panel's conclusion is 'positive' in terms of the NVAO framework. Therefore, the panel will advise the NVAO to decide positively regarding the re-accreditation of both programmes.

Rotterdam, 15 July 2022,

Prof. dr. M.L. Groot
(panel chair)

Drs. B.E. Roemers
(panel secretary)

2. Programme administrative information

Name programme in CROHO:	Bachelor Nanobiology (joint degree) Master Nanobiology (joint degree)
Orientation, level programme:	Academic Bachelor (BSc) Academic Master (MSc)
Number of credits:	BSc: 180 EC (3 years) MSc: 120 EC (2 years)
Specialisations:	n/a
Location:	Delft and Rotterdam
Mode of study:	Full-time
Language of instruction	English
Registration in CROHO:	BSc Nanobiology: 55003 MSc Nanobiology: 65011
Initial accreditation expiry date:	BSc Nanobiology: 30 July 2023 MSc Nanobiology: 29 June 2021 (extended for clustering)
Extension:	MSc Accreditation extended to enable cluster with BSc
Latest submission date advisory report:	BSc Nanobiology: 31 October 2022 MSc Nanobiology: 31 October 2022
Name of institutions:	Delft University of Technology Erasmus University Rotterdam
File numbers NVAO:	Delft University of Technology: PA-1135 Erasmus University Rotterdam: PA-1136
Coordinator (“ <i>penvoerder</i> ”):	Delft University of Technology
Status of institutions:	Delft University of Technology: government-funded Erasmus University Rotterdam: government-funded
Institution’s quality assurance:	ITK Delft University of Technology: positive outcome, valid until 20 November 2023 ITK Erasmus University Rotterdam: positive outcome, valid until 22 October 2024

3. Findings, considerations and assessments per standard

3.1 Standard 1: Intended learning outcomes

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

Findings

Introduction

Since 2012 the Faculty of Applied Sciences of Delft University of Technology and the Faculty of Medical Science (Erasmus Medical Centre) of Erasmus University Rotterdam offer the bachelor programme of Nanobiology as a joint degree. The agreement on which this partnership is based, was signed by both participating universities in August 2011.

Since 2015 the Faculty of Applied Sciences of Delft University of Technology and the Faculty of Medical Science (Erasmus MC) of Erasmus University Rotterdam offer the master programme of Nanobiology, also as a joint degree. The agreement on which this partnership is based, was signed by both participating universities in July 2014.

The NVAO preferred one assessment process in which both programmes were evaluated (“*clustervisitatie*”). To enable this, the expiry date of the accreditation of the master programme was extended (see previous page).

Discipline of nanobiology

Nanobiology is an emerging discipline where biology (focusing on living organisms) and physics (focusing on inanimate systems) meet, to unravel the molecular basis of health and disease. To be successful in this unravelling (for instance to apply quantitative analysis), knowledge and skills from adjoining disciplines like mathematics, chemistry and computer sciences are essential. As the programme managements puts it “nanobiologists use the language of maths and the concepts of physics to understand the complexity of biology”.

Profile and position

The programme of Nanobiology compares itself amongst other programmes with the programme Life Science and Technology (LST) and states that Nanobiology focuses on connecting biology and physics, whereas LST focuses on connecting biology and chemistry. Graduates therefore end up in different fields. Nanobiologists develop a small-scale-focus and use this for instance to invent and develop medical applications, LST graduates focus on larger scale questions and use this to analyse and improve industrial processes.

Intended learning outcomes

In order to formulate intended learning outcomes, the programme studied the English reference framework of the Quality Assurance Agency of Higher Education (QAAHE) and states that intended learning outcomes (ILOs) related to fundamental physics and molecular biology are suitable for the Nanobiology programme. These ILOs therefore served as a basis. Subsequently the ILOs for both programmes are divided in knowledge, research skills and communication skills and linked to the five Dublin descriptors.

Aim of the programmes

The bachelor programme is a fundamental programme, aiming to prepare for a wide range of master programmes, including the master of Nanobiology, Biomedical Engineering, Neuroscience and Molecular Medicine.

The master programme aims to prepare for a wide range of (research) careers, both in academia and in the job market outside university, including consultancy, industry, policy and education.

Workfield and alumni

During the site visit the panel spoke to alumni and work field representatives. Some of them employed former students Nanobiology, some of them worked as a supervisor of graduation projects and some provided internships. They had not met each other before and had not yet been consulted in the process of formulating intended learning outcomes.

Considerations

Profile

The bachelor programme has now been running for ten years, the master programme for seven years. According to the panel, the programmes of Nanobiology are steadily growing into mature programmes with a distinctive, unique profile.

For the coming years the panel suggests investigating possibilities to compile a domain specific reference framework for Nanobiology and related programmes (including programmes in the domain of medical physics, molecular biology etc.). Such a broader framework for more than one programme is not necessarily a must-have but could help to distinguish the similarities and differences between related programmes and therefore help fine-tuning and emphasising the unique profile of Nanobiology.

ILOs

The ILOs have been formulated with care and the difference between bachelor and master level has been made clear by linking the ILOs to the Dublin descriptors for bachelor and master level. The ILOs are relevant for the field and have been evaluated in an international perspective by using the QAAHE framework as a starting point.

As about 40% of the master graduates finds a job outside university, some ILOs of the master programme should be tailored more explicitly to the needs of the nanobiologists who will be working in consultancy, industry, policy and education. In this context, the panel suggests considering including ILOs regarding entrepreneurial skills and more engineering-oriented skills in the master's ILOs.

In general, the panel thinks that the programme could benefit more from the connections with the work field representatives and alumni. Their current involvement is more on a practical level (i.e., supervising students and employing alumni) than on a strategic level (i.e., providing input on programme level, for instance evaluating the ILOs). According to the panel, organising meetings once or twice a year with these external stakeholders can be worthwhile to retrieve first-hand information on changes in the job market that need translation into the ILOs.

Moreover, intensifying the relationship with employers outside academia will also stimulate the process of "brand recognition". According to students this is necessary, because many possible employers do not have a clear picture yet of what nanobiologists have to offer.

Assessment of this standard (summary and conclusion)

The bachelor and master programmes of Nanobiology are steadily growing into programmes with a distinctive, unique profile. The ILOs are relevant for the field, are of bachelor, respectively master level and are evaluated in an international perspective. Therefore, the panel concludes that both the bachelor and the master programme meet the criteria of standard 1.

That said, the panel sees room for improvement regarding the involvement of work field representatives and alumni when it comes to tailoring (some of) the ILOs to the field of industry, policy making, education etc. This applies in particular to the master programme, since 40% of the master graduates pursue a career outside academia.

3.2 Standard 2: Teaching-learning environment

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

Findings

Bachelor programme

The bachelor programme, 180 EC (3 years), consists of a “core” of 120 EC (year 1 and 2). This core includes fundamental courses in biology, physics, mathematics, and chemistry. So-called ‘integration courses’ (courses in which content of the previously mentioned disciplines are taught combined), ‘umbrella courses’ (philosophy, ethics journal clubs etc.) and ‘courses for skill training’ (including lab work, programming etc.) are also core courses.

The last year (year 3, 60 EC) consists of a minor (30 EC), for instance a minor abroad, a bridging minor or a self-composed minor, electives (10 EC) and an academic research project (20 EC) called the bachelor end project (BEP) ending up in a bachelor thesis.

Master programme

The master programme consists of a core of advanced interdisciplinary courses (26 EC) combining physics, biology, computation and mathematics. Electives (22 EC), courses in academic skills (10 EC), a small research project, to be carried out at the university or as an internship at a company (18 EC) and an academic research project (44 EC) called the master end project (MEP) ending in a master thesis, complete the programme.

Comparison

Students state that the bachelor programme is a broad, fundamental programme preparing for more than just the master of Nanobiology. Graduates can enrol in the master programmes of Biomedical Engineering, Neuroscience and Molecular Medicine without bridging programmes. By choosing specific electives, even more options are on offer. Students claim that teachers do their utmost to support them discovering their talents, rather than pushing them to the master Nanobiology.

Most teachers are active in both programmes. According to them, the difference between the programmes is that the bachelor programme is a founding programme, covering the immutable fundamentals of nanobiology supporting disciplines, whereas the master is a dynamic constantly changing programme on the cutting edges of the relevant disciplines.

The management adds that the bachelor is mainly focused on preparing students for a master programme, although some bachelor graduates become a research technician, a data analyst, or a chemistry teacher. Since most bachelor graduates enrol in a master programme, the bachelor programme does not include a company experience, whereas the master programme does offer that option.

Joint degree

Both participating institutions have a programme director (Delft for the master programme, Rotterdam for the bachelor programme), both institutions provide teachers from various departments (see section ‘teachers’ next page), and both institutions provide graduation projects for bachelors and masters. The core department in Delft is the department of Bionanoscience, the core department in Rotterdam is Molecular Genetics. Educational activities take place at both campuses. The programme coordinator and the academic counsellor, employed by Delft University of Technology, divide their time between both locations.

Influx, internationalisation, and language of instruction

The bachelor programme has an enrolment cap (*numerus fixus*) and is open to 120 new students every year since 2021. (Before 2021 the enrolment cap was 100.) The bachelor programme has been attracting about 90 students every year during the last three years, the master programme about 40.

Both programmes are in English. These days, about 50 percent of the bachelor influx comes from abroad. Students, teachers, and management applaud this: it is good for the international vibe. Moreover, the diversity in educational backgrounds enables and stimulates students to help each other.

The percentage of international students entering the master programme is unclear, since students who followed the bachelor programme are classified as “having a Dutch educational background” when entering the master. Almost all master students (95%) followed the bachelor programme of Nanobiology. For those who did not, the master programme offers bridging programmes.

In the bachelor programme students can choose for a minor abroad, in the master programme students can do their internship abroad. Following electives in foreign countries is stimulated and during the programmes (both bachelor and master), students are immersed in an international educational environment since many students and many teachers come from countries outside the Netherlands. Especially during the end projects (both bachelor and master end projects), students participate in an international research community. About 10% of the bachelor graduates pursuing a master outside nanobiology, go to international universities.

Working methods

Both programmes use various working methods, including projects, exercises, lectures, practicals (lab work) etc. Students often work in groups, especially when executing experiments and preparing presentations of the outcomes. According to students, the courses in Delft are mainly focused on developing technical knowledge and skills, the courses in Rotterdam are mainly focused on the field of biology, which is reflected in the educational methods: the biology courses require transferring a lot of theoretical information. Lectures are then appropriate. Application is key to develop technical skills. Students thus practice in labs. Maths is mainly taught in lectures. Next to the theoretical information students get a lot of exercises in the math courses.

Study load

The average percentage of bachelor students graduating within 3 years (nominal) is 35% (within 4 years (nominal + 1) 68%). The average percentage of master students graduating within 2 years (nominal) is 34% (within 3 years (nominal + 1) 70%). Students hardly complain about the study load of the programmes. According to them, information provided to prospect students is unambiguous regarding what to expect in terms of study load, and what is expected in terms of attitude and discipline. Furthermore, they state that in many cases, it is a personal choice to take one or two extra years, for instance to combine studies with a board year or with working as a high school teacher. Nevertheless, students also mention that for international students who do not have the luxury of being able to extend their study period, the situation is different.

Furthermore, students stress that some successful measures have been taken to make the programme more studyable. The MOOCs for maths and physics were considered helpful. The rescheduling of courses, exams and resits in the bachelor helped to balance the study load and to lower the risk of having to retake a course a full year later. Teachers of interrelated courses (for instance biology and chemistry) discussed the content of their courses with each other to prevent overlap. Courses have been tailored to the needs of nanobiologists as much as possible, meaning that redundant content is left out. In some cases, the number of ECs did not represent the study load accurately. Students were then being consulted when the numbers of ECs were evaluated.

In the master programme, the schedule has been changed as well to spread the study load; it is now possible to do an internship without having to combine this with courses. Students consider this an important improvement. (Because of personal choices, the internship can still lead to delays; some students extend their internship.)

Furthermore, preventing master students from taking too much time for their MEP, received extra attention. According to students it can be tempting to keep on executing extra experiments to collect more data, but supervisors are increasingly keen on warning them for potential delays.

Teachers

Most teachers are active in both programmes. Since nanobiology is still a relatively new field, the teachers are not educated as nanobiologist, but all are experts in the one or more disciplines essential for nanobiology. To stimulate their own development as a nanobiologist and the development of the programme, teacher meetings are organised to discuss learning lines, cross-overs, interconnections etc.

Most teachers are relatively young and not yet full professor. About two-thirds of the bachelor teachers (29/46) and about two-thirds (13/21) of the master teachers have their UTQ. Most of the other teachers are currently working on their UTQ.

About half of the teachers are employed in Rotterdam, the other half in Delft. Departments providing teachers are the departments of Bionanoscience, Imaging Physics, Chemical engineering, and Applied Mathematics in Delft, and the departments of Molecular Genetics, Developmental Biology, Cell Biology, Neuroscience, and Optical Imaging in Rotterdam. A few teachers work at both institutions.

Programme coordinators

There are two programme coordinators. One of them mainly focusing on selection, the other one serving as a linking pin and a spider in the web. Teachers state that the latter provides a lot of practical information, especially during the pandemic. Students claim that she is very approachable and that she helps students in all sorts of situations. She is eager to assist every single student optimally. During the site visit students mentioned various examples to illustrate this.

Board of Studies and Study Association

The Board of Studies (BoS) (*opleidingscommissie*) takes pride in its role of safeguarding the quality of the programme by evaluating individual courses and the programme as a whole. (During the site visit, the BoS members explained their influence on the repositioning of Optical Imaging and Protein Design in the curriculum.) The BoS uses questionnaires but collects more input during the free lunches organised by the study association Hooke. The BoS and Hooke actively stimulate students to give feedback on the programme. The BoS and Hooke also mingle in discussions about reducing the study load and dealing with covid restrictions. To make sure that international students have a voice, the BoS has an international student member. The BoS is supported by a secretary (*ambtelijk secretaris*).

Covid-19

Teachers of Delft and Rotterdam stated that the covid pandemic brought them closer together since they had to discuss more than under normal circumstances. Several measures were discussed and implemented to enable students to continue their studies as smoothly as possible. Students were taught in smaller groups, the programme management stayed in close contact with teachers to identify possible problems and to provide solutions, course content was published online, guest lectures were given online and both in Delft and in Rotterdam laboratories were kept open many extra hours, also during weekends, to enable small groups of students to do lab research. Last but not least, the Corona Research Super Project was developed as a research project.

Both students and teachers stated that some of the new educational “discoveries” during the covid pandemic were considered to be useful and useable in normal circumstances as well, such as videos, recorded lectures, and online lectures provided by guest lecturers. These novelties have been adopted permanently.

Considerations

ILOs, learning objectives and working methods

Both programmes are composed of courses, linked to the ILOs of the programmes. The tables demonstrating this connection, are transparent. More detailed information (learning objectives, educational methods, assessment methods etc.) are provided in the study guide. This information is available for students well in advance. Both programmes use various working methods in line with the goals of the courses.

Student-centred

Both programmes have a clear structure of a solid core, possibilities to tailor the programme to individual ambitions and an end project ending up in a thesis. It has been explained convincingly why the master programme offers more options and more flexibility than the bachelor programme; the bachelor programme mainly serves as a preparation for a master programme for which the basis (fundamental knowledge in biology, physics, maths and chemistry) needs to be strong. This also explains why an internship is only facilitated in the master. In the bachelor it would be at the expense of acquiring fundamental knowledge. Moreover, since most bachelor graduates continue their studies in a master programme, only a few students would benefit from a bachelor's internship.

At the same time the panel does see a lot of possibilities to also customise the bachelor programme to students' personal preferences, especially when it comes to choosing electives and an end project. Teachers sincerely support students to develop their own profile and choose electives accordingly, rather than trying to force them into the direction of the master of Nanobiology. Teachers hereby truly give substance to the concept of student-oriented education.

The panel also observed this student-oriented approach and atmosphere at other levels. Teachers and students interact and cocreate and form a strong and vibrant teaching-and-learning-community. As one of the teachers said: "Our students are the true nanobiologists, they need us for their development, but we need them for our development and further development of the programme."

Furthermore, the panel observed that communication lines are short, the BoS and Hooke are on top of things and the programme coordinator dedicatedly fulfills her role with a personal touch. Even during the covid pandemic, this student-centred quality culture was not at stake.

Study load and programme coherence

Both programmes are challenging. Not many students graduate within the nominal study duration. Students themselves do not see this as a serious problem. Communication about what to expect is clear and students make well-informed choices regarding extracurricular activities, knowing that this will cause delays. Moreover, the programme implemented measures to tackle some of the problems. As one of the panel members summarised: "The treatable ailments have been treated".

Nevertheless, the panel does see room for further improvement. Both programmes offer a lot of small courses (2 or 3 ECs). Since students mention that they sometimes have trouble seeing the coherence and the bigger picture of nanobiology, the panel thinks that a "triple-purpose-solution" lies ahead: if some smaller interrelated courses are merged, the relation between these courses will become clearer and the study load will be reduced. (Topics regarding ethics for example, could be part of several of the other courses, rather than being taught separately in one course of 3 EC.) Thirdly, the panel believes that combining courses will stimulate co-teaching and a more interdisciplinary approach. If for instance a course on biology (Rotterdam) and a course on physics (Delft) are merged and then taught by both teachers, this will create a fertile environment for true bridging initiatives, thereby strengthening the unique profile of the programmes. In line with this, co-supervising bachelor and master students during their end projects, i.e. involving both a supervisor from Delft and a supervisor from Rotterdam, should be considered as well.

The panel noticed that students (and teachers) were not too fond of the idea of merging courses, but the panel thinks that their reluctance is based on cold feet. After all, many programmes have good experiences with this type of transitions. According to the panel, the programme management should play a more prominent role in this. Course evaluation is well-structured, but the evaluation of the programme as a whole should receive more attention.

Joint degree

Both institutions clearly have their own role, and each institution does what it does best. At the same time, they add value to each other, which is reflected in this joint degree. Covid even turned out to have a positive effect on collaborating; online meetings are common these days. The panel believes, the time has come to try to grow from the solid basis of multidisciplinary to interdisciplinarity (see previous section).

English-taught

Both programmes are in English. According to the panel this is an obvious choice. Many staff members come from foreign countries, do not speak Dutch and are not replaceable. The research field is international and will benefit from more international input in the future. Moreover, offering the bachelor in English will prevent students from experiencing difficulties regarding English-taught lectures in the master.

Teachers

The teachers made a very enthusiastic and dedicated impression on the panel. They are specialists in their fields, but at the same time they are prepared to focus on those parts that are particularly important for nanobiology. Most of them are young and education-minded and they represent a new generation of teachers. Although the panel sees this as a strength of the programme, this also brings challenges regarding the development of the research field. Since the field of nanobiology is relatively young, the programme could benefit from hiring more full professors for educational tasks.

Teachers communicate with each other about their courses. The panel welcomes this and encourages the teachers to go one step further and explore co-teaching (see study load section).

About two-thirds of the teachers have their UTQ and most of the others are currently working on their UTQ. A mere handful does not have a UTQ certificate. The panel is confident that the MT will continue to monitor progress and that the UTQ rate will soon be about 90%.

Assessment of this standard (summary and conclusion)

The courses of both programmes are linked to the ILOs of both programmes. The programmes enable achieving the ILOs and reaching the intended end level (see standard 4). The programmes have a clear structure, students know what to expect. Different working methods are used, tailored to the goals of the courses.

Both programmes are challenging, completion rates within the nominal study duration are low. Most students do complete their studies but take one or two extra years. Teachers and management are aware of this and have successfully addressed some of the underlying problems.

Both programmes are taught in English, because of the international staff and research field. The English-taught bachelor programme has the additional advantage of attracting international students, thereby creating an international teaching-learning environment right from the start.

Both programmes are strongly student-oriented in its broadest sense. Students have a lot of freedom and a lot of options to choose from. Even in the bachelor, which is a fundamental programme focused on covering the basics of several disciplines, it is still possible to tailor the programme to individual needs. Teachers are dedicated and inspiring, they all have a passion for education.

Therefore, the panel concludes that both the bachelor and the master programme meet the criteria of standard 2.

That said, the panel thinks that merging some of the small courses would improve the studyability of the programmes and would at the same time enhance the coherence. It will also stimulate co-teaching (between teachers from Delft and Rotterdam) and interdisciplinary approaches.

3.3 Standard 3: Assessment

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

Assessment policy

Both programmes adopted faculty wide assessment policy, described in the Rules and Regulations of the Board of Examiners (*examencommissie*) and in the Teaching and Examination Regulations (TER) (*onderwijs- en examenregeling*). Each TER contains a programme-bound part. The programmes have no specific vision or policy regarding formative and summative assessment.

Assessment methods

Both programmes use various assessment methods, including written and oral exams, examination through (poster) presentation, reports, homework assignments, laboratory notebooks, group presentations for journal clubs etc., depending on the goal of the course. The study guide provides assessment information of every course.

According to students and teachers, discussions between the student and his/her supervising teaching assistant (TA) is the most important part of the learning process. Other forms of formative assessment include the intermediate exams (before drafting the final report) and feedback fruits (peer review among students).

Board of Examiners

The Board of Examiners (BoE) is a two-level-board, consisting of a faculty BoE and a programme-bound BoE. The bachelor and master programme of Nanobiology share the same programme-bound BoE: the NB-BoE. Some NB-BoE members are employed in Delft, others in Rotterdam. All members have a background related to (parts of) the field of nanobiology (including biochemistry, metabolic systems, molecular genetics, imaging physics etc.). The board has an external member and is supported by a secretary (*ambtelijk secretaris*).

Every year the NB-BoE re-assesses about 20% of the bachelor and master theses, drafted in Delft and in Rotterdam, and shares its findings with the faculty BoE and with the Nanobiology programme management. In their latest annual report, they stated that not all comment fields were completed properly by the examiners and that it was sometimes unclear how the plagiarism check had been executed.

The BoE appoints examiners. Examination (and supervision) of internships is organised and monitored by the Internship Office. One internship examiner is employed at the university of Delft or Rotterdam, the other one works at the company. The judgment of the examiner at the company is taken into account in the final grade for the internship. According to some of the work field representatives a weighting percentage was being used, according to the BoE the examiner employed at the university has the mandate to overrule this.

Covid

During the covid pandemic only two exams were postponed. All other exams were either changed into open book exams, or webcam proctored exams or other online exams. Learning objectives were maintained. When lab work (for instance for the biochemistry course) was not possible, students received data to analyse at home. These analyses were sent in and assessed.

Considerations

Valid, reliable and transparent

Both programmes use various assessment methods, corresponding with the goals of the courses. The exams are valid; what needs to be assessed and judged is assessed and judged. Exams are developed by two examiners and student products are judged by two examiners as well. This “both-ends-method” demonstrates the four-eyes-principle is considered to be essential which makes the exams and grades reliable. Detailed information about the exams is available well in advance through publication in the study guide. Both programmes have rubrics or other assessment and judging instructions available for every exam, including extensive rubrics for the bachelor and master theses. Next to that, teachers provide extra information on assessment of their courses during lectures. Assessment is thus transparent for students.

Rubrics for bachelor and master theses

The valid, reliable, and transparent assessment system provides a solid foundation enabling fine-tuning for further improvement. The panel suggests to evaluate the theses rubrics. The panel observed that only a few ‘boxes’ in the rubric forms are directly related to the reports and the panel missed a specific criterion for judging the interdisciplinary character of the conducted research project.

Board of Examiners

According to the panel the NB-BoE has a clear view of the end level of bachelor and master theses. The NB-BoE has a well-structured procedure in place to annually review a substantial part of the bachelor and master theses. Outcomes of the latest review are in line with the findings of the panel, especially regarding the plagiarism check: studying the thirty theses (see standard 4 for the outcomes), the panel came across Turnitin, DeepBR, Google, and ‘comparison with literature’. The panel advises to select one method and make this method compulsory. To achieve this, the BoE could play a steering role. Furthermore, the BoE observes the narrative feedback on the forms is sometimes a bit too “lean”. The panel agrees. Students would benefit from richer narrative feedback and the BoE could play a more stimulating role to achieve this.

This also goes for the approach of formative and summative assessment. BoE members stated that it is up to teachers to decide whether to use formative assessments, summative assessments or both for their courses. According to the panel, assessment policy should include principles for formative and summative assessments and the BoE could take the initiative to formulate this policy.

The BoE appoints examiners, but during the site visit it did not become clear what this policy meant in practice for the internships, since the Internship Office appoints the company's supervisor, who also has a say in the final grade of the student. The panel advises the BoE to either appoint all examiners, meaning both the examiners employed by the participating universities and the examiners in the companies, or only appoint the examiners affiliated with the participating universities and limit the role of the supervisors in the companies to just giving advice.

All in all, the panel thinks that the BoE takes its legal duty seriously and has a clear view of the quality and end level of the bachelor and master theses. The BoE plays a prominent role in safeguarding this end level. At the same time, the BoE could still grow in its role of steering and influencing policy matters.

Covid

The programme responded adequately to the covid pandemic. Only a couple of exams had to be postponed, all other exams were adapted to the circumstances and were proceeded.

Assessment of this standard (summary and conclusion)

Bachelor and master assessments are valid, outcomes are reliable, and procedures and criteria are transparent. The BoE operates properly and has a clear picture of the achieved end level of both programmes, through a well-structured and carefully executed re-assessment procedure of theses. Therefore, the panel concludes that both the bachelor and the master programme meet the criteria of standard 3.

There is room for improvement regarding policy matters. Principles for formative and summative assessment, a straightforward procedure for executing the plagiarism check, and a procedure for appointing internship examiners, should be addressed in the programme's assessment policy. The BoE could grow in its role of steering and influencing these policy matters.

3.4 Standard 4: Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.
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Findings

Teachers' impression

Teachers in the bachelor programme claim that the graduates have a solid base for both the master programme of Nanobiology and for continuing their studies in other, related master programmes. Teachers in the master programme claim that the master graduates have an independent spirit and a proactive attitude. They are used to things and situations being unclear at the beginning and they are good at solving their own problems. At the same time, they are cocreators at heart and they focus on interacting and communicating with others to come to satisfactory output.

Employers' impression

To evaluate the picture painted by the teachers, the panel spoke to work field representatives providing internships and employing graduates. They were unanimously enthusiastic about the Nanobiology graduates, stressing their most distinctive qualities: the graduates demonstrate a very high level of academic research while at the same time they are effective communicators, displaying their broad scope. They are creative, independent, and flexible and show a hands-on mentality when it comes to working on challenging projects and solving problems.

Theses

To get a more detailed image of the achieved end level of the programmes, the panel studied thirty theses, including the assessment forms completed by the examiners. Eight bachelor and eight master theses were written under supervision of a department in Delft, seven bachelor and seven master theses under supervision of a department in Rotterdam. Considerations are described below.

Considerations

Bachelor theses

The bachelor theses reflected bachelor level and demonstrated the intended learning outcomes had been achieved. The theses dealt with subjects relevant for the field of nanobiology. Criteria were clear and judgment was in line with the criteria. According to the panel, in a few cases comments on the grading forms were not in-depth or extensive enough (see standard 3).

The panel agreed with fourteen of the fifteen grades. One thesis, graded with a 7, should have been graded with a 6 according to the panel. This thesis was too much focused on engineering and physics and therefore not a typical nanobiology thesis. Secondly, proper testing and discussing the end results of the project were lacking in this thesis.

Master theses

The panel was impressed by the master theses. All theses dealt with research questions relevant for the field of nanobiology and almost all theses were of a very high level. More than just a few even touched upon PhD level. The panel was surprised to find out that none of the alumni seemed to have graduated cum laude. The master theses demonstrated that master graduates are more than fit for the next step in their careers as nanobiologists.

Assessment of this standard (summary and conclusion)

The theses are relevant for the field and are of bachelor, respectively master level. Especially the master theses are of exceptional quality. The programme delivers top level alumni. The panel concludes that both programmes meet the criteria of standard 4.

4. Overview of assessments

Bachelor programme Nanobiology

Standard	Assessment
Standard 1 - Intended learning outcomes	Programme meets Standard 1
Standard 2 - Teaching-learning environment	Programme meets Standard 2
Standard 3 - Student assessment	Programme meets Standard 3
Standard 4 - Achieved learning outcomes	Programme meets Standard 4
Conclusion, overall judgment	Positive

Master programme Nanobiology

Standard	Assessment
Standard 1 - Intended learning outcomes	Programme meets Standard 1
Standard 2 - Teaching-learning environment	Programme meets Standard 2
Standard 3 - Student assessment	Programme meets Standard 3
Standard 4 - Achieved learning outcomes	Programme meets Standard 4
Conclusion, overall judgment	Positive

5. Strengths and points of attention

In this report, strong points and points of attention have been addressed. In this chapter these are summarised in a compact list to provide a quick overview.

Strengths of the programmes

The panel observed the following strengths:

- The programmes have a distinctive, unique profile.
- Both programmes are strongly student-centred. This applies to
 - the approach in the bachelor: supporting students without forcing them in the direction of the master of Nanobiology
 - the possibilities to tailor the programmes to individual needs
 - the enthusiastic and dedicated teams, prepared to go the extra mile, which specifically applies to
 - the teachers and teaching assistants,
 - the programme coordinator,
 - the board of studies, and
 - the study association.
 - the climate of cocreation: teachers and students build the programmes together
- Some successful measures to reduce the study load in the bachelor have been taken:
 - rescheduling courses, exams and resits,
 - providing MOOCs for maths and physics,
 - reducing overlap between courses,
 - reducing redundant content, and
 - redistributing ECs of some courses.
- Some successful measures to reduce the study load in the master have been taken:
 - enabling to do an internship without having to combine this with courses, and
 - stimulating master students to deliver their thesis in time.
- A strong quality culture where everyone takes responsibility, for instance demonstrated by the adequate response to covid. Measures were more than adequate and some new teaching methods were adopted permanently.
- The BoE has a clear view of the end level of the bachelor and master alumni.
- The BoE has a well-structured procedure to annually review a substantial part of the theses of bachelor and master alumni.
- The master theses are of exceptional quality.

Points of attention and panel's recommendations

The panel observed some points of attention leading to the following recommendations:

- Intensify the relationship with the work field¹ and alumni to be on top of new developments in the work field, especially outside academia.
- Small courses should be merged in order to
 - o further reduce the study load,
 - o stress the coherence,
 - o stimulate co-teaching, and thereby
 - o stress and stimulate an interdisciplinary approach.
- Attract more full professors for educational tasks.
- Evaluate the rubrics for the theses (both bachelor and master) regarding
 - o direct connection to the report, and
 - o the assessment of an interdisciplinary approach
- Evaluate and strengthen assessment policy regarding
 - o methods for detecting plagiarism,
 - o formative and summative assessment, and
 - o the assessment of internships.

¹ Note that this was also advised by the panel that assessed the bachelor programme in 2017.

Appendix I Assessment process

Certiked VBI received a request to conduct a limited programme assessment for the re-accreditation of the bachelor and master programme Nanobiology. This request was submitted by the Delft University of Technology (“*penvoerder*”) and Erasmus University Rotterdam.

The objective of the programme assessment process was to assess whether the programme meets the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands of September 2018 (officially published in Stcrt. 2019 no. 3198, on 29 January 2019). In addition, the protocol for assessing joint degrees (version 2011/7 June 2010) has been used.

The Nanobiology programme management of Delft University of Technology and Erasmus University Rotterdam provided a longlist of panel candidates. Having conferred with programme management, Certiked invited candidate panel members to participate in the assessment panel. The panel composition was as follows:

- Prof. dr. M.L. (Marloes) de Groot, chair (Vrije Universiteit Amsterdam):
Faculty of Science, LaserLab, section Biophotonics and Medical Imaging
- Prof. dr. J.A.E. (Jan) Eggermont, domain expert (KU Leuven):
Laboratory of Cellular Transport Systems (part of Cellular and Molecular Medicine)
- Dr. ir. W.K.P. (Wilko) van Loon, domain expert (Wageningen University & Research):
Programme director BSc Agrotechnology, MSc Biosystems Engineering, and BSc + MSc Molecular Life Sciences
- A.T. (Anne) Leerling BSc, student member:
Combines finalising MSc Medicine and PhD Endocrinology with academic courses
Philosophy

On behalf of Certiked, the process coordinator/secretary in the assessment process was drs. B.E. (Barbara) Roemers.

All panel members and the process coordinator/secretary confirmed in writing that they had no conflict of interest with regard to the programme to be assessed and that they would observe the rules of confidentiality. Having obtained the authorisation (“*volmachten*”) by Delft University of Technology and Erasmus University Rotterdam, Certiked submitted the request-for-approval-form (“*verantwoordingsformulier*”) including detailed information on the proposed panel members to conduct the assessment. NVAO approved of the suggested panel on 7 March 2022 with file number PA-1135 (Delft University of Technology) en PA-1136 (Erasmus University Rotterdam).

To prepare the assessment process, the process coordinator/secretary had regular contact with the Nanobiology programme coordinator regarding the self-evaluation report and the site visit. The planning of activities in preparation of the site visit were also discussed. The activities prior to the site visit were performed as planned. The programme management approved of the schedule for the site visit on 31 January 2022, the panel chair approved of the schedule 10 February 2022.

Prior to the site visit, on 10 February 2022, the panel chair and the panel secretary met to discuss the assessment process. The panel chair was informed about the NVAO profile for panel chairs. The panel chair agreed to work in line with this profile.

On 3 April 2022, the programme management provided the list of theses of BSc and MSc alumni from the two most recent years. Acting on behalf of the assessment panel, the process coordinator/secretary selected fifteen theses from this list. The grade distribution in the selection was chosen to match the grade distribution in the list forwarded by programme management, on the understanding that special attention was paid to the lower grades.

The secretary explained the NVAO Assessment framework and provided the information file of the programme to the panel members on 22 April 2022, being the programme's self-evaluation report (including a student chapter) and the 30 theses. (*Note that the student did not receive the theses.*)

Prior to the date of the site visit, all panel members sent in their preliminary findings and questions on 13 May 2022, based on the self-evaluation report and the theses. The secretary summarised this information, compiling a list of questions, which served as a starting point for the sessions with the programme representatives during the site visit. On 16 May 2022, the panel met to prepare the site visit, based on this list of questions. The procedures to be adopted during the site visit, were also discussed.

As a result of the spread of Covid infections in the Netherlands, the programme management and the panel chair agreed to split the site visit into two parts: the first part being online on 23 May 2022, the second part being on campus on 24 May 2022. This decision was made in January to enable necessary adaptations on short notice (meaning changing the second day's programme to an online version as well).

Day 1 23 May Online	1200-1240	Session 1: MT BSc + MSc Nanobiology (management from Delft and Rotterdam)
	1240-1255	Time for the panel to deliberate
	1255-1335	Session 2: Board of Examiners (<i>examencommissie</i>) (members from Delft and Rotterdam)
	1335-1350	Time for the panel to deliberate
	1350-1405	Coffee Break
	1405-1440	Session 3: Work field
	1440-1455	Time for the panel to deliberate
	1455-1535	Session 4: Board of Studies (<i>opleidingscommissie</i>) (members from Delft and Rotterdam)
	1535-1600	Time for the panel to deliberate (wrap up day 1)

Day 2 24 May On the campus of TUD- AS.	1000-1010	Walk-in
	1010-1050	Session 5: Teachers BSc (teachers from Delft and Rotterdam)
	1050-1105	Time for the panel to deliberate
	1105-1145	Session 6: Students BSc
	1145-1200	Time for the panel to deliberate
	1200-1245	Lunch Break (including checking course material and assessments)
	1245-1325	Session 7: Teachers MSc (teachers from Delft and Rotterdam)
	1325-1340	Time for the panel to deliberate
	1340-1420	Session 8: Students MSc
	1420-1435	Time for the panel to deliberate
	1435-1445	Coffee Break
	1445-1545	Time for the panel to deliberate: preparation of decisions standard 1-4 + feedback
	1545-1600	Feedback (conclusion)

Since Delft University of Technology is *penvoerder*, it was decided to organise the second day in Delft. Stakeholders from Rotterdam were invited to come to Delft. The programme management displayed course material and assessment examples and student products of courses from Delft and Rotterdam on the reading table for the panel members on this second day.

Open-office hours were communicated timely by programme management to programme staff, lecturers and students. No one came forward to make use of these open hours.

In a closed session at the end of the second day, the panel discussed findings and considerations and arrived at conclusions regarding the quality of the programme. The panel chair presented a broad outline of findings, considerations, and recommendations to the programme representatives.

The advisory report, based on the findings and considerations of the panel, was drafted by the secretary. The draft report was sent to the chair on 8 June 2022 and to the panel members on 21 June 2022, who provided feedback. After having processed this feedback, the secretary sent the report to the programme management on 24 June 2022 to be corrected for factual inaccuracies. The programme management responded on 8 July 2022. Factual inaccuracies have been corrected and the chair adopted the report on 15 July 2022. The report has been sent to both university boards to accompany their request to continue the accreditation of this programme.

The so-called ‘development meeting’ (*ontwikkelgesprek*) will be held on 29 August 2022. The date has been picked after this report was finalised to ensure that outcomes of the development meeting will be clearly separated from the process of the programme assessment. During this development meeting future developments of the programme will be discussed. The programme management will provide topics one week in advance and the Certiked secretary will take minutes and write a short report. The programme is obliged to publish this (for instance on Brightspace), to enable stakeholders (students, lecturers, examiners etc.) to take note of what has been discussed.

Appendix II Abbreviations

BEP	Bachelor End Project (ending up in a bachelor thesis)
BoE	Board of Examiners (<i>examencommissie</i>) ²
BoS	Board of Studies (<i>opleidingscommissie</i>) ³
EUR	Erasmus University Rotterdam
Erasmus MC	Erasmus Medical Centre, in this report also referred to as ‘Rotterdam’
ILOs	Intended learning outcomes
LST	Life Science and Technology
MEP	Master End Project (ending up in a master thesis)
NB-BoE	Programme-bound Board of Examiners of the BSc and MSc programmes of Nanobiology
QAAHE	Quality Assurance Agency of Higher Education
TER	Teaching and Examination Rules (<i>Onderwijs- en examenregeling</i>)
TUD	Delft University of Technology (<i>Technische Universiteit Delft</i>)
AS	Faculty of Applied Sciences, in this report also referred to as ‘Delft’

² The panel would like to point out that Examination Board is a more widely used translation of *examencommissie*.

³ The panel would like to point out that Education Board, Programme Board and Programme Committee are more widely used translations for *opleidingscommissie*.