



NVAO • THE NETHERLANDS

## INITIAL ACCREDITATION

ACADEMIC BACHELOR

B BRAIN SCIENCE

Maastricht University

FULL REPORT

27 JUNE 2023

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## 1 Peer review

The Accreditation Organisation of the Netherlands and Flanders (NVAO) determines the quality of a new programme on the basis of a peer review. This initial accreditation procedure is required when an institution wishes to award a recognised degree after the successful completion of a study programme.

The procedure for new programmes differs slightly from the approach to existing programmes that have already been accredited. Initial accreditation is in fact an ex ante assessment of a programme. Once accredited the new programme becomes subject to the regular review process.

The quality of a new programme is assessed by means of peer review. A panel of independent peers including a student reviews the plans during a site visit to the institution. A discussion amongst peer experts forms the basis for the panel's final judgement and the advisory report. The agenda for the panel visit and the documents reviewed are available from the NVAO office upon request.

The outcome of this peer review is based on the standards described and published in the limited NVAO Assessment framework for the higher education accreditation system of the Netherlands (Stcrt. 2019, nr. 3198). Each standard is judged on a three-point scale: meets, does not meet or partially meets the standard. The panel will reach a conclusion about the quality of the programme, also on a three-point scale: positive, conditionally positive or negative.

NVAO takes an accreditation decision on the basis of the full report. Following a positive NVAO decision with or without conditions the institution can proceed to offer the new programme.

This report contains the findings, analysis and judgements of the panel resulting from the peer review. It also details the commendations as well as recommendations for follow-up actions. A summary report with the main outcomes of the peer review is also available.

Both the full and summary reports of each peer review are published on NVAO's website [www.nvao.net](http://www.nvao.net). There you can also find more information on NVAO and peer reviews of new programmes.

## 2 New programme

### 2.1 General data

<b>Institution</b>	Maastricht University
<b>Programme</b>	BSc Brain Science (wo-bachelor)
<b>Variants</b>	Fulltime: yes. Parttime: no. Dual: no.
<b>Degree</b>	Bachelor of Science
<b>Tracks</b>	-
<b>Locations</b>	Maastricht
<b>Study load</b>	180 EC <sup>1</sup>
<b>Field of study</b>	Nature (CROHO: Natuur)

### 2.2 Profile

Maastricht University is a publicly funded university consisting of six different faculties. Over 22,000 students are enrolled at Maastricht University (UM). Annually, the UM confers over 300 PhD degrees.

The academic bachelor's programme Brain Science is a 180 EC three-year fulltime programme. The English-taught programme aims to train a new generation of professionals who take a transdisciplinary approach to studying the complex structure and functioning of the human brain.

The transdisciplinary nature of the programme is evidenced by the way it is organised. The programme is offered by a collaboration of three UM faculties: the Faculty of Psychology and Neuroscience (FPN), Faculty of Health, Medicine, and Life Sciences (FHML) and the Faculty of Science and Engineering, in which the FPN serves as "anchor faculty".

### 2.3 Panel

#### Peer experts

- Prof. dr. Elly Hol (chair), professor of Glia biology of brain diseases, Utrecht University, member of the Academia Europaea, and head of the department of Translational Neuroscience at the University Medical Center Utrecht Brain Center
- Prof. dr. Sander Bohté, professor of Cognitive Computational Neuroscience, University of Amsterdam, and senior researcher in the CWI Machine Learning group
- Prof. dr. Wim Vanduffel, professor Faculty of Medicine, head of the Research Group Neurophysiology, and head of the Laboratory for Neuro- and Psychophysiology, KU Leuven, and assistant professor, Harvard Medical School, Boston
- Loes Damhuis BSc, (student-member), student pre-master Clinical Psychology, Open University, and Bachelor of Social Work, HAN University of Applied Sciences, Arnhem/Nijmegen

#### Assisting staff

- Dr. Duco Duchatteau MBA, secretary
- Michèle Wera MA, NVAO policy advisor and process coordinator

#### Site visit

23 May 2023, Maastricht University

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<sup>1</sup> European Credits

### 3 Outcome

The NVAO approved panel reaches a positive conclusion regarding the quality of the BSc Brain Science offered by Maastricht University. The programme complies with all standards of the limited NVAO framework.

The BSc Brain Science offers a well-defined and challenging profile. The programme aims to train a new generation of professionals who study the complex structure and functioning of the human brain in a transdisciplinary manner. In other words, students learn to look beyond the boundaries of a single discipline. The underlying disciplines are psychology, biology and computational science. The student learns to combine insights from these three disciplines. This allows the graduate to become a bridge builder between the different disciplines and between science and practice.

Maastricht University developed an attractive and coherent three-year full-time academic programme. In the first two years, the student follows a more or less fixed curriculum. In the third year, the student chooses his or her own profile with in-depth electives and a thesis research project in one of the different fields. The programme allows students to gain understanding of the three underlying disciplines, while still achieving sufficient depth for an academic bachelor's programme.

The programme is unique, especially at bachelor level. The input from three different faculties ensures that students have a broad perspective. The curriculum has been designed in such a way that it has truly become "transdisciplinary". The way Maastricht University has implemented problem-based learning can contribute. The programme is well designed and worked out in great detail. The panel does think, however, that the programme can be challenging. The panel therefore advises the programme to monitor the student intake well and keep an eye on the study success of students with different high school profiles. The programme should also ensure that it provides adequate information to prospective students.

Because of the international character of the academic discipline and strong employer preferences, Maastricht University offers the programme in English. In addition, the programme expects to attract a large number of foreign students. Maastricht University has motivated the choice for English as the chosen language of instruction well.

The academic staff is knowledgeable in the field they teach and well trained for their roles in the Maastricht University Problem-based Learning concepts. Many staff members were involved in the development of the programme and they are eager to start. The panel appreciates the staff's enthusiasm.

Maastricht University has a clear vision on student assessment that has been well implemented. The panel deems the examinations to be valid and reliable. Processes to ensure objective and independent assessment are in place.

The panel has made a recommendation to reconsider the manner on which some of the committees are organised. Brain Science specific committees with members coming from all three faculties would do justice to the transdisciplinary nature of the programme. The large number of expected new students as well as the innovative nature of the programme provide additional arguments to opt for another way of organising the committees. This recommendation is, however, one of the few recommendations the panel has made. All in all, the panel is very positive about the proposed programme.

Maastricht University expects graduates from the BSc programme in Brain Science to make a meaningful contribution to the development of the field. The panel agrees wholeheartedly.

Standard	Judgement
1. Intended learning outcomes	meets the standard
2. Teaching-learning environment	meets the standard
3. Student assessment	meets the standard
<i>Conclusion</i>	<i>Positive</i>

## 4 Commendations

The programme is commended for the following features of good practice.

1. Innovative programme – The programme combines the disciplines psychology, biology and computational science in a unique and novel manner.
2. Transdisciplinary approach – The programme has a truly transdisciplinary approach: students are consistently trained to think across the borders of the three underlying disciplines.
3. Stakeholder involvement – Both external stakeholders (potential employers) and internal stakeholders (scientists) from three different faculties were involved in developing the programme. The programme is widely supported by academic staff and the professional field alike.
4. Coherence – Despite the fact that the programme is built from three distinct underlying disciplines (psychology, biology and computational science), the programme has succeeded in developing a well-structured and coherent curriculum. In addition, processes are in place to avoid overlap and to ensure that elements of the programme that are taught in parallel, enforce one another.
5. Well-developed plans – Not only the programme as a whole is well-developed. The detailed design of the various individual courses and projects testifies to a meticulous development process.

## 5 Recommendations

For further improvement to the programme, the panel recommends a number of follow-up actions.

1. Information provision – Communicate clearly to potential students about the ambitious level and the science-oriented nature of the programme. Be transparent about the importance of sufficient proficiency of high school mathematics, chemistry, physics, and biology.
2. Enrolment – Monitor the enrolment into the programme, including the profile and chosen final examination subjects of matriculants. The programme might prove to be more challenging for matriculants with a Nature and Health (Natuur en Gezondheid) profile without Mathematics B.
3. Education Programme Committee – Take the interfaculty and transdisciplinary nature of the programme into account when deciding on the composition of the Education Programme Committee. Also, the large number of students and the novel character of the programme provide arguments to opt for a dedicated Brain Science Education Programme Committee with staff committee members representing all three faculties.
4. Board of Examiners – Take the interfaculty and transdisciplinary nature of the programme into account when deciding on the composition of the Board of Examiners. Also, the large number of students and the novel character of the programme provide arguments to opt for a dedicated Board of Examiners with members from all three faculties, who bring complementing expertise to the table.

## 6 Assessment

### 6.1 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.*

#### **Judgement**

Meets the standard.

#### **Findings, analysis, and considerations**

The BSc Brain Science programme aims to train a new generation of professionals who take a transdisciplinary approach to studying the complex structure and functioning of the human brain. Building on foundational knowledge of the underlying disciplines psychology, biology, and computational science, students are trained to connect data and theories across and beyond disciplinary boundaries.

Based on the general programme aim, Maastricht University (UM) has defined four competence domains: brain scientist, science communicator, professional, and lifelong learner. These competence domains were in turn translated into a set of 19 intended learning outcomes (ILOs). The ILOs clearly describe what the programme intends to achieve. In the information file, the UM has linked the ILOs to the Dublin descriptors to justify the bachelor's level of the programme.

During the site visit, the panel learned that the UM has followed a rigorous process in defining the programme's learning outcomes. A considerable number of scientists from the Faculty of Psychology and Neuroscience (FPN), the Faculty of Health, Medicine, and Life Sciences (FHML) and the Faculty of Science and Engineering (FSE) has collaborated in defining the aim and ambition of the programme. This process did not only ensure broad input from all academic disciplines involved; it also contributed considerably to a sense of ownership amongst academic staff members. In the meeting with staff members, the panel met with scientists who were true ambassadors for the programme. The panel felt a clear and broad support amongst the staff.

In addition to a broad involvement of academic staff, the UM has consulted with potential future employers, including international corporations. This process ensures that the intended learning outcomes not only align with expectations from the scientific community, but also with expectations from the national and international corporate environment. The professional field unanimously expressed support for the programme, its aim, and its intended learning outcomes.

Both the academic professional field and the corporate professional field explicitly support the aim to educate transdisciplinary bridgebuilders. The panel discussed the risk of educating scientists who are taught very broadly, possibly at the expense of depth. The answers provided by academic staff members demonstrated that this topic has been extensively discussed. In the discussions with the staff and designers of the curriculum, the panel became convinced that the programme aims for an appropriate amount of depth as well (see also standard 2).

The panel has no doubt that the intended learning outcomes are in line with the academic orientation of the programme. In fact, the panel is of the opinion that the ILOs are ambitious. The panel considers the ILOs to be well described, challenging, novel and indeed transdisciplinary. The ILOs provide a balanced combination of "soft and hard skills" and a balanced combination of scientific knowledge of the involved academic disciplines and transdisciplinary competencies.

All in all, the panel is of the opinion that the UM has done an excellent job in defining a relevant and appropriate set of intended learning outcomes. The programme offers a unique transdisciplinary approach, which is widely supported by the academic and professional field. The panel concludes that the first NVAO standard is met.



## 6.2 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.*

### **Judgement**

Meets the standard.

### **Findings, analysis, and considerations**

The programme's four competency domains are operationalised in 19 programme ILOs. Using a process of constructive alignment and backward chaining, the programme ILOs are translated in learning objectives for courses and projects. The course level learning objectives are in turn operationalised in specific learning and teaching activities. The panel appreciates the clear and well described process of curriculum development. This process ensures that the sum of all learning activities add up to attaining the programme objectives.

Maastricht University developed an attractive and coherent three-year 180 EC programme. Each academic year contains four eight-week periods and two four-week periods. Eight-week courses are offered in the longer periods in the first two years of the programme. The shorter periods consist of project work. The third and last year of the programme mainly consists of electives/minors and the bachelor thesis. Three learning lines run parallel to the courses and projects: 1) programming, 2) writing and presenting and 3) mentor-guided portfolio building.

The programme becomes increasingly transdisciplinary. At the start of the programme, there is an emphasis on the foundations of psychology, biology, and computational science. Starting halfway through the first year of the programme, the courses become increasingly transdisciplinary. In the courses on perception, movement, and learning & memory, each topic is studied from different perspectives and students are increasingly challenged to cross the boundaries of the underlying disciplines.

The programme's ILO's and the curriculum are clearly described in the 'Draft Education and Examination Regulations Bachelor Brain Science 2024-2025'. The Education and Examination Regulations are exhaustive and sufficiently detailed. There are no considerable deviations from the UM standards.

The programme has a logical composition and is well thought out. In meetings with the programme developers and staff, the panel learned that many staff members from all disciplines were intensively involved in developing the programme. Scientists from different backgrounds met frequently to collaborate in designing the programme. This has contributed to the transdisciplinary nature of the programme. It has also ensured that all disciplines are adequately covered and that there is an appropriate balance within the programme.

To ensure that all disciplines keep working together after the design phase, a structure has been set up where academic staff members from different backgrounds meet when their courses are being taught. The same topic is studied from different perspectives in courses that are taught in parallel. Staff members meet to discuss one another's topics. The panel is impressed with this approach. Although it is a logical approach, such an approach is not obvious and requires continuous commitment of all three faculties.

The didactical approach is consistent with the UM's vision on learning, with a strong emphasis on problem-based learning (PBL) and mentor-guided competency development. The chosen didactical approach ties in nicely with the transdisciplinary nature of the programme. As mentioned before, students are challenged to approach topics from different perspectives simultaneously. This should contribute to students becoming true bridge builders.

When studying and discussing the information file, the panel noted the broadness of the programme. The question arose, how the programme succeeds in finding sufficient depth. This question was explicitly discussed during the site visit. In years one and two, the student is challenged to aim for some depth in the project work. The real depth, however, is to be found predominantly in year three. In this year, the student chooses the elective courses or minors that should enable him or her to delve deeper in a topic, while preparing for the thesis phase. With the help of a mentor, the student chooses an individual profile, depending on individual strength, learning needs and interests. During the site visit, the panel became increasingly convinced that the programme is not "a mile wide and an inch deep". There is sufficient depth to be found, in line with the academic bachelor's level of the programme.

The chosen approach, with ample room for individual choice in projects, electives/minors and the thesis, contributes considerably to the student-centeredness of the programme.

In preparation of the site visit, the panel had the opportunity to examine a large amount of course materials. Most course descriptions and learning materials were developed in great detail. The content was relevant and up-to-date, and the materials were at academic bachelor's level. The literature was recent, relevant and of an appropriate academic level. The course content was demonstrably in line with the course's learning objectives. The transdisciplinary approach was clearly visible throughout all course materials.

Admission to the programme is open to vwo<sup>2</sup>-graduates, with either a 'Natuur & Gezondheid' (Nature & Health) profile combined with Physics, or a 'Natuur & Techniek' (Nature & Technology) profile combined with Biology. Although most high school students with Physics as an exam subject are expected to also have Mathematics B, the Nature & Health profile allows for high school students to graduate with Mathematics A only. When studying the course materials, the panel had some concerns that calculus courses as well as some of the computational science courses could prove to be particularly challenging for matriculants with Mathematics A, who have no experience in integral calculus and differential calculus at all. The panel therefore discussed why the UM had chosen to not require Mathematics B for matriculants.

The panel learned that this was a deliberate choice. The UM did not want to create an additional threshold. In addition, the UM is convinced that a broader variety of matriculant profiles enriches the learning experience for students. Some students might have a preference to look at a given problem from one angle, while others contribute with their complimentary view. A too narrowly defined profile would result in a less heterogeneous student population.

Because neither Mathematics A (with a focus on statistics) nor Mathematics B (with a more algebraic emphasis) are required explicitly, the programme needs to build up all mathematical skills from the ground up. Programme designers and academic staff explained how the proposed programme does this. In addition, staff members point out that the UM has ample experience in offering science-oriented master's level programmes for psychology graduates, which offer similar challenges.

The panel believes that the consequences of the chosen admission requirements are thought through quite well. The programme has ensured that the intended learning outcomes are attainable for all incoming students. The panel does, however, advise the programme to carefully monitor the enrolment, including the profile and chosen final examination subjects of matriculants to investigate whether or not some students encounter more or other challenges than others. In addition, the UM should be clear about the sciences orientation of the programme to prospective students. Students must be made aware of the presence of calculus and computational science in the programme.

The information file contained the resumes of many academic staff members. The panel has established that the academic staff members can be identified as experts in the field they teach. Many of them are established scholars. During the site visit, the panel met with academic staff. All staff members were involved in developing (parts of) the programme and were enthusiastic about the programme. Staff members expressed that they were prepared for their role and trained in the didactical concepts of PBL. They also expressed that staff numbers were expected to be appropriate for the expected student intake. UM ensured this by opting for a numerus fixus of 150 students at the start of the programme. The chosen numerus fixus also serves to ensure that there will be sufficient intern positions. Staff and management expressed that they were not worried about finding suitable opportunities for research internships and thesis projects.

The programme has an appropriate system of student support in place. Mentors, who are specifically trained for their role, help students progress through the programme, build their portfolio and choose a specific profile before the start of year three. The mentoring system encompasses a considerable amount of one-on-one

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<sup>2</sup> voorbereidend wetenschappelijk onderwijs (Pre University Education)

guidance. The mentoring system, which appears to be well-developed, contributes to the student-centeredness of the programme.

The programme is internationally oriented. About half the student population is expected to be foreign. The programme educates for a discipline in which English is the prime language. This is not only the case for the different scientific disciplines, but also for the professional field outside academia. In most corporations that would employ graduates, English is the dominant language. In fact, a survey among employers demonstrates that three quarters of potential employers would prefer an English-taught programme. The UM has therefore chosen English as its language of instruction. The panel wholeheartedly agrees with this choice. The same goes for the name of the programme. Brain Science (in English) covers the content well. The panel has established that the university has a system in place to ensure English language proficiency of staff members as well as support for students. Academic writing skills in English are explicitly addressed in the 'Writing and Presenting' learning lines in years one and two of the programme. In addition, the Maastricht University Language Centre offers English language courses at reduced fees for UM students.

During the site visit, the panel met with members of the Education Programme Committee (EPC). The committee is considering integrating the Brain Science EPC in the existing FPN EPCs. Considering that the FPN is the "anchor faculty" of the programme, this choice appears to be logical. The panel believes, however, that this would be a missed opportunity. The Brain Science programme differs considerably from existing programmes within the FPN. Also, an FPN EPC does not do justice to the unique transdisciplinary character of the programme. The panel, therefore, suggests the UM to take the interfaculty and transdisciplinary nature of the programme into account when deciding on the composition and the positioning of the Education Programme Committee. In addition, UM expects an intake of 150 students in the first year. The large number of students as well as the novelty of the programme provide additional arguments to opt for a separate, dedicated interfaculty Brain Science EPC.

In conclusion, the panel is positive about the teaching-learning environment. The only recommendations for improvement have to do with the committee structure and monitoring the fit between the profile of incoming students and the science-oriented nature of the programme. Maastricht University has developed a truly novel and transdisciplinary programme. The programme is well thought out in detail by a group of knowledgeable and enthusiastic staff members. The panel, therefore, concludes that this NVAO standard is met.

### 6.3 Standard 3: Student assessment

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

#### **Judgement**

Meets the standard.

#### **Findings, analysis, and considerations**

Maastricht University has developed a clear vision on assessment. The assessment is to support the constructive, collaborative, contextual and self-directed (CCCS) learning of the student. Assessment should be constructively aligned with the intended learning outcomes. The UM distinguishes between assessment of learning, assessment as learning, and assessment for learning. This university-wide vision has been consistently implemented in the programme.

The programme makes use of a wide variety of assessment formats. There is a good match between the form and the content of the assessment (alignment). The programme makes use of a combination of formative and summative assessment, while ensuring that all ILOs are in fact summatively assessed. Using the provided documentation, the panel was able to establish that all ILOs are covered by the different assessments.

The assessment procedures and regulations are robust. Where students work together, the individual contribution is always assessed to ensure individual achievement of competencies. The thesis is graded by two staff members.

The panel was able to evaluate several examinations. They were of good quality, both in terms of content as well as in terms of level of complexity.

During the site visit, the panel met with representatives of the Board of Examiners (BoE) as well as with representatives of the test committee. The BoE has discussed and commented on the assessment documentation. The BoE has established that the proposed system of assessment is valid, reliable and in line with the UM vision on assessment. The test committee has also evaluated individual examinations. The test committee assessed the evaluated examinations as being appropriate and fitting within the UM assessment framework.

The panel discussed the influence that artificial intelligence (AI) and the emergence of new resources such as ChatGPT are expected to have on assessment. The panel learned that AI is on the agenda of the relevant committees. AI is not necessarily perceived as a threat. In the Brain Science programme, AI has a prominent place. The programme might prove to be an excellent place for experimenting with the use of AI for assessment.

Maastricht University is considering integrating the Brain Science BoE in an existing broad FPN BoE. Analogous to the suggestion to create a dedicated, interfaculty EPC (see standard 2), the panel suggests the UM to take the interfaculty and transdisciplinary nature of the programme into account when deciding on the composition and the positioning of the Board of Examiners. This would ensure that all relevant expertise is represented in the BoE. The proposed programme differs considerably from existing programmes, which would indeed justify a separate BoE. The considerable number of expected students and the novel nature of the programme provide additional arguments to opt for a dedicated interfaculty BoE.

The only suggestion for improvement relates to the positioning and composition of the BoE. All other elements under this standard are evaluated positively. The UM has a clear vision that has been well implemented. The examinations cover all ILOs and there is structural alignment between aim and form of the assessments. The panel deems the examinations to be valid and reliable. Processes to ensure objective and independent assessment are in place. The panel therefore concludes that this standard is met.

#### 6.4 Degree and field of study

The panel advises awarding the following degree to the new programme: Bachelor of Science

The panel supports the programme's preference for the following field of study: Nature (CROHO: Natuur)

## Abbreviations

AI	Artificial Intelligence
BoE	Board of Examiners
BSc	Bachelor of Science
CCCS	constructive, collaborative, contextual and self-directed
CROHO	Centraal Register Opleidingen Hoger Onderwijs
EC	European Credit
EPC	Education Programme Committee
FHML	Faculty of Health, Medicine, and Life Sciences
FPN	Faculty of Psychology and Neuroscience
FSE	Faculty of Science and Engineering
ILO	Intended Learning Outcome
NVAO	The Accreditation Organisation of the Netherlands and Flanders
PBL	Problem-based Learning
UM	Maastricht University
vwo	Vorbereidend wetenschappelijk onderwijs (Pre University Education)

