ONDERZOEKERIJ

Research Master Molecular Medicine

Erasmus University Rotterdam

Report of the limited programme assessment

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Executive summary

The outcome of the external assessment of the research master's programme Molecular Medicine (MScMM) of Erasmus University Rotterdam (EUR) by an NVAO approved panel is positive.

The two-year full-time programme aims to deliver professionals well equipped with knowledge and skills to become independent biomedical researchers in the fields of molecular cell biology, developmental biology, and genetics. The MScMM programme provides students with a high-level scientific training in basic and translational research. Based on the shared framework for all five research master's programmes offered by Erasmus MC, MScMM formulated six intended learning outcomes (ILOs). The panel advises formulating the learning outcomes in a more specific and ambitious way. In addition, the ILOs should be updated by integrating the attention the programme pays to the development of transferable skills.

The curriculum provides a balance between theoretical courses, skills courses, and intensive hands-on training in research. The research orientation of the curriculum is beyond dispute. The panel is positive about the level and the content of the courses. However, the programme would benefit by integrating statistics and bioinformatics in a more structured way. The panel advises implementing a compulsory course on bioinformatics and statistics, including the use of 'R'. Assign this course with sufficient EC.

The panel highly appreciates the two Lab Research Projects in which students obtain practical experience in laboratory research, collect scientific data, practice communication skills, master research techniques and further develop scientific thinking and reasoning. The panel advises the programme to encourage students to choose one research project outside Erasmus MC. This will allow them to get a broader network in preparation for their future career.

Students need to ask their supervisor for time to follow the mandatory courses parallel to their first Lab Research Project. The panel advises the management to coach and support students in a more structured way by creating a timetable that specifies the time to spend on both the research project and the courses.

The main didactical concept of interactive and personalized training using the apprenticeship model fits well with a research master's programme. The panel advises the programme to further elaborate, explicate and implement the didactic concept aimed at activating interactive education that pays attention to the personal and professional development of students.

The programme is highly selective with respect to admission of students and carefully looks for a good match between the scientific potential of prospective students and the programme. This results in a group of motivated and well-performing students. However, the panel advises to make the selection procedure more transparent and communicate clearly on which criteria students are ranked and selected.

The MScMM programme is part of the Biomedical Sciences Theme. The panel thinks highly of the staff members, many of whom are established scientists in their field. The panel also considers the lecturers to be very committed. The panel was concerned that the teaching staff is currently not rewarded by financial compensation and support of their professionalisation. The panel was relieved to hear that there are concrete plans to change this soon and that the necessary funding will be made available.

The programme has a clear framework for assessment and makes use of an appropriate range of assessment methods. The panel appreciates the use of rubrics to evaluate the student's performance at the end of the Lab Research projects. The panel also appreciates the thoughtful and extensive

process to safeguard the quality of the master's theses. It also highly values the rebuttal that students write in the response to the feedback they received.

The Chamber Research Masters of the Examination Board Erasmus MC (CRMEB) is responsible for the examination and assessment quality of the programme. The panel is confident that the CRMEB is well equipped and positioned to safeguard the quality of the assessments, but a lot of work remains to be done. It encourages the programme management to prioritise the assessment carrousel to ensure and improve the quality of the assessment.

The panel is impressed by the high quality and academic level of the fifteen theses it examined. This indicates that the students are thoroughly prepared for a PhD position. Alumni also indicated to feel well-prepared for a job as a researcher. 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: 18 February 2022

Frans Ramaekers	Esther Poort
(chair)	(secretary)

1. Introduction

1.1 Administrative data

Name of the programme:	M Molecular Medicine (research)
CROHO number:	60279
Level of the programme:	Master of Science
Orientation of the programme:	Academic
Study load:	120 EC
Location:	Rotterdam
Variant:	Full-time
Submission deadline:	1 May 2022

1.2 Introduction

This report focuses on the assessment of the research master's programme Molecular Medicine (MScMM) of the Erasmus University Rotterdam. 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 masters 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 several additional criteria as described by the NVAO (specification of additional criteria for research masters 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 extra 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 Sciences, 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 self-evaluation report describing the programme's strengths and weaknesses. This self-evaluation report included a chapter in which the students reflected on the programme. The panel members prepared the assessment by analysing the self-evaluation 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 several 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 25 and 26 November 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 Examination Board. 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 based on 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 reached a substantiated 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, 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's programme Molecular Medicine (MScMM) is one of the five research master's programmes offered by Erasmus Medical Center (Erasmus MC). The main aim of MScMM is to deliver professionals well equipped with knowledge and skills to become independent biomedical researchers in the fields of molecular cell biology, developmental biology, and genetics. MScMM graduates can explain various biomedical processes at the molecular and cell biological level and can design experiments to gain mechanistic insight into these processes. These competences allow graduates of the MScMM programme to design experiments to further our knowledge of basic biological processes and help to develop new therapeutic strategies to successfully treat diseases.

The panel acknowledges that the MScMM programme provides students with a high-level scientific training in basic and translational research. MScMM distinguishes itself by admitting a mix of biomedical and medical students. The panel applauds the intention of the programme to solve important preclinical and clinical challenges by facilitating interdisciplinary teamwork.

The programme clearly leverages on its setting in which it is embedded in the Theme of Biomedical Sciences of Erasmus MC. Many of the faculty is associated with one of the departments of this Theme, most notably Cell Biology, Developmental Biology and Molecular Genetics. In addition, a significant number of the faculty is associated with biomedical research groups at other departments of Erasmus MC. The involvement of senior researchers with a leading international reputation in their field ensures that the programme is geared to the expectations of the professional field, the discipline, and international requirements.

The five research master's programmes of Erasmus MC have developed a shared framework of intended learning outcomes (ILOs). In general, these ILOs aim to offer a solid basis for a research career. Each research master's programme has further elaborated these general ILOs to fit its specific profile. In the case of MScMM, the focus is on the domain of molecular cell biology, developmental biology, and genetics in fundamental and translational research.

The panel verified the relationship between the six ILOs formulated by MScMM and the Dublin descriptors. The emphasis on research skills as well as other academic skills testifies to the programme's research master's orientation. Overall, the panel is of the opinion that the ILOs of MScMM fulfil the requirements in terms of content, level, and orientation. However, the panel thinks that the current ILOs are not optimally formulated and do not do full justice to all specificities and objectives of this master's programme. The panel advises updating several learning outcomes so that they are better aligned with the content of the curriculum. First, there is room for improvement for formulating the learning outcomes in a more specific and ambitious way. For example, the panel would have expected more references to advanced thinking skills like making an analyses and syntheses of the literature, or to issues regarding scientific integrity and open science. Based on the written documentation and the discussions with staff and students, the panel noted these are indeed present in the programme.

Similarly, the panel advises updating the intended learning outcomes by integrating the development of transferable skills. This would do better justice to the training of students in social skills, communication skills and learning skills.

According to the critical reflection, the main goal of the programme is to prepare students for a future in the international scientific world. The vast majority of graduates of the MScMM programme continue their training to become independent scientists by pursuing a PhD programme. The panel fully agrees that the programme should primarily have an academic focus, but it also thinks that the programme could strengthen the orientation on future careers outside academia. It suggests evaluating and eventually rephrasing its intended learning outcomes to better reflect this orientation on a (research) career outside academia. The panel, therefore, advises that the programme should strengthen the orientation on a (research) career outside academia. It thinks it is important to make students fully aware that the knowledge and skills they acquire during the research master's programme, and possibly deepened during a PhD, are very valuable in non-academic settings as well.

Conclusion

The intended learning outcomes 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

Curriculum

The MScMM is a two-year programme with a total of 120 EC. The curriculum consists of the Introduction Weeks (2 EC), compulsory theoretical courses and skills courses (in total 42 EC), elective courses and seminars (4 EC), the Lab Research Project year I (24 EC), the Lab Research Project year II (38 EC), and the MSc thesis (10 EC).

The panel established that there is a good balance between theoretical courses, skills courses, and intensive hands-on training in lab research. The research orientation of the curriculum is beyond dispute. The panel considers the curriculum to be an appropriate reflection of the ILOs of the programme.

During the Introduction Weeks (IW 2 EC), students meet their peers, the programme management, scientific group leaders, and course coordinators. They also visit several research laboratories to get a broader view on the projects they can choose for their first Lab Research Project. From mid-September until February, students participate in four textbook courses (in total 17 EC). These courses need to ensure that all students acquire the necessary background knowledge in the fields of molecular cell biology, genetics and developmental biology, and techniques used in these fields. From January until April students follow two in-depth theoretical courses (in total 7 EC) to acquire the basic knowledge and capacities that they need during the research projects. Based on the faculty presentations, lab visits, and discussions with research supervisors, tutors and course directors, students choose a topic and research group for the Lab Research Project Year 1 (24 EC). Students obtain practical experience in laboratory research, collect scientific data, practise communication skills, master research techniques and further develop scientific thinking and reasoning. During the second part of this Lab Research

Project year 1, students also follow three courses focusing on presenting and discussing research results, both orally and in written form. This concerns two courses on presentation skills (in total 4 EC) and one course Report Writing (6 EC) where students learn the basics of scientific presentation and the central aspects of scientific writing, followed by the writing of their research report at the end of the first year.

Students and alumni indicated that it is the students' responsibility to ask their supervisor for time to follow the mandatory courses parallel to their Lab Research Project. Some supervisors are more responsive to these requests than others, which may put some students at a disadvantage. The panel advises the management to support students in a more structured way by creating a timetable that specifies the time to spend on both the research project and the courses. This timetable should preferably be approved by the supervisor and the programme management.

The second year of the programme evolves around doing the Lab Research Project year II (38 EC) and covers all aspects of the scientific cycle. Students are guided by a direct supervisor, often a PhD student or a postdoc, and the PI of the research group. After a month in which students get to know their project and the research group, the student starts writing an elaborate project proposal (2 EC), together with, and approved by, the supervisor of the research project. This proposal is evaluated by an independent MScMM faculty member. Halfway the second year, students present their project to their peers at the Research Progress Presentations course (2 EC) At the end of their second-year research project, students write and defend their master's thesis (10 EC).

In addition to the Lab Research Project, students participate in several courses, seminars, lectures, and symposia available at Erasmus MC or elsewhere. In consultation with their research supervisor and course directors, students compose their own programme (worth 4 EC). The panel highly appreciates this opportunity to gear the programme to the need and interest of the individual student. The panel also appreciates the course (4 EC) in which students write a literature review on a specific topic within the wide field of biomedical sciences. This topic differs from the topic of their research project, and they are guided by an experienced faculty member.

The panel is positive about the level and the content of the courses. However, the programme would benefit from a further alignment of the courses. In particular, the panel advises to integrate statistics and bioinformatics in a more structured way in the curriculum. The panel feels that it is important that research skills which are typically expected from a research master's student have already been covered prior to internships. It therefore strongly suggests introducing a learning line in research methods within the compulsory courses. The panel was pleased to hear that the programme intends to develop a course on bioinformatics. It strongly suggests making this a compulsory course. In addition, the panel advises to combine this with a compulsory course on statistics, including the use of 'R'.

The panel highly appreciates the two Lab Research Projects in which students obtain practical experience in laboratory research, collect scientific data, practice communication skills, master research techniques and further develop scientific thinking and reasoning. Students were also enthusiastic about these research projects. Students suggest in the critical reflection to provide the opportunity to evaluate the internships by giving a numerical grade. The panel agrees that this would be valuable for other students to make a more informed decision about their research project and encourages the programme to follow up this suggestion.

The panel understands that students must do their first research project at Erasmus MC because they also must attend mandatory classes parallel to their research project. For their second Lab Research Project, students can choose to go to another university in the Netherlands, whilst being supervised by a teacher of Erasmus MC. For every project outside Erasmus MC, the student's external supervisor should have close connections with at least one researcher within Erasmus MC. Also, excellence of the

student and the hosting institute are important factors. The panel values this opportunity to gain research experience outside Erasmus MC. However, the panel noted that only one or two students per year follow an internship outside Erasmus MC. The panel advises the programme to encourage students to choose one research project outside Erasmus MC. This will allow them to get a broader network in preparation for their further career.

Only very occasionally a student performs an international research project. The panel thinks that going abroad helps students to develop a truly international orientation. Since the programme has sufficient international contacts, there should be opportunities to strengthen international exchange. The panel advises the programme to encourage (especially the Dutch) students to spend part of their studies at a university abroad.

The MScMM 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 lingua franca of the research domain of biomedical science is English and that the use of English maximises inclusivity of international students and staff members. The panel endorses this. Since the language of science is English, the programme requires each staff member to speak English fluently. All teachers collaborate with international partners and present their data on international conferences, publish in peer-reviewed (English) international literature, and write international grant applications.

Admission and student population

MScMM is open for students with an academic bachelor's degree in medicine or biomedical sciences (biology, biomedical sciences, biotechnology, or a similar degree). The programme selects medical students in the third year of their bachelor programme of Erasmus MC. The programme is also open for non-academic students with a bachelor's degree in biomedical laboratory techniques. International applicants whose native language is not English should submit the official score of either one approved English language proficiency test), or a proof that the previous education was in English.

The panel established that the programme is highly selective in admitting students. On average, the programme receives about 80-100 applications per year. In the pre-selection procedure, in particular the (numerical) grades obtained during the Bachelor phase and personal motivation are assessed. As a rule of thumb, the programme expects students to have a GPA of at least 7 on a scale from 1-10. The selection is carried out by two faculty members, typically the director and a board member. Based on this pre-evaluation, they decide whether the candidate is invited for an interview, in person for Dutch candidates or via video call for international candidates. Based on the interview and written documents (grade transcripts, CV, motivation letter and letters of recommendation), they decide whether the candidate is accepted into the programme. In case of any doubt, a candidate can be asked to take an entrance exam, which is then also considered for the final decision. The programme selects 30-35 students per year, of which 15-25 start in the programme.

The panel appreciates the substantial weight on student motivation in the selection process and the careful procedure to see if there is a good match between the scientific potential of the prospective student and the programme. This results in a group of motivated and well-performing students. However, the panel advises to make this procedure more transparent and communicate clearly on which criteria students are ranked and selected.

Approximately one third of the students has a bachelor's degree in medicine from the Erasmus MC, a third are Dutch students that have obtained a bachelor from one of the Dutch biomedical faculties and the other third are international students. This diversity in nationalities and educational backgrounds

offers good opportunities for students to learn from one another and to gain new perspectives on knowledge, technology, and culture.

Didactical principles

One of the main didactical principles is the focus on interactive and personalised training. The panel is of the opinion that this didactical concept fits well with a research master's programme. After studying the curriculum, it also recognised aspects of this principle in the programme. In general, there is room for informal interaction between the staff and students and the students value the fact that they are educated by high-level researchers in the field. As indicated in the critical reflection, the MScMM programme intends to improve interactivity in teaching sessions, by developing blended learning and assignments. The panel strongly supports this and encourages the programme to elaborate, explicate and implement the didactic concept aimed at activating interactive education that pays attention to the personal and professional development of students.

The critical reflection indicates that the embeddedness in a research environment is also considered to be a main educational principle. The panel appreciates that students are part of the research groups during their research internships and have ample opportunities getting hands-on research experience. In particular, the panel highly values the apprenticeship relationship between students and supervisors. Students and alumni were also very positive about the embeddedness in the research environment.

The panel also acknowledges the didactical principle of 'integrated education' in the programme. The theoretical knowledge that is acquired during the theoretical modules is applied in practice during the research projects where students go through all steps of the scientific cycle.

Study load and study guidance

The students and alumni who were interviewed by the panel, indicated that the programme is intensive during the first year, and at times they experienced a heavy study load. According to the panel the study load is certainly heavy, but given the level of commitment, qualifications, and results of the student population, this seems suitable for this type of programme. The panel appreciates that the programme management monitors the study load and makes adaptations when necessary. For example, the courses have been concentrated more in the first half year to diminish the overlap with the first Lab Research Project. The panel encourages the programme management to continue discussing with students how they perceive the study load and monitor their well-being.

The panel noted that almost all students with a non-medical educational background complete the MScMM programme in two years. Medical students typically take 4.5 years to complete both the MScMM and the medical master's programme. Effectively, these students also spend two years on the MScMM programme.

Whenever they experience problems with their study, the students can turn to the programme management. Due to the small class sizes, programme management is in close contact with its students, which makes it easy for the students to voice their problems. However, this close contact may make it harder for students to talk about issues they would rather discuss with someone outside the managing team. The panel is pleased with the intention to appoint an independent student advisor who will be available for all students of the graduate school seeking advice from a counsellor not related to the programme organisation.

Staff

The MScMM is part of the Biomedical Sciences Theme which encompasses six departments: Biochemistry, Genetic Identification, Molecular Genetics, Neuroscience, Cell Biology and Developmental Biology. Many of the faculty of the programme are assistant, associate, or full professors at one of these six departments. In addition, a significant number of the faculty is associated with biomedical research groups at other departments of Erasmus MC, including Clinical Genetics, Immunology, Orthopaedics, Pathology, Paediatrics, and Pulmonary Medicine.

The MScMM programme has 64 faculty members; 48 of them contribute to teaching in the courses. In addition, each student is guided by an experienced scientist when writing the Literature Review and during the year 1 and 2 research projects.

The panel met with very qualified and dedicated teachers and supervisors. Staff members are very engaged with the students and supervision and tutoring is taken very seriously. The ambitious and small-scale character of the programme adds to the commitment of the staff to the programme and to the motivation to work with MScMM students.

The panel acknowledges the staff's excellent scientific quality and international academic reputation. They are active researchers and able to bring in the latest developments in their field. The excellent research quality of the teachers is evident from last year's positive evaluation of the 47 research departments in Erasmus MC by an international review committee as part of the Standard Evaluation Protocol (SEP). All 47 Erasmus MC research departments scored very good to excellent in each of the evaluation categories 'quality of research', 'relevance' and 'viability'. In the SEP evaluation report, the research quality of the departments of Biochemistry, Genetic Identification, Molecular Genetics and Neuroscience was assessed as excellent, and of the departments of Cell Biology and Developmental Biology as very good. This reputation of the departments is endorsed by the panel. It is clear to the panel that students are part of a high-quality and committed research environment.

The percentage of teachers with a UTQ certificate and teachers who are following the UTQ training is 67%. As explained in the critical reflection, this rather low percentage has to do with the fact that some of the teachers have only a very limited teaching load, which mainly involves guiding students during their internship or reviewing proposals, reviews, reports, or theses. The panel encourages the programme to continue improving these numbers.

The panel was concerned that the teaching staff lacked acknowledgement and appreciation because they are not rewarded by financial compensation for their teaching and are to a limited extent supported in their professional development as a teacher. The panel was relieved to hear that there are concrete plans, including the necessary funding, to change this soon.

Graduate School

Newly created in 2021, the Erasmus MC Graduate School is the hub for graduate programmes at both research masters and PhD level. The Scientific Director and the Managing Director consult in the Graduate School Management Team with a representative of the Research Masters and a representative of the PhD branch. According to the self-reflection, the Graduate School is a platform for both existing education, as well as for new initiatives within the convergence of Erasmus MC with TU Delft and Erasmus University Rotterdam. The period ahead will be marked by the structuring of the organisation and better coordination of the five research master's programmes. The panel sees a clear added value in the Graduate School and encourages the programme to optimally utilise this hub to explore where the research master's programmes can reinforce each other.

ECRM

The Education Committee Research Masters (ECRM) consists of students and teachers from the five Research Masters. The ECRM advises the programme on matters relating to quality assurance of the programme and approves the Teaching and Examination Regulations. The panel noted during the site visit that the ECRM is involved in the development of the programme, but that this involvement could be more formalised.

COVID-19

Obviously, COVID-19 had a large impact on the programme. Especially the first lockdown, from March-June 2020, had a large effect as all students who already started their research projects were no longer allowed to come to the lab. During this period, students worked on their project from home, analysing their results or other data sets from their research group and they started writing their research report or master's thesis. The programme organised Zoom sessions to explain the situation and reassured students that they will be able to finish their first or second year. The panel compliments the programme management for paying close attention to the mental health of students during COVID-19.

After the lockdown, all students returned to the lab and managed to acquire sufficient lab experience. There were only few courses in this period, which were offered online. Exams were postponed until after the lockdown.

In the academic year 2020-2021, the COVID-19 pandemic had less effect on the programme. From September to December, all teaching sessions were live at the Erasmus MC. This was possible, because of the small size of the student group. From December onwards, in the second full lockdown, teaching sessions were again online, but exams were at Erasmus MC. Whilst this evidently had an impact on the interaction between students and teachers, both were positive about the quick and efficient transition.

The panel concluded that although the COVID-19 situation is not an optimal teaching and learning situation, the programme still allowed students to achieve the intended learning outcomes. It suggests the programme to explore what aspects of online education might be kept after COVID-19 and how this could be further improved.

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 panel noted that the programme has a solid set of documents and procedures in place which secure an adequate assessment system. The Assessment Policy and Assessment Plan describes the assessment vision, in line with the educational vision and ensures consistency at the various levels. The annexed Education Plan relates the ILOs to the various courses and examinations. The assessment policy has been further elaborated in the Teaching and Examination Regulations Research Master's Programmes 2021-2022.

The MScMM programme uses assessments for two functions: 1) the qualification of the student and 2) the support of the learning process. Due to the small scale of the programme, it is possible to discuss the progress and development with the students individually. The panel appreciates the use of rubrics to support the learning process. It also values the written personal feedback students receive about which competences need additional attention. The panel encourages the programme to explicate how both students and teachers can optimally benefit from the use of summative and formative assessment methods.

The programme uses a good variety of different forms of assessment, including written exams with open questions, assignments (individual and group), and presentations (individual and group). All theoretical courses of the first year are concluded with a written exam. The written exams consist of open questions to assess whether the student sufficiently understands and can apply the knowledge taught in that course. According to the students, the written exams are well constructed and cover all learning material of the different lecturers. Students feel well prepared for their exams and appreciate the post exam meetings where they discuss any question. During the first-year courses students also give presentations of the results of group assignments. These group assignments are graded with one mark for the whole group.

The panel appreciates the broad ranges of methods to assess the Lab Research Projects. It appreciates the use of rubrics to evaluate the student's performance at the end of the project. Main categories in the rubric are 'knowledge and understanding', 'scientific approach', 'competence in doing research', and 'communication and other competences', including 'functioning in a team', 'motivation', 'dealing with setbacks', and 'independency'. The research lab supervisor also provides written and oral feedback when discussing the outcome of the assessment. Based on the rubric, the supervisor suggests a grade for the research project of the student. During the first year, the Year 1 Coordinator goes through all the rubrics and feedback forms, determines if the grades are consistent and determines the final grades. If the grading seems inconsistent this is further discussed by the Year 1 Coordinator and the research project supervisor. During the second year, the research project supervisor discusses the grading with the Year 2 Coordinator and the Programme Director at the end of the thesis defence (see below). Based on the advice of the research project supervisor and the discussion, the Year 2 Coordinator and the Programme Director determine the grade, making sure that the grading is consistent.

In addition to these assessments of the performance at the end of the Lab Research Projects, the programme assesses students during several related skills courses, using both oral presentations and written assignments. Students present their work during the so called 'Research Progress Presentations'. These oral presentations are individual assignments and graded with a numerical grade. Students receive feedback on their presentation (skills) by independent faculty. In year one this is a small group of four to six faculty members, two of whom are present at each presentation. In year two all presentations are assessed by two examiners, the Year 2 Coordinator and the Programme Director. Students receive written feedback from the examiners, provided on a feedback form. The assessments focus on presentation style, content and response to questions, and discussion. At the end of year two, the students also present and defend their thesis (see below). During a recent meeting of the assessment committee, the programme decided to develop rubrics to assess the progress presentations. These rubrics will also include space on the form to provide personalised feedback to the student. The panel supports this development.

In addition, the programme has several written assignments that are related to the Lab Research Projects. Parallel to the first Lab Research project, students follow the course Report Writing (6 EC), where the basics of scientific English writing are taught, and students write a scientific report of their

year one research project. In the second-year, students write an elaborate project proposal (2 EC) together with, and approved by, the supervisor of the research project. This proposal is evaluated by an independent MScMM faculty member. Students also review and discuss the complete proposals of two of their peers.

At the end of their second-year research project, students write and defend their master's thesis. The thesis should demonstrate the ability of the student to organise and present results and knowledge in a form required for publication of a scientific article. In contrast to a regular manuscript, the thesis must include a more elaborate introduction and materials and methods section. The panel highly appreciates the extensive process to safeguard the quality of the thesis. First, the thesis is assessed by the supervisor and an independent faculty member. The student provides a 1-to-2-page summary of the specific improvements the student implemented in the final version based on the comments the student received on the draft version from his supervisor and an independent faculty member. This should be the form of a rebuttal letter. The student gives an oral presentation on the aim, results, and conclusion of the thesis work. The students' supervisor and at least two independent faculty members assess the presentation and the defence. The panel noted that the narrative feedback on the theses as provided by supervisors and reviewers is extensive. It also highly appreciates the use of the rebuttal. In its opinion, it is an intensive procedure, but it certainly has added value.

Examination Board

The Examination Board (EB) is responsible for the examination and assessment quality of all bachelor's and master's programmes at Erasmus MC. In 2018, the Research Master Examination Board joined forces with the EB of the bachelor's and master's programme Medicine and has become the Chamber Research Masters of the EB Erasmus MC (CRMEB). The CRMEB operates as an independent body and safeguards the quality and level of the assessments, assessment system and achievement of learning outcomes, determines whether students meet the requirements set out in the Teaching and Examination Regulations (TER), and sets the rules and guidelines that are supplementary to the TER for the five research master's programmes and postgraduate master's programme.

The assessment committee is a joint effort by the EB and the programme management. This committee functions as a meeting place for the programme management and the EB, where members can discuss any topic concerning assessment they want. The topics discussed are more on a general level than in the assessment carrousel that is introduced in 2018 to support the EB in adequately assuring the quality of examinations. Further assistance was provided in 2019 by a two-year intensive EUR-wide project on assuring the quality of assessment, with financial support from the Executive Board and the Dean.

The MScMM assessment carrousel consists of two examiners of the programme, one educational assessment expert, one member of the Programme Board and two members of the EB. Four times per year, two or three examiners are invited to evaluate their assessment(s) and the assessment process in a cooperative and constructive manner. The assessment carousel assesses the quality and the format of the exams, monitors the exam procedure and, if necessary, advises the Programme Board and reports to the EB. The panel was pleased to hear that the assessment carousel recently evaluated the master's thesis of three recently graduated MScMM students. In 2021, the initial joint responsibility was replaced by a clearer role division in which the programme is in the lead of the assessment carousel and the EB observes and participates.

The panel is confident that the CRMEB is well equipped and positioned to safeguard the quality of the assessments, but adequate support and facilitation of the CRMEB by the organisation remains very

important. The panel encourages the programme management to prioritise the assessment carrousel to ensure and improve the quality of the assessment.

Conclusion

The panel concludes that MScMM has an adequate assessment system. 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 was impressed by the high quality of the theses. The work described in several theses was published in a high-ranking scientific journal, which underpins once more its high quality. The theses have a clear academic style, a proper methodical section, and a critical discussion of results. All the theses that the panel studied demonstrate that students have the ability to conduct research at a research master's level. Sometimes, the panel would have given a slightly higher or slightly lower grade, but never deviating by more than one point. The panel determined that all students accomplished the entire research cycle during the second research internship.

In the period 2015-2020, 92 MScMM students graduated. Of these graduates, 72 continued onto a PhD programme (78%). Of the 92 graduates, there were 31 medical students, 25 of which continued onto a PhD programme (81%). Of the 61 biomedical students, 47 continued onto a PhD programme (77%). During the site visit, the alumni reported that they feel well-prepared for their current PhD position.

The panel concludes that the students are thoroughly prepared for a PhD position. However, not all students end up in a PhD position and of those who do, most will not continue in academia upon receiving their doctorate. Students at this stage of their career are often not aware of the fact that only a limited fraction will remain in academia. Therefore, the panel was pleased to note the programme also pays attention to career paths outside academia. It encourages the programme to strongly and proactively advise students to attend career events or contact Erasmus University Rotterdam career service who provide career advice and workshops. The panel feels this is very important to allow students to make an educated and motivated decision about their future career.

The programme puts lots of efforts in its contact with alumni and a substantial part of the alumni joined the Linked in group for MScMM alumni. The intention to send surveys after one and five years after graduation will provide valuable insight into the short- and long-term career paths of the alumni. The panel also values the recently established Erasmus MC Alumni Network. The panel encourages the programme to utilise these ties with alumni for organising career talks with alumni or inviting them as guest lecturers.

Conclusion

The panel concludes that the MScMM students achieve an adequate final level and find suitable jobs. The programme therefore meets standard 4.

3. Strengths and recommendations

3.1 Strengths of the programme

The panel is impressed by the following features:

- Balanced curriculum – The curriculum provides a balance between theoretical courses, skills courses, and intensive hands-on training in research.
- Research orientation – The research orientation of the curriculum is beyond dispute. The curriculum includes two Lab Research Projects, allowing students to obtain practical experience with all aspects of the scientific cycle.
- Selective programme – The programme is highly selective with respect of admission of students and the students who enter the programme are very motivated and well-performing.
- Teaching team – The teaching staff is motivated, well-qualified and knowledgeable in their respective areas. They are active researchers and able to bring in the latest developments in their field.
- Assessment – The programme has a clear framework for assessment and makes use of an appropriate range of assessment methods, including the use of rubrics to evaluate the student's performance at the end of the Lab Research projects.
- Master's thesis – The programme has a thoughtful and extensive procedure to safeguard the quality of the master's thesis, including the rebuttal that students write. The theses reflect the high scientific standards of the research master's programme.

3.2 Recommendations

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

- Intended learning outcomes – Reformulate the ILOs in a more specific and ambitious way. In addition, the ILOs should be updated by integrating the attention the programme pays to the development of transferable skills.
- Statistics and bioinformatics – Integrate statistics and bioinformatics in a more structured way into the curriculum by implementing a compulsory course on bioinformatics and statistics, including the use of 'R'. Assign this course with sufficient EC.
- Selection procedure – Make the selection procedure more transparent and communicate clearly on which criteria students are ranked and selected.
- Research project – Create a timetable that specificizes the time to spend on the first Lab Research project and the mandatory courses students follow parallel to this research project. Encourage students to choose one research project outside Erasmus MC. This will allow them to get a broader network in preparation for their future career.
- Didactical concept – Further elaborate, explicate and implement the didactic concept aimed at activating interactive education that pays attention to the personal and professional development of students.
- Assessment carrousel – Prioritise the assessment carrousel to ensure and improve the quality of the assessment.
- Career paths – Pay specific attention to career paths outside academia to allow students to make an educated and motivated decision about their future career.

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 intended learning outcomes reflect the programme's aims and vision 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 intended learning outcomes.

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 M 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 M Molecular Medicine and Innovative Treatment (research), University of Groningen (graduated in 2021).

Appendix B – Schedule of the visit

Programme site visit research masters Infection & Immunity and Molecular Medicine

25 November

Time	Session
8:30 -10.00	Panel preparation Infection & Immunity
10.00 -10.45	Programme Management Infection & Immunity
11.00 -12.00	Students and Alumni Infection & Immunity
12.00- 12.30	Open Consultation hour (I&I and MScMM combined)
12.30 -13.15	Lunch
13.15 -14.00	Lecturers Infection & Immunity
14.00 -15.00	Evaluation and preparing questions for second management meeting Infection & Immunity
15.00 -16.00	Student presentations of current lab work
16.00 -17.30	Panel preparation Molecular Medicine

26 November

Time	Session
9.00 - 9.45	Programme Management Molecular Medicine
10.00 -11.00	Students and Alumni Molecular Medicine
11.15- 12.00	Lecturers Molecular Medicine
12.00 -12.45	Lunch
12.45 -13.30	Examination Board Infection & Immunity and Molecular Medicine
13.30 -14.15	Evaluation and preparing questions for management Molecular Medicine
14.15 -14.45	Second management meeting Infection & Immunity
14.45 -15.15	Second management meeting Molecular Medicine
15.15 - 17.00	Panel evaluation of preliminary findings (panel only)
17.00 -17.30	Presentation preliminary panel findings (in English)

Appendix C – Documents studied

- Critical reflection with appendices:
    - Appendix 1 – Departments participating in the programme
    - Appendix 2 – Intended learning outcomes
    - Appendix 3 – Success rate and teacher education
    - Appendix 4 – Recommendations of the previous assessment panel
    - Appendix 5 – Overview of appendices that are digitally available
- Fifteen theses with assessment forms
- Teaching and Examination Regulations Research Masters (2021-2022)
- Teaching and Examination Regulations Research Masters Appendices (2021-2022)
- Rules and Regulations of the Examination Board (2021-2022)
- Annual report Examination Board Erasmus MC (2019-2020)
- Educational Vision Erasmus MC Research Masters
- Assessment Policy MSc Molecular Medicine
- Education Plan MSc Molecular Medicine
- List of MSc Molecular Medicine Faculty Members / Lecturers / Examiners
- Report of evaluation meeting with first year MScMM students (June 2020)
- Anonymised list of MScMM theses (August 2018 - June 2021)
- SEP report Biomedical Sciences Erasmus MC
- Student manual

Appendix D – Abbreviations

CRMEB	Chamber Research Master Examination Board
EB	Examination Board
EC	European Credit
Erasmus MC	Erasmus Medical Centre
I&I	Infection and Immunity
ILO	Intended learning outcome
MScMM	Master Molecular Medicine
NVAO	*Nederlands-Vlaamse Accreditatieorganisatie*
PhD	Philosophiae Doctor
SEP	Standard/Strategy Evaluation Protocol
TER	Teaching and Examination Regulations
UTQ	University Teaching Qualification
SUTQ	Senior University Teaching Qualification