

ONDERZOEKERIJ

Research Master

Molecular Mechanisms of Disease

Radboud University

Report of the limited programme assessment

De Onderzoekerij
Vondellaan 58
2332 AH Leiden

Email: info@onderzoekerij.nl
Internet: www.onderzoekerij.nl



Contents

Contents	3
Executive summary	4
1. Introduction.....	6
1.1 Administrative data	6
1.2 Introduction.....	6
1.3 Panel composition.....	6
1.4 Working method	7
2. Review	9
2.1 Intended learning outcomes.....	9
2.2 Teaching-learning environment.....	10
2.3 Student assessment	15
2.4 Achieved learning outcomes.....	17
3. Strengths and recommendations	19
3.1 Strengths of the programme	19
3.2 Recommendations	19
4. Conclusion	20
Appendix A – Panel composition and programmes of the cluster.....	21
Appendix B – Schedule of the visit.....	22
Appendix C – Documents studied.....	23
Appendix D – Abbreviations.....	24



Executive summary

The outcome of the external assessment of the research master's programme Molecular Mechanisms of Disease (MSc MMD) of Radboud University by an NVAO approved panel is positive.

The two-year full-time programme aims to educate excellent future scientists with a broad fundamental knowledge in Molecular Life Sciences and the skills to translate this knowledge into medical experimental research and clinical applications. The MSc MMD programme is organised along three broad educational themes with each educational theme covering both a fundamental and a disease-related/translational aspect. The programme translated its aims into a set of seven final qualifications. The final qualifications clearly and unambiguously reflect the level that may be expected from graduates of a research master's programme. They demonstrate a good balance between skills-based (both academic and transferable skills) and knowledge-based qualifications. However, the panel feels that the knowledge-based qualifications are rather broad and could be more tailored to the three educational themes of the programme.

The panel is positive about the curriculum that offers a good balance between theoretical courses, skills courses, elective courses, and two research training periods. Point of attention is the limited possibility to follow electives during the first quarter of the second year. The programme has a truly international orientation. This is not only testified by the high proportion of international students, but also by the high proportion of students that perform their second research training period abroad. The panel values the attention paid to the well-being of students, including the recently developed learning trajectory 'Personal & professional development'. It advises to implement this trajectory formally into the curriculum and assign the appropriate EC.

The programme is highly selective with respect to admission of students. The admission criteria adequately reflect the research-oriented nature and high demands of the programme. The panel is impressed by the ability to recruit international top students, both from within and outside Europe.

The panel welcomes the highly interactive and collaborative learning environment. The structural use of group assignments stimulates interaction, cooperation, and cohesion amongst students and staff. The panel advises the programme to further develop and implement a shared vision and didactical concept based on the well-functioning aspects of collaborative learning.

The panel thinks highly of the staff members, who are acknowledged scientists in their field and take supervision and tutoring of the research master's students very seriously. The panel encourages the management to continue the efforts to ensure that all staff members involved in the teaching of MSc MMD are supported, both by the financial reward of their teaching tasks and by stimulating their professional development as a teacher.

The research master's programme has an adequate assessment system. The Board of Examiners is very well organised and safeguards the quality of the assessments in a proactive and structured manner. The programme uses a wide variety of assessment methods which are consistent with the goals of the courses. The panel praises the programme for the progress it made in the assessment of the second research training period which is mainly conducted abroad. It is positive about the extensive process for the grading of this final project, but the panel also sees room for further improvements. To enhance the transparency of the process, the panel suggests to further develop the current assessment form, for instance by using rubrics. In addition, the panel encourages the programme to continue its efforts to provide all students with substantive written narrative feedback.



All final qualifications are assessed in an integrated way in the second research training period, that results in a master's thesis. The panel is pleased with the high quality and academic level of the fifteen theses it examined. Many students were able to publish the results obtained in the research projects in internationally peer-reviewed scientific journals. According to the panel, the students reach a high level of achievement and are very well prepared for a scientific career in the Molecular Life Sciences. The panel advises to pay more attention to career paths outside academia because this will allow students to make an educated and motivated decision about their future career.

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 the report. They confirm that the assessment has been conducted in accordance with the demands relating to independence.

Date: 21 February 2022

Frans Ramaekers
(chair)

Esther Poort
(secretary)



1. Introduction

1.1 Administrative data

Name of the programme:	M Molecular Mechanisms of Disease (research)
CROHO number:	60322
Level of the programme:	Master of Science
Orientation of the programme:	Academic
Study load:	120 EC
Location:	Nijmegen
Variant:	Full-time
Submission deadline:	1 May 2022

1.2 Introduction

This report focuses on the assessment of the research master's programme Molecular Mechanisms of Disease of the Radboud University. This assessment forms part of a cluster assessment of six research master's programmes at three universities. The cluster was divided into two subclusters, each consisting of three programmes: a health cluster and a molecular cluster. Appendix A provides an overview of the six participating research master's programmes and the composition of the total panel.

The assessment is based on the standards and criteria described in the NVAO Assessment Framework for the Higher Education Accreditation System of the Netherlands 2018 (limited framework). Research master's programmes must meet a number of additional criteria as described by the NVAO (specification of additional criteria for research master's programmes, 2016).

1.3 Panel composition

In total, seven panel members participated in this cluster assessment. Three panel members participated in all assessments (the core panel). In addition, each cluster subpanel included two additional panel members (see Appendix A). The panel that assessed this research master's programme consisted of the following members:

- Prof. Frans Ramaekers (chair), professor emeritus Molecular Cell Biology, Maastricht University;
- Dr. Jolanda van der Zee, associate professor in Education of Biomedical Science and Medicine, Leiden University;
- Prof. Marieke van der Schaaf, professor of Research and Development of Health Professions Education, University Medical Center Utrecht;
- Prof. dr. J. (John) Creemers, professor of Biomedical Science, KU Leuven;
- V.E.J.M. (Victoria) Palasantzas MSc, student M Molecular Medicine and Innovative Treatment (research), University of Groningen (graduated in 2021).



The panel was supported by drs. Esther Poort, who acted as secretary.

All panel members and the secretary have signed a declaration of independence and confidentiality. In this declaration they affirm not to have had any business or personal ties with the programme in question for at least five years prior to the review.

The NVAO approved the composition of the panel on 25 May 2021.

1.4 Working method

Preparation

On 28 June 2021, the panel of the entire cluster held a general online kick off meeting. In this meeting the panel received an introduction to the assessment framework and discussed the working methods in preparation to and during the site visits.

The programme drew up a critical reflection report describing the programme's strengths and weaknesses. This report included a chapter in which the students reflected on the programme. The panel members prepared the assessment by analysing the critical reflection report and the appendices provided by the institution. The panel also studied a selection of fifteen master's theses and the accompanying assessment forms from the programme. The theses selection was made by the panel's secretary based on a provided list of at least thirty theses of the most recent years. In the selection, consideration was given to a variation in assessments (grades) and topics.

The panel members individually formulated their preliminary findings and a number of questions they wanted to raise during the site visit. The secretary made an overview of these preliminary findings and questions and sent it to the panel members as a starting point for the preparation of the panel during the site visit.

Visit

The site visit took place on 3 December 2021 (see Appendix B for the schedule). During the preparatory meeting, the panel discussed the preliminary findings and decided which questions to raise in their meetings with the programme representatives. During the visit, the panel spoke with representatives of the management, students and alumni, lecturers, and the Board of Examiners. Everybody involved in the programme had the opportunity to inform the panel in confidence about matters they considered important to the assessment. No one made use of this opportunity. The panel used the last part of the visit to evaluate the interviews and had a second meeting with the programme's management to receive answers to any remaining questions. At the end of the visit, the chair presented the panel's preliminary findings and impressions of the programme.



Report

The secretary drew up a draft report based on the panel's findings. This draft report was presented to the members of the panel and adjusted on the basis of their feedback. After adjustments, the draft report was sent to the institution for verification of factual inaccuracies. The secretary discussed the programme's comments with the chair, after which the secretary drew up the final report and circulated it to the panel for a final round of comments.

The report follows the four standards of the NVAO's Assessment Framework 2018 (limited framework): 1) the intended learning outcomes, 2) the teaching-learning environment, 3) assessment, and 4) achieved learning outcomes. Regarding each of the standards, the assessment panel gave a substantiated judgement on a three-point scale: meets, does not meet, or partially meets the standard. The panel subsequently gave a substantiated final conclusion regarding the quality of the programme, also on a three-point scale: positive, conditionally positive, or negative.

Development dialogue

Although clearly separated from the process of the programme assessment, the assessment panel members and programme representatives will conduct a development dialogue in early 2022, with the objective of discussing future developments of the programme in light of the outcomes of the assessment report.



2. Review

2.1 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, analysis, and considerations

The research master Molecular Mechanisms of Diseases (MSc MMD) aims to educate excellent future scientists with a broad fundamental knowledge in Molecular Life Sciences and the skills to translate this knowledge into medical experimental research and clinical applications.

The programme is embedded in the Radboud Institute for Molecular Life Sciences (RIMLS), which is one of three research institutes of Radboud university medical center (Radboudumc). The RIMLS is a leading research institute within the domain of molecular mechanisms of health and disease. The panel acknowledges that the involvement of senior RIMLS researchers ensures that the programme is geared to the professional requirements of the field. In addition, this embedding within RIMLS provides ample opportunities for translational research.

The MSc MMD programme is organised along three broad educational themes with each educational theme covering both a fundamental and a disease-related/translational aspect:

- Cell growth and differentiation/Developmental disorders and malignancies;
- Metabolism, transport and motion/Metabolic disorders;
- Immunity, infection and inflammation/Immunity-related disorders and immunotherapy.

The programme translated its aims into a set of seven intended learning outcomes (the programme uses the term final qualification) which are linked to the Dublin descriptors for the master's level. In the eyes of the panel, the final qualifications are in line with the goal of preparing high-calibre students to become top-researchers in the field of Molecular Life Sciences. They demonstrate a balance between skills-based (both academic and transferable skills) and knowledge-based qualifications. The panel appreciates the way the final qualifications address transferable skills and research skills. The alumni emphasised that they appreciate this explicit focus very much and that this is of great value in their professional lives. However, the panel feels that the knowledge-based qualifications are rather broadly articulated and could be more tailored to the three educational themes. It encourages the programme rephrasing its final qualifications in a more specific manner to better align with the actual content of the programme.

The panel is pleased that the programme not only aims to educate students for academic careers, but also provides students with qualifications to pursue a career outside academia. The panel encourages the programme to continue the efforts to make students aware that the knowledge and skills they acquire during the research master's programme are very valuable in non-academic settings as well.

Conclusion

The final qualifications fulfil all requirements in terms of content, level, and orientation. The programme therefore meets standard 1.



2.2 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, analysis, and considerations

The MSc MMD programme is a fulltime research master's programme of 120 EC. The curriculum consists of mandatory theoretical courses and skills courses, elective courses, masterclasses, and two research training periods.

The first 4.5 months of the curriculum consists of a mandatory set of courses. In the introduction course (2.5 EC), students orient themselves in the RIMLS and Radboudumc educational and research environments. Thereafter, the curriculum consists of three theoretical courses (in total 16.5 EC) that provide students of different BSc backgrounds a solid knowledge basis in the three thematic areas of the programme. During the first 2-2.5 weeks of these theoretical courses, students acquire fundamental knowledge about molecular and cellular mechanisms. The next 1.5 weeks focus on the translation of this knowledge towards applications for diagnosis, treatment and (bio)medical experimental research in theme-related diseases. The panel values this well-thought-out course design that offers a good balance between fundamental insights and the translation into diagnostics and therapies. The panel believes that there is still room for improvement and advises to make all teachers involved in the programme fully aware of the diverse backgrounds of the students. As indicated in the student chapter, students without a background in (bio)medical sciences may find it hard to follow the courses addressing the translational part. Especially the clinical lectures may sometimes overestimate the medical knowledge of the students. This was also confirmed by the students the panel met.

The first mandatory part of the programme also comprises several courses on academic skills and research skills, including 'Excellence in communication' (1.5 EC), 'Understanding basic statistics using R' (1.5 EC) and 'Computational Biology and Bioinformatics' (3 EC). The panel appreciates that all students acquire these essential skills prior to their research training periods.

During the second part of first year, students gain hands-on experience in the Research training period 1 (30 EC). Under direct supervision of a RIMLS or molecular research oriented Radboudumc group leader, students are trained in research design, practical (laboratory) research, (data) analysis, and reporting. Students also acquire the in-depth theoretical background of their research question, all leading to a comprehensive report. Each report needs to include a paragraph on the translational character of the research. To guarantee high standards, the MSc MMD explicitly requires direct involvement of a senior researcher (assistant, associate or full professor) in the supervision and discussion of progress and final evaluation of the report. During this first research training period, students also follow the 'Scientific skills' course (1.5 EC). This course consists of several workshops focussing on skills required for proper scientific reporting according to the rules of good scientific practice. The panel was pleased to hear that from 2022 onwards, this course will also pay attention to FAIR data principles.

The second year of the curriculum starts with two mandatory courses: 'Omics data analysis and interpretation' (3 EC) and 'Science and society' (1.5 EC). During the remainder of the second year, students can specialise in their field of interest by following electives and the Research training period 2 (6-7 months, 39 or 45 EC). Students are encouraged to choose an international top institute to do their Research training period 2. The panel highly appreciates that about 90% of the MSc MMD students choose to do so. This enables students to develop a truly international orientation and to



start building their own international research network. The panel highly values the possibilities for students to arrange the financial means for their stay abroad by applying for several types of funding. When they apply, students are commonly awarded by a Radboudumc *Studentbudget*, a Radboud University Individual Travel Grant, and/or an Erasmus grant.

Students can choose to follow 11 EC electives in combination with a second Research period of 45 EC, or to follow 17 EC electives in combination with a 39 EC second Research period. Elective courses may be theoretical courses from other master programmes at Radboud University or elsewhere, courses from PhD programmes or individual courses. Individual courses include writing a full research proposal for the Radboudumc PhD proposal competition or Massive Open Online Courses (MOOCs), such as 'R Programming'. The academic quality of MOOCs is evaluated by the Board of Examiners (BoE), and RIMLS lecturers will serve as examiners. Students can also choose a 'literature thesis' (6 EC) as elective. Strict guidelines are in place regarding the timing (fixed period of 4 weeks) and supervision of the Literature thesis. The panel welcomes this broad range of opportunities to personalise the curriculum. The panel was pleased to hear that the BoE evaluates very strictly the choices for elective courses prior to commencement of these courses on an individual basis. However, the panel does not support the current policy that allows students to select a maximum of 6 EC of electives at advanced bachelor's level to repair knowledge deficiencies or for a broader career development. In the opinion of the panel, bachelor courses can never be appropriate for a research master's programme. It strongly advises the management to change this policy.

Students indicate in the student chapter that they are very satisfied with the content and structure of the programme. However, students also mention that the structure of the second year reduces the possibilities for electives. The reason for this is that the elective courses from relevant programmes are scheduled simultaneously with the mandatory MSc MMD courses. Therefore, students feel pushed to do electives in their first year (mostly scheduled once weekly along the internship), which increases the workload. The panel encourages the management to investigate how to enhance the flexibility of the programme at the beginning of the second year to increase the possibilities for electives during the second year.

The curriculum includes one unique masterclass per academic year (3 EC in total). Topics and teaching staff change every year to be able to anticipate on new developments in the domain of molecular research. Distinguished (inter-)national guest speakers present the latest research developments in their field, introducing new research topics and challenging questions. Students reflect on this research and can address their questions. The panel highly values this opportunity to acquire in depth knowledge about a cutting-edge research topic.

The panel is positive about the actions taken by the management to strengthen coherence in the programme. In 2020-2021, a learning trajectory was setup that focuses on skills how to handle (big) data sets. The learning objectives and computation programmes of the involved courses (Bioinformatics introductory module, Understanding basic statistics using R, Computational biology & bioinformatics, Omics data analysis and interpretation) were aligned with the involved lecturers in order to create a consistent learning trajectory. The panel highly values the development of this learning trajectory and encourages the management to investigate how the coherence of the programme can be further strengthened, for instance by making 'development trajectories' in certain knowledge and skills items more explicit throughout the curriculum for students and teachers.

Overall, the panel considers the curriculum to be an appropriate reflection of the final qualification of the programme. The curriculum comprises a good balance between theoretical courses, skills courses, and intensive hands-on training in research. The research orientation of the curriculum is beyond



dispute. The two research training periods allow students to engage actively in a variety of research groups.

The MSc MMD programme has deliberately chosen an English programme name and English as the language of instruction. The programme management substantiates its choice by arguing that the current lingua franca of scientific research is English, the research domain of Molecular Life Science is carried out in an international context, and the research master's programme is open to international students and involves international staff members. The panel supports this choice. Since the language of science is English, the programme requires each staff member to speak English fluently. English proficiency of lecturers is very positively evaluated (average score 4.5 with a standard deviation of 0.3 (on a scale of 1-5).

Admission

The MSc MMD programme is open for students with an academic bachelor's degree in Molecular Life Sciences, Medical Biology, Molecular Medicine, Biochemistry, Biotechnology or any biomedical or life sciences education with an emphasis on cell and molecular biology.

The panel established that the programme is highly selective with respect to admission of students. The programme aims to enrol highly talented students with a strong motivation for research and the ambition to strive for excellence. The admission criteria adequately reflect the research-oriented nature and high demands of the programme. The BoE is responsible for the selection of students. Based on a letter of motivation, transcript of BSc courses, CV, two letters of recommendation and the results of an English language test (for students not having a Dutch BSc degree), students may be invited by the selection coordinators for a selection interview, either online, or in person. This interview assesses, by means of a standardised protocol, whether the student has the potential to become a successful student of the programme. All students that are judged to be admissible are subsequently ranked by the selection coordinators and programme director at certain times during the selection period (February, end of March, end of April). At each point in time, the highest-ranking students are offered a place in the programme. Students that score ≥ 9.0 on their interview are offered a place directly.

The number of applicants and enrolled students has increased to the intended maximum of 24 students in the last years. Of the 80-100 yearly assessed applicants, about 40% is found to be admissible by the BoE.

The programme has a diverse student population. Students have various nationalities and educational backgrounds. Students from 44 countries have started and successfully completed the MSc MMD programme since 2005. The international character of the programme has been stable over the years with about 45% students from the Netherlands, 30% from other European countries and 25% non-European students. The panel is impressed by the ability to recruit international top students, both from within and outside Europe.

Teaching concept and teaching format

The educational concept of the MSc MMD courses is based on small group assignments in which cutting edge knowledge can be deepened through direct application and interactive discussion. Students are encouraged to ask questions from the very beginning. During the courses, students perform assignments in small groups (2-6 students) in which they need to critically discuss the presented research findings, solve scientific problems, translate fundamental science to clinical



applications, propose and present follow-up questions and/or research proposals. Personal feedback is provided as much as possible to enhance the learning experience of students. The use of rubrics to give structured feedback to students on assignments is stimulated. The panel highly appreciates this.

The panel noticed that the programme uses the international classroom in a deliberate and thoughtful manner. By acting in a group with different scientific and cultural backgrounds, students need to use their knowledge and insight, share it with the other group members and appreciate contributions of others.

The panel appreciates the way the programme stimulates interaction, cooperation, and cohesion amongst students and staff. Students indicated both in the interview and the student chapter to highly value the team bonding and the family-like atmosphere. The small-scale character of the programme entails that it is very easy to contact lecturers in an informal way. Furthermore, the students feel respected and taken seriously by the teachers. The panel is convinced that the programme's approach of collaborative learning is supportive for the learning process of the students, but still sees room for improvements. It encourages the management to develop a shared didactical concept, including a specific recognizable vision on collaborative learning. Next it is important to explicate how students optimally benefit from this concept. Elements of the concept could include the use of computer supported collaborative learning, peer-tutoring, peer assessment and balancing group assessments with individual assessments.

Success rate, study load, study guidance

The success rate of the MSc MMD programme is high. So far, 93% of all students that started have successfully finished the programme. On average 76% of students graduate in the nominal time of 2 years. The panel understands that some students delayed their graduation with a couple of months due to personal reasons such as illness, study breaks or longer international research training periods.

The panel established that students experience a heavy study load. In their contribution to the critical reflection report, students indicated to perceive the first half year as very demanding, while the workload during the first internship is generally less high. This division in the first year is appreciated by the students, since the period of hard work has a definitive end, and the (relative) freedom that comes after it is enjoyed. Students with whom the panel spoke, indicated that especially the first part of the programme is challenging, but that the programme is feasible. Overall, the panel is of the opinion that the study load is certainly high, but given the level of commitment, qualifications, and results of the student population, this seems suitable for this type of programme.

The panel finds it positive that the management monitors the study load annually and pays explicit attention to the well-being of the students. During the last years, stress among students was a regular topic for discussion in the Programme Committee (PC) and Educational Management Team (OMT). In 2018-2019, students were experiencing more problems in handling the demands of the programme than in earlier years. In 2019-2020, the programme introduced intervision sessions to support students to develop their personal leadership/self-management skills and to assist in improving well-being. In three sessions, in groups of eight, students are guided by a professional coach to discuss (study) stress-related problems. The panel encourages the programme to continue monitoring the study load and well-being of students and to take action if necessary.

The panel established that the MSc MMD programme provides intensive tutoring through its mentor programme. Each student is assigned a personal mentor, being a RIMLS senior scientist. The mentor provides support, coaching and guidance to facilitate the successful completion of the programme. The mentor stimulates the student to reflect on their personal interests, personal and professional development, choice of elective subjects and research training periods. Students prepare for the



scheduled meetings with their mentor by writing a personal reflection report, with advised topics such as first orientation in the group of peers and making a proper choice for the next step of the career. Students are expected to schedule seven meetings in the 2-year programme. Students are also stimulated to reflect and discuss with their mentor on their choice of the international host laboratory. The panel was pleased to hear that the management systematically monitors the quality of mentors and that it may occur that mentors are no longer asked because they are repeatedly evaluated negatively.

Mentor meetings are part of a more elaborate “Personal & professional development” learning trajectory that was implemented as a pilot in 2020-2021. Next to these mentor sessions, this learning trajectory consists of the afore mentioned intervision sessions and Q&A sessions with the programme coordinator and director where students can ask practical questions. In addition, elements of the regular courses (personality test, team-role workshop, CV writing workshop and peer feedback) were aligned in order to teach students reflection skills for personal development and increased well-being/vitality, thereby reducing possible study stress. The panel highly values this learning trajectory and is convinced of the added value. It strongly encourages the programme to formally and wider implement this in the curriculum and assign the appropriate EC.

Staff

The MSc MMD programme is taught by scientific staff members, who are mainly affiliated with RIMLS, and occasionally with the Donders Center for Medical Neuroscience (DCMN) and Faculty of Science (RU). Nearly all lecturers in the programme are actively involved in research, and 97% have a PhD degree. The panel thinks highly of the staff members, who are acknowledged scientists in their field and take supervision and tutoring of the research master’s students very seriously. The excellent research quality of the teachers is also evident from the external research assessment (SEP) in 2018. The SEP committee was impressed by RIMLS’ overall research quality, which was rated very good to excellent.

The general policy of the Radboud University is that staff members should have a University Teaching Qualification (UTQ). The Radboudumc has its own comparable teaching qualification system, with up to 2018 a separate theoretical and research training supervision component. About 65% of lecturers in the MSc MMD programme obtained a qualification which equals the UTQ. The panel understands that this rather low percentage can be explained by the fact that lecturers in this research master’s programme are strongly focusing on research. Course coordinators in the MSc MMD programme and assessors of research training periods have to obtain the relevant teaching qualifications. Of the MSc MMD core lecturers 81% has an UTQ. The panel noted that educational activities and involvement in educational committees are reimbursed to the teaching staff by means of a distribution model that applies to all Radboudumc degree programmes. In some cases, the compensation may be less than desired or unknown to teachers or less than the real time invested. However, this does not specifically concern MSc MMD, but all educational programmes, because there is a maximum education budget that is distributed via a distribution key. The panel encourages the management to continue their efforts to ensure that all staff members involved in teaching activities of MSc MMD are supported, both by the financial reward of their teaching tasks and their professional development as a teacher, which is available for all Radboudumc teachers through the Radboud Health Academy (RHA).



COVID-19

The most important consequence of the outbreak of the coronavirus in March 2020 was the immediate closure of laboratories when all students were performing their research training period. For first year students this was in laboratories at the RIMLS/Radboudumc and for second year students mostly abroad. Through immediate and coordinated action of the management team and BoE, all students were offered adequate alternatives, such as computational studies, literature theses and/or postponement of experimental work.

In the academic year 2020-2021, all courses were designed as a mix of on-campus and online activities. About 25% of classes were scheduled on-campus for reasons of bonding to the programme, group development, interactive classes, graded assignments like presentations and (computer) skills training. All other teaching activities were presented live online with as much interaction as possible, using for example polls, question times or joint screen drawing.

The panel concluded that, although the COVID-19 situation is not an optimal teaching and learning circumstance, the programme still allows students to achieve the final qualifications. The panel encourages the management to explore what measures might be kept in place after COVID-19 and to coordinate the support of teachers in the preparation and teaching of online education.

Conclusion

The panel concludes that the programme fulfils all specific requirements for the teaching and learning environment of a research master's programme and therefore meets standard 2.

2.3 Student assessment

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

The system of assessment of MSc MMD is guided by the assessment policy of the Assessment Service of the Radboud Health Academy (RHA), which the panel found well-thought-out. This assessment policy is based on three main principles: 1) assessment for learning, 2) transparency for students, and 3) reliability and validity of assessment.

The panel observed that these principles are adequately implemented in the assessment system of the programme, but that there is still some room for improvement. Firstly, the BoE recently established that not all course coordinators provide all required documents, such as the assessment matrix or a peer-review of the written exam by a qualified colleague lecturer. Secondly, students indicated during the interview that the written exams sometimes include questions that are not fully aligned with the content of the course. The panel encourages the management to continue its efforts to make all assessments in agreement with the formal instructions and to explicate expectations about assessments to students beforehand. This is needed for the sake of transparency of the assessment procedure.

The panel established that the assessment methods are sufficiently varied and suitable for the final qualifications that they are meant to assess. The programme uses written examinations with essay questions, assignments including writing and presenting of research proposals, research training period reports, and oral or visual presentations. Also, there is a balance between assessment with a formative and a summative function – although this balance can be made more explicit throughout



the programme. Several courses have a combination of assessment types, which together determine the final grade. Individual performance contributes for at least 50% to the final degree in each course. The panel is positive about this well-balanced combination of group assignments and individual assessments.

Research training periods

The research training periods are assessed on basis of the research skills and professional attitude of the student, oral presentations, and the quality of the structure and content of the report. In recent years, the programme made several improvements in response to the recommendations of the previous evaluation committee. One important improvement concerns the addition of a second external assessor for the assessment of the report of Research training period 2.

Research training period reports are independently evaluated by the supervisor and one assessor (Research training period 1) or two assessors (Research training period 2). The assessors are assigned from a pool of external assessors (Radboudumc scientists) by the BoE. The panel is pleased with the implementation of the 'Research training period assessment form' which lists criteria for the research conducted, professional attitude, oral presentation, and report. Also written narrative feedback is requested.

The product of the Research training period 2, the master's thesis, has to be written in the form of an article for the "Journal of Cell Biology" with the addition of a translational paragraph. This journal format was chosen as it requires detailed description of the experimental setup and data analysis and provides ample space for the results section. Detailed guidelines, including author contribution instructions for the research training period reports are available. Results that do not fit into the main body of the paper are included in supplements.

The final grade for the Research training period 2 is established by weighted factors: 40% grade for professional attitude (graded by supervisor); 10% oral presentation defence (graded by supervisor); 50% final written report graded by both external assessors (25% each). In case the difference between the report grades of the two external assessors is more than 1 grade point a third assessor is appointed by the BoE. The final grade for the written report will then be the average of the three grades.

The panel praises the programme for the progress it made in the assessment of the Research training period 2. It highly appreciates the extensive process for the grading of this final project. However, the panel believes that there is still room for improvement. The panel suggests to further develop the 'Research training period assessment form' for instance by using rubrics. When well implemented and facilitated, rubrics can further enhance the transparency of the assessment process and guide both students and staff members on what criteria and standards are expected. In addition, the panel encourages the programme to continue its efforts to provide all students with substantive written narrative feedback. The panel noted that the amount and quality of feedback vary between and highly depend on the individual supervisor and assessor. Another suggestion of the panel is not to round up all intermediate grades, but only the final grade.

In 2016, the evaluation committee was concerned about the number of 'cum laude' judicia that was awarded in the MSc MMD programme and the high grades for some research training period reports. The panel agrees that the high grades can be mostly explained by the fact that MSc MMD students are pre-selected on the basis of well above average performance and therefore do not represent the general student population. As indicated in the critical reflection report, this has also to do with the tendency of international supervisors to give very high grades. The programme took adequate



measures to deal with this. From September 2018 onwards, supervisors of (international) Research training periods 2 only give feedback to the report instead of actually grading the report. In addition, the cum laude judicium regulations were adapted. Both research training periods need to be graded equal or above 8.0 and all other marks (for courses and electives) need to have a weighed mean equal or above 8.0.

Board of Examiners

The MSc MMD BoE is responsible for the quality assurance of the assessment and examination. Board members are formally appointed by the Dean of the Faculty of Medical Sciences. Each year, the BoE issues rules and guidelines for examiners and students in order to secure the quality of course examinations. The BoE gives instructions to examiners regarding requirements and standards for assessment papers. As of 2018, the BoE arranges a yearly meeting with examiners and with the newly enrolled student cohort, in order to increase visibility of the BoE and to raise awareness of rules and guidelines. Each year the BoE samples the assessments of six to eight master's theses (reports first and second research training period) to evaluate the assessment. In addition, Assessment Service has reviewed, each year, three written course examinations to give feedback to examiners and BoE about the composition and content of written exams. From 2021 onwards, complete assessment papers of three to four courses (including instructions for assignments and rubrics) are reviewed by the Assessment Service each year. In this way, all courses will be assessed at least once during a four-years' time period.

The BoE needs to approve the 'Study plan' of each student. The BoE assesses the level and content of elective courses, potential overlapping learning activities, and choices for research training periods. Additionally, students need to hand in a 'Work plan research training period' in which they specify the intended research question, background, aims, and plan of investigation. Each Work plan is discussed in detail and needs to be approved by the BoE, which also evaluates the academic quality of the supervisor and suitability of the host laboratory.

A point of attention is to clearly separate the roles of an examiner and that of the member of the BoE to ensure the independency of both roles. This could be achieved by a clear delineation of tasks and responsibilities, also during meetings of the BoE so that the independence of both roles is guaranteed.

Overall, the panel is of the opinion that the BoE is well organised and safeguards the quality of the assessments in a proactive and structured manner.

Conclusion.

The panel concludes that the programme has a sound and thorough system of assessment in place and the BoE takes its responsibilities very seriously. The programme therefore meets standard 3.

2.4 Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

The panel reviewed fifteen master's theses of the programme. The panel established that students accomplished the entire research cycle during the Research training period 2. It was impressed by the overall level of the theses. Most of them were of good to excellent quality. The panel considers the



theses' quality to be in line with the grades given. The high quality of the theses is reflected in the relatively high grades and in the fact that many students were able to publish the results obtained in the research projects in internationally peer-reviewed scientific journals. The theses demonstrated that MSc MMD graduates can perform scientific research on a high level and achieve the ambitious final qualifications of the programme.

The panel is very positive about the career chances of the graduates of the programme. The vast majority (88%) finds a PhD position just before or directly after graduation. About 50% of these graduates choose to pursue their PhD at the Radboud University, generally within the RIMLS; 30% choose a PhD abroad and 20% elsewhere in the Netherlands. The critical reflection reports that students who pursue a non-research-oriented career also find a suitable position shortly after graduation.

During the visit, alumni reported that they were very satisfied with their education and felt well-prepared for a job as a researcher. The panel was impressed by their enthusiasm and confidence in their career abilities and their professional development.

Students report in the student chapter that the focus on a PhD as next career step makes it difficult for students to know what other opportunities they have after their graduation. The panel was pleased that this issue has recently been actively addressed by the management by organising a recurring MSc MMD career orientation event where MSc MMD alumni are invited to talk about their career path. According to the panel, it is important to make students aware that not all students end up in a PhD position and of those who do, most will not continue in academia upon receiving their PhD. It encourages the programme to strongly and proactively advise students to attend the MSc MMD career event or contact the Radboudumc Career Service who offers career orientation events. The panel feels this is very important to allow students to make an educated and motivated decision about their future career.

Conclusion

The panel concludes that the master's theses reflect the high scientific standards of the research master's programme, and graduates are well prepared for research positions. The programme therefore meets standard 4.



3. Strengths and recommendations

3.1 Strengths of the programme

The panel is impressed by the following features:

- Curriculum - The curriculum provides a good balance between theoretical courses, skills courses, electives, and two intensive research training periods.
- Learning environment - The didactical concept is characterised by working on small group assignments with an emphasis on interaction, cooperation, and cohesion amongst students and staff.
- International orientation - The programme has a diverse international student population and most students do their second research training period abroad.
- Selective programme - The programme is highly selective with respect of admission of students and recruits international top students, both from within and outside the EU.
- Teaching team - Staff members are acknowledged scientists in their field and take supervision and tutoring of the research master's students very seriously.
- Master's thesis - The theses reflect the high scientific standards of the research master's programme. Many students were able to publish the results obtained in the research projects in internationally peer-reviewed scientific journals.
- Alumni - Graduates of the programme have very good career chances. Alumni were very enthusiastic about the programme and expressed great confidence in their career opportunities.

3.2 Recommendations

For further improvement of the programme, the panel makes the following recommendations:

- Final qualifications - Reformulate the final qualifications in a more specific manner to better align with the content wise focus of the programme on the three educational themes.
- Didactical concept - Develop and implement a shared vision between management, teachers, and educationalists on how to optimally benefit from the didactical concept of collaborative learning, e.g. working with group assignments, use of peer assessment.
- Electives - Investigate how to enhance the flexibility of the programme at the beginning of the second year to increase the possibilities for electives.
- Personal & professional development learning trajectory - Implement this valuable learning trajectory formally and wider in the curriculum and assign the appropriate EC.
- Staff support - Ensure that all staff members involved in the teaching of MSc MMD are supported, both by the financial reward of their teaching tasks and their professional development as a teacher.
- Assessment - Continue with the efforts to make the assessments of all courses in agreement with the formal instructions. Also continue the improvement of the assessment of Research training period 2, for example by using rubrics and by putting more emphasis on the requirement to provide narrative written feedback.
- Career paths - Pay specific attention to career paths outside academia.



4. Conclusion

The panel has found that the intended learning outcomes (standard 1), the teaching- learning environment (standard 2), the assessment system (standard 3) and the achieved learning outcomes (standard 4) meet the criteria.

The final qualifications reflect the programme's aims and are in line with the discipline's and international requirements. The curriculum, the teaching methods, the quality of the teaching staff and the assessment system enable the incoming students to achieve the final qualifications.

Standard	Judgement
Standard 1	Meets the standard
Standard 2	Meets the standard
Standard 3	Meets the standard
Standard 4	Meets the standard
Final conclusion	Positive



Appendix A – Panel composition and programmes of the cluster

The cluster consists of six research master's programmes:

66586	M Cardiovascular Research (research)	Vrije Universiteit Amsterdam
60312	M Clinical Research (research)	Erasmus University Rotterdam
60120	M Health Sciences (research)	Erasmus University Rotterdam
60375	M Infection and Immunity (research)	Erasmus University Rotterdam
60322	M Molecular Mechanisms of Disease (research)	Radboud University Nijmegen
60279	M Molecular Medicine (research)	Erasmus University Rotterdam

Panel composition of the cluster

Core panel

- Prof. dr. F.C.S. (Frans) Ramaekers, professor emeritus Molecular Cell Biology, Maastricht University;
- Prof. dr. M. (Marieke) van der Schaaf, professor of Research and Development of Health Professions Education, University Medical Center Utrecht;
- Dr. J. (Jolanda) van der Zee, associate professor in Education of Biomedical Science and Medicine, Leiden University.

Health Cluster

- Prof. dr. M.B. (Monique) Breteler, Director of Population Health Sciences, German Center for Neurodegenerative Diseases (DZNE), professor of Population Health Sciences, University of Bonn, Germany;
- L.M. (Lotte) Klein BSc, student Clinical and Psychosocial Epidemiology (research), University of Groningen.

Molecular Cluster

- Prof. dr. J. (John) Creemers, professor of Biomedical Science, KU Leuven;
- V.E.J.M. (Victoria) Palasantzas MSc, student Molecular Medicine and Innovative Treatment (research), University of Groningen (graduated in 2021).



Appendix B – Schedule of the visit

Programme site visit research master's programme Molecular Mechanisms of Disease

3 December 2021

Time		Session
08.30	10.00	Preparatory meeting panel
10.00	10.45	Interview with the programme management
10.45	11.00	Internal meeting panel
11.00	11.45	Interview with students (incl. PC student members)
11.45	12.00	Internal meeting panel
12.00	12.45	Lunch
12.45	13.30	Interview with lecturers (incl. PC lecturer members)
13.30	13.45	Internal meeting panel
13.45	14.15	Interview with alumni
14.15	14.30	Internal meeting panel
14.30	15.00	Interview with Board of Examiners
15.00	15.30	Internal meeting panel
15.30	16.00	Interview with programme management (including dean)
16.00	17.30	Internal meeting panel
17.30	17.45	Presentation of preliminary findings (public)



Appendix C – Documents studied

- Critical reflection with appendices
 - Student chapter
 - NVAO report MSc MMD accreditation 2016
 - Adjustments based on previous accreditation
 - Study guide MSc MMD 2021-2022
 - Education and examination regulations MSc MMD 2021-2022
 - Assessment plan
 - List of MSc MMD staff
 - Covid-19 related guidelines
 - Selection of students: entry and background of admitted students
 - MSc MMD success rate
 - RIMLS research assessment (SEP)
 - Assessment form research training period 2
 - Employment of MSc MMD graduates
 - Publications with student contribution
 - MSc MMD graduates 2017-2019, 2018-2020, 2019-2021
- Fifteen theses with assessment forms
- Assessment files of the written exams



Appendix D – Abbreviations

BoE	Board of Examiners
EC	European Credit
DCMN	Donders Center for Medical Neuroscience
MSc	Master of Science
MOOC	Massive Online Open Course
NVAO	<i>Nederlands-Vlaamse Accreditatieorganisatie</i>
OMT	Educational Management Team
PhD	Philosophy Doctor
PC	Programme Committee
PI	Principal Investigator
Q&A	Question and Answer
Radboudumc	Radboud university medical center
RIMLS	Radboud Institute for Molecular Life Sciences
RHA	Radboudumc Health Academy
SEP	Standard Evaluation Protocol
RU	Radboud University
UTQ	University Teaching Qualification

