Radboud University Nijmegen Medical Centre
Nijmegen Centre for Molecular Life Sciences

Research Master's Programme

Molecular Mechanisms of Disease

Information dossier

Application for NVAO re-accreditation 2011

February 2010

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Radboud University (RU) Nijmegen, Comeniuslaan 4, 6525 HP, Nijmegen

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Study Centre Medical Sciences, Geert Grooteplein 21, 6525 EZ, Nijmegen

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Contents

List of figures

List of tables

1 Preface

Introduction
The Master's programme Molecular Mechanisms of Disease (MMD) was established in 2005 to provide talented students the best and most suitable education needed to mature them into leading scientists in the field of molecular life sciences with a keen interest in both fundamental and translational aspects of disease processes. Scientists from the Nijmegen Centre for Molecular Life Sciences (NCMLS) designed an intensive training programme that sprouts from its three main research themes and is linked to the translational activities within the Radboud University Nijmegen Medical Centre (RUNMC). The small-scale and interactive nature of the MSc MMD modules provides a challenging educational platform for both students and lecturers at the crossroads between 'bench' and 'bedside' research activities.

The significant financial and personnel investments are paying off. We adhered to strict entrance criteria and were able to attract many talented international students. Our mentor programme assures very low drop-out rates. MMD students contributed significantly to high-impact publications. Nineteen from 21 graduates started their PhD in internationally recognised research groups, 9 of which at the Radboud University Nijmegen. Five students wrote their own PhD project and obtained personal funding, exemplifying the potential of the MSc MMD programme.

Procedure
This self evaluation report was written to prepare for the re-accreditation 2011 of the research Master's programme, according to the accreditation framework 2007-2010 for existing research Master's programmes, given by the Netherlands-Flanders Accreditation Organisation (NVAO). Data were collected and the report was written by the writing committee, which was assisted by external advisors from the department Market Research, Strategy and Development (MSO) of Radboud University Nijmegen and IOWO. The complete report was assessed by several NCMLS advisors.

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2 Organisational setting

The Master's programme Molecular Mechanisms of Disease (**MMD**) is a multidisciplinary programme which involves the Faculty of Medical Sciences and the Faculty of Science, Mathematics & Computing Sciences, both situated at the campus of the Radboud University Nijmegen. The Faculty of Medical Sciences is part of the Radboud University Nijmegen Medical Centre (RUNMC).
The Faculty of Medical Sciences is the coordinating and primary responsible faculty for the programme. Within the RUNMC, departments associated with the Nijmegen Centre for Molecular Life Sciences (NCMLS) research institute share the main responsibilities associated with the practical implementation of the programme.

The NCMLS was established in 1995 as an expert centre where scientists share their knowledge and facilities with the aim to understand the molecular and cellular basis of disease. Within the research institute, scientists collaborate to translate new findings into clinical application, in order to improve diagnostics and develop novel treatment regimes. The MSc programme Molecular Mechanisms of Disease is part of the NCMLS Graduate School, which guarantees a smooth connection between the Bachelor and PhD phase.

Staff members affiliated with other research institutes (Institute for Genetic and Metabolic Diseases [IGMD], Nijmegen Institute for Infection, Inflammation and Immunity [N4i], Research Institute for Oncology [RUCO], Institute for Molecules and Materials [IMM]), and the Donders Institute for Brain, Cognition and Behaviour [DI-BCB]) also are involved in lecturing and tutoring of MMD Master's students. For the course "Science and Society", expert teachers are attracted from the Centre for Society and Genomics [CSG].

Management and Committees
The management of the programme is headed by the Programme Director. The Programme Director participates in the Educational Council ('Onderwijsraad') of the Faculty of Medical Sciences, which consists of Programme Directors of the Bachelor's and Master's programmes (4), the Directors of the Institutes of Postgraduate Medical and Dentistry Education (2), as well as the Directors of the postgraduate medical specialist training programmes (2), the manager of the Academic Educational Institute (IWOO), a student representative, and the Dean of the Faculty of Medical Sciences. The Educational Council meets every two weeks. Through a yearly progress report, the Programme Director informs the Dean of the Faculty of Medical Sciences under whose responsibility he/she operates.

The Programme Director is responsible for the yearly amendments and adequate implementation of the Master's programme, the 'Education and Examination Regulations' (OER) and the quality of the programme. The Programme Director is assisted by the Programme Coordinator who is responsible for the daily management of the programme (see **Figure 1**).

The Programme Director is supported by the Education Management Team ('Onderwijs Management Team' – OMT), which consists of three NCMLS theme representatives, the Programme Coordinator, and an MMD student member (**Appendix A.1**). The OMT meets every 3 weeks; twice a year, the OMT meets with the NCMLS Director and the three NCMLS Theme leaders.

The programme has the following committees of which the tasks and responsibilities are described in the respective appendices:
- Programme Committee ('Opleidingscommissie'), consisting of three staff members, three students and a secretary (**Appendix A.2**)
- Board of Examiners ('Examencommissie'), consisting of five staff members and a secretary (**Appendix A.3**)

- Admission Committee, consisting of 15 NCMLS staff members from the different (sub)themes (**Appendix A.4**)

Student members are chosen yearly through democratic elections within and by the students of the Master's programme at the start of the academic year.

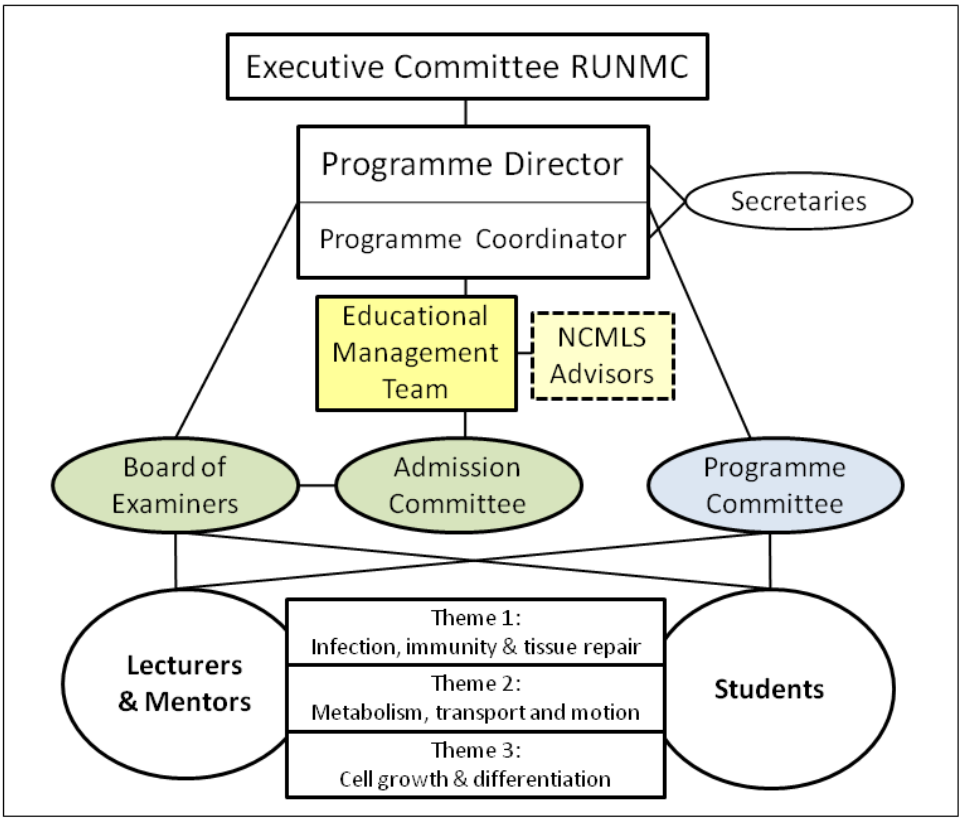


Fig. 1. Organizational chart of the MMD programme

3 Assessment protocol

3.1 Aims and objectives of the programme

Introduction:
The research Master's programme Molecular Mechanisms of Disease is part of the NCMLS Graduate School, which is involved with education and training during the complete career path of a top scientist (**Figure 2**). The NCMLS regards it essential to recruit and educate promising students, who can develop into future leading scientists that can compete at the highest international research levels and become future staff members of Radboud University Nijmegen or other research institutes. All research and education that is performed at the NCMLS serves the mission of the institute:

"**The NCMLS seeks to achieve greater insights into the complexity of living cells with the purpose of obtaining a multifaceted knowledge of both normal and pathological processes. The NCMLS will pursue its goals in the interests of curiosity driven research and education. The NCMLS aims to advance innovation in translational research based on the integration of diverse scientific expertises in molecular and medical sciences.**"

In an important early phase of a researcher's career track, the MMD Master's programme aims to provide the best education and training to young, talented students in the field of molecular life sciences. This final goal is reflected in the final qualifications of the programme, as outlined below.

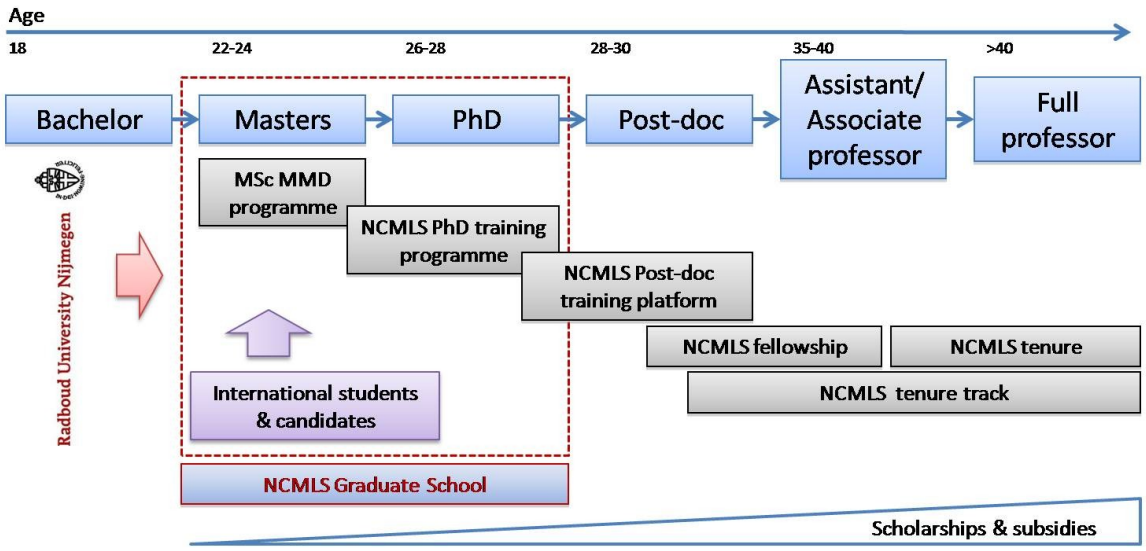


Figure 2. Schematic overview of embedding of the NCMLS Graduate School within the career development route. Students from the Radboud University (red arrow) as well as international students (lilac arrow) can enter the Master's programme.

Domain
The research and education within the NCMLS Graduate School is focussed on three themes:

1. Infection, immunity and tissue repair
2. Metabolism, transport and motion
3. Cell growth and differentiation

Together these three themes cover the field of molecular life sciences that is most important to disease. These research fields are connected to diseases that account for about 80% of the patients that visit the academic hospital. The three themes are subdivided in subthemes, as depicted in **Figure 3**.

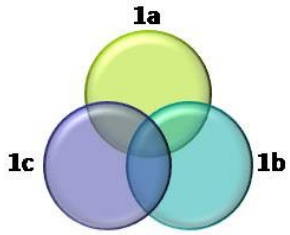
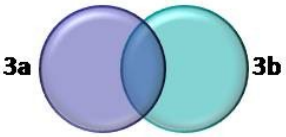
Theme 1 **Infection, immunity & tissue repair**	**Theme 2** **Metabolism, transport & motion**	**Theme 3** **Cell growth and differentiation**
		
1a: Infection and autoimmunity **1b: Immune regulation** **1c: Tissue engineering and pathology**	**2a: Energy and redox metabolism** **2b: Membrane transport and cell dynamics**	**3a: Genetic & epigenetic pathways of disease** **3b: Chemical and physical biology**

Figure 3: NCMLS research themes & subthemes.

3.1.1 Subject-/discipline-specific requirements

Criterion: The learning outcomes of the programme correspond with the requirements set by professional colleagues, both nationally and internationally, and by the professional practice for programmes in the domain concerned (subject/discipline and/or professional practice).

Aim of the Programme MSc Molecular Mechanisms of Disease
The aim of the MSc research programme Molecular Mechanisms of Disease is to provide MSc students with a multi-faceted education in molecular life sciences, particularly in the fields of molecular medicine, cell biology and translational research. The MSc programme aims to create highly qualified researchers who can successfully carry out internationally oriented PhD projects in the area of molecular life sciences, with the focus on pathological processes in living cells or who can participate in clinical research programmes contributing to the innovation of translational research at the interface of molecular and medical science.

Specification: Within the specified domain, the programme aims to deliver outstanding young scientists, who have developed all competencies to successfully perform PhD research and/or become leading independent researchers either in academia or in industry. In particular, the programme is internationally oriented: it aims to stimulate the exchange of ideas and concepts between students with different educational and cultural backgrounds and, importantly, between students and international scientists. Furthermore, students develop skills such as building up and maintaining an international network during the programme.

Final Qualifications of the Programme
The final qualifications of the programme are the following:

a. The MSc student must be capable of autonomously formulating a research problem, designing and performing scientific research and must be equipped with communication skills to enable participation in scientific discussions at an international level.

   Specification: Within the scientific field of molecular life sciences, researchers are expected to perform their research autonomously. Graduates have knowledge of the field of molecular life sciences, especially related to each of the three NCMLS research themes, and can apply this knowledge to design and perform scientific research. They are able to present their research and results at a high scientific level. In addition, they have understanding of what is relevant to the field of molecular medicine and have the international and intercultural competencies that are relevant to an internationally-oriented scientist.

b. The MSc student must have an overview of molecular life science research and must be capable of participating in multi-disciplinary research projects. The MSc student should have fundamental and advanced knowledge of the latest developments in the area of molecular life sciences.

   Specification: An MMD graduate has state-of-the-art knowledge of research and techniques within the fields of molecular cell biology, immunology, genetics and cell physiology, and understands how defects can lead to disease. He/she is able to translate fundamental science into clinically relevant applications and work in a research environment in which researchers from different scientific fields participate. He/she has developed the skills to extract most relevant information from scientific presentations or manuscripts, and is able to ask the most relevant questions. As the molecular life sciences field is continuously expanding and new methods (e.g. genomics, imaging) play increasingly important roles, he/she is able to master these new developments quickly.

c. The MSc student must be able to write at the level of published articles in international peer-reviewed journals. Furthermore, the MSc student must be able to present his/her work in the English language before an international scientific audience.

   Specification: An MMD student is able to present his/her results in the form of a scientific publication and understands the importance of high impact publications in peer-reviewed journals. He/she can also present the results, discussion and implications of his/her results to an international audience in oral and poster presentation. He/she can chair a scientific seminar and has advanced communication skills expected from a junior scientist who aspires to become a group leader.

d. The MSc student must be able to propose plans for continuation of his/her research in terms of a PhD programme and must possess the knowledge, insight and research skills necessary for the execution of such a PhD project on a high level in keeping with international standards.

   Specification: An MMD student is expected to (be able to) start a PhD research project after graduation. He/she has substantial scientific knowledge and understanding and can apply this by doing scientific research in the interdisciplinary field of molecular life sciences. Based on his/her own research experience, he/she can ask research questions relevant for continuing the research and can identify interesting new research areas. He/she can work independently, while maintaining international scientific standards, and perform research in an original and relevant direction. He/she has all knowledge and skills to assess the research of other molecular life scientists. Moreover, the MMD student can write an original research proposal based on previously performed research and published results.

e. The MSc student must be able to integrate the societal and ethical impact of scientific research at relevant moments and in relevant situations in his/her scientific career.

Specification: The MMD student is able to reflect on the impact that his/her research may have for society and communicate about this to a broader audience. He/she can apply this knowledge and reflection to take responsibility for his/her own scientific career and make judgement accordingly. As developments in molecular life sciences take place at an increasingly fast pace, the student takes the responsibility to be involved in ethical discussions and make his/her contribution to the public debate. He/she is aware of cultural differences and can place the ethical issues in an international setting.

The Master's programme Molecular Mechanisms of Disease has some (implicit) final qualifications that are less obvious in other programmes (**Appendix B**).

- The MMD student can participate in research programmes that aim to translate fundamental research findings into clinical applications.
- The MMD student is able to work in an international atmosphere and can set up and maintain an international scientific network. He/she can bridge cultural differences and can successfully be involved in an international research team.
- The MMD student is able to reflect on his/her own career path in an early phase and take career decisions adequately.

3.1.2 Master's degree

Criterion: The learning outcomes of the programme correspond with the general, internationally accepted descriptions of a Master's qualification.

The final qualifications of MMD are equivalent to qualifications of other (international) research-oriented Master's programmes. In all cases, students are expected to reach the entry level of a PhD studentship concerning knowledge, understanding and skills, as well as to be able to relate to adjacent research fields. A comparison with other local, national and international MSc programmes is found in **Appendix B**.

Content, teaching methods and final achievements were carefully chosen to serve the goal of the programme: providing the best preparation for a PhD. These final achievements comply with or exceed the international accepted descriptions of a Master's qualification (Dublin Descriptors), as indicated in **Table 1**. This paragraph describes how the final qualifications are related to the Dublin Descriptors, and paragraph 3.2.2 describes how these are connected to the curriculum.

Table 1: Comparison of the MMD final qualifications to Dublin Descriptors

Dublin Descriptor	Specification	Final Qualifications (from OER)
1. Knowledge and understanding	Have demonstrated knowledge and understanding that is founded upon and extends and/or enhances that typically associated with Bachelor's level, and that provides a basis or opportunity for originality in developing and/or applying ideas, often within a research context	b, d
2. Applying knowledge and understanding	Can apply their knowledge and understanding and problem solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study; have the ability to integrate knowledge and handle complexity	a, b, c, d, e
3. Making judgements	Can formulate judgements with incomplete or limited information, that rather include reflection on social and ethical responsibilities linked to the application of their knowledge and judgements	d, e
4. Communication	Can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously	a, c, e
5. Learning skills	Have the learning skills to allow them to continue to study in a manner that may be largely self-directed or autonomous	a, b, c, d

1. Knowledge and understanding
The MMD programme is oriented towards the acquisition of knowledge and skills that enable students to work in the scientific field of their interest and deliver original contributions to the development of ideas, particularly to the integration of fundamental science and translational knowledge in the field of molecular life sciences.

2. Applying knowledge and understanding
The programme is specifically aimed at the application of knowledge and understanding in a multidisciplinary context, as is particularly expressed in the acquisition of research skills, which will prepare students for a research career covering all areas of molecular life sciences in health and disease.

3. Making judgements
The programme's qualifications describe competences necessary for conducting original academic research. By gaining increasingly complex skills and knowledge, students are gradually enabled to make appropriate judgements about established theories, critically analyse problems and formulate new questions and hypotheses in the field of molecular life sciences. They are also able to reflect on the ethical implications of biomedical research and act accordingly.

4. Communication
MMD students are expected to gain skills to deliver oral presentations and write reports and scientific articles, as described in final qualifications a and c. Another important aspect of academic, multidisciplinary research in the medical field is the ability to communicate with both fundamental researchers and medical doctors, as well as to communicate to a general audience. This aspect is given due attention.

5. Learning skills
Students will have acquired enough knowledge and skills to embark on research projects related to molecular mechanisms of diseases. Students will also be able to swiftly acquire insight into scientific fields that are not part of his/her specialisation.

3.1.3 Academic orientation

Criterion: The learning outcomes of the programme correspond with the following descriptions of a master's degree Academic higher education:

- *The learning outcomes are derived from requirements set by the academic discipline, the international scientific practice and for programmes to which this applies the relevant practice in the future professional field;*
- *An academic master (WO-master) has the qualifications to independently conduct research or to solve multidisciplinary and interdisciplinary questions in a professional field for which academic higher education is required or useful.*

Academic Master's qualifications
Molecular Mechanisms of Disease is a two-year, 120 EC, research Master's programme. The MMD Master's programme specifically trains the best 10% of students to become top-level researchers, and as such it is distinct from regular Master's programmes in the field of life sciences offered at Dutch universities. The programme aims to provide students with all skills and knowledge necessary to rapidly move into an international PhD programme or to start a research position at public or private institutions (e.g. pharmaceutical or biotechnology companies). The MMD programme is distinct from most non-research Master's programmes with respect to its smaller scale, more intense teaching formats, and training in writing enquiry-based research proposals. Also the training in scientific communication and the interactive format of the masterclasses are unique (see **Table 2** for programme). Graduates are equipped with highly specialised knowledge of multidisciplinary research not only in the mechanisms of disease, but also in state-of-the-art diagnostic methods and technologies (e.g. proteomics, genomics and bioinformatics), and know how to apply fundamental research to answer medical questions. The requirements from the field are reflected in the final qualifications and comply with the internationally recognised requirements of an academic Master's degree: being able to independently design, perform, evaluate and communicate a research project at the level of a starting PhD programme.

In addition, graduates of the MSc Molecular Mechanisms of Disease have a critical attitude and have the ability to recognise interesting research subjects. They have the skill to extract relevant knowledge from a scientific article or presentation and ask relevant questions. They can outline new research opportunities and describe these in a research proposal, as well as critically assess research proposals of others.

International orientation
This programme distinguishes itself from other programmes in the field in its international orientation. In the field of molecular life sciences, internationalisation is essential for quality. In the programme's view, an "international classroom" contributes to the personal and academic training of the students. For the MSc programme MMD, the international classroom not only includes the international student group, but also international lecturers who are invited to teach during the interactive courses, masterclasses in particular. The broader view of the graduates that is a result of the intercultural contacts and international experience during the programme is a necessity for the next generation of scientists, who operate in a global scientific community.

The programme's view of internationalisation corresponds to the vision formulated by the Executive Board of Radboud University Nijmegen: "a top university is a university which operates internationally. Over the coming years Radboud University will dedicate itself to

strengthening its international orientation and reputation in order to improve its academic education and research."
Targets set by the MMD programme (50% international students, all students with Dutch BSc perform one out of two research training periods abroad) are ambitious and will make a major contribution to the University's targets (approximately 25% international students in English Master's programmes in 2013 and 33% of the students have spent > 1 month abroad for educational reasons). (Inspired by Quality, Focused on the Future, Strategic Plan for 2009-2013, Radboud University Nijmegen, p.5).

3.2 Curriculum

Programme summary

The MSc Molecular Mechanisms of Disease programme is a two-year research Master's programme of 120 EC, where one EC equals a study load of 28 hours. The structure of the curriculum is shown in **Table 2**. The courses are described in detail in the prospectus, which is published online (for convenience, course descriptions of 2009-2010 are also listed in **Appendix C**).

Table 2: Study programme of the Master's Molecular Mechanisms of Disease. The courses are taught sequentially in the order indicated.

Course code	Course name	Study load Year 1 (EC)	Study load Year 2 (EC)	Graded (G) or Pass/Fail (P)
8IC01	Introduction course	1.5	-	P
8C01	Excellence in Communication	1.5	-	G
8SE01	Science & Society	1.5	-	G
8T01	Infection, Immunity and Tissue Repair	5.5	-	G
8T02	Metabolism, Transport and Motion	5.5	-	G
8T03	Cell Growth and Differentiation	5.5	-	G
8MC02	Masterclass Theme 2	1.5	-	G
8MC03	Masterclass Theme 3	1.5	-	G
8P01	Research & write up: year 1	34	-	G
	Electives: year 1 [a]	2	-	G [b]
8MC01	Masterclass Theme 1	-	1.5	G
8ST01	Genomics and Statistics	-	4	G
8P02	Research & write up: year 2	-	45	G
	Electives: year 2 [c]	-	9.5	G [b]
	Total	60	60	

[a] Electives year 1 may include up to 2 EC Knowledge Transfer
[b] Knowledge transfer is graded "Passed" (P)
[c] Electives year 2 include between 2.0 and 4.0 EC Knowledge Transfer

All theoretical courses are taught sequentially (depicted in **Fig. 4**). This ensures that students have a solid knowledge basis in each of the research themes before making their choice for a research training period. Furthermore, the knowledge basis gained during the core fundamental courses is essential to be able to fully participate in the masterclasses. Moreover, skills that are acquired during one course (such as writing a research proposal), are repeated and further developed during other courses. Knowledge and skills obtained during the first 4.5 months of courses are put to practice during the first research training period. Experiences from the first training period will serve in choosing further elective courses and the second research training period in the second year.

Students have the opportunity to broaden their knowledge during the elective courses. Elective courses may be theoretical courses from other Master's programmes at Radboud University (such as Molecular Life Sciences, Biology and Biomedical Sciences), courses from other (partner) Master's programmes (such as Molecular Medicine at Erasmus University Rotterdam, or Biology of Disease at UMC Utrecht), courses from PhD programmes (such as NCMLS and Erasmus MC Molecular Medicine Postgraduate School) or individual courses. Individual courses may include writing a full research proposal. The Board of Examiners evaluates the choices for elective courses for suitability prior to the courses. Requirements for elective courses and a list of common elective courses are found in **Appendix D**.

A limited number of students from outside the programme are allowed to join the MMD theoretical courses, depending on the places available. The course coordinator assesses eligibility of the student, particularly based on his/her pre-existing knowledge. Extra students joining the courses may be NCMLS PhD students or students from other Master's programmes at Radboud University Nijmegen, or students from collaborating Master's programmes (for example Molecular Medicine at Erasmus University Rotterdam).

Both theoretical courses and the first research training period are performed at the NCMLS research institute, thus strongly linking the education programme with the latest research developments. The second research training period is performed in a foreign institute (obligatory for students with Dutch BSc), which facilitates students to achieve the international learning outcomes.

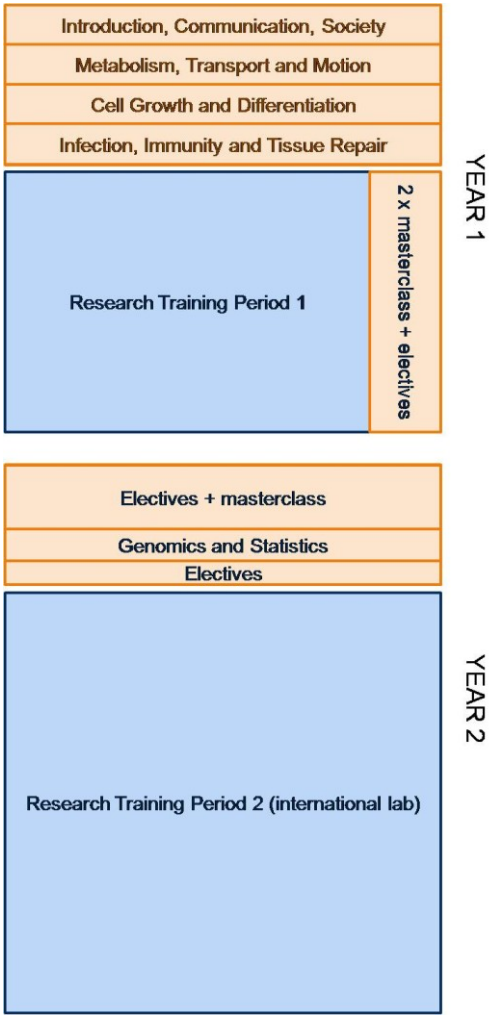


Figure 4: Structure MMD programme year 1 and year 2

Changes to the curriculum implemented in 2008 - 2010:
The structure and content of the curriculum as designed in 2004 has proven to be an effective and attractive programme, as judged by the increasing number of students, increasing visibility and the achievements of MMD students and graduates such as publications, awards and grant acquisition. To maintain the high standards, experiences and comments from students taken into account when making some minor changes to the curriculum in 2008:

- An extra 2nd year module was added to the curriculum to address statistics and genomics. Important recent developments in the molecular life sciences field are the rapidly increasing throughput of DNA variant genotyping (e.g. testing of 2.7 million variants in one experiment using SNP microarrays) and the 100-1000 fold scale up of sequence analysis (30 million bp analysed in one experiment). This has lead to an increased demand for scientists who are well-trained in bioinformatic data mining and statistical methods. The RUNMC has proven excellence in this area, especially in the departments of Human Genetics and Molecular Biology. Therefore, hands-on training in bioinformatics was included in the Introductory and the "Cell Growth and Differentiation" core fundamental courses. Furthermore, an extra course in "Genomics and Statistics" has been developed and implemented in the second year, building on the knowledge gained in the first year.
- Core fundamental and translational research modules from the same research theme were joined into one 4-week period to improve coherence and long-term planning of the programme. This planning is now synchronised with Medicine and Biomedical Sciences Master's study planning, which enables students from these programmes and other Master's programmes at the RUN to choose MMD modules as elective courses.
- Implementation of a 3-year rotation scheme for the core fundamental/translational research modules of the three themes to avoid the tendency of students to choose their research training period with group leaders who lectured in the first module.
- The study burden for students was alleviated by spreading the masterclasses, which have a very high study load, during the two years of the programme.
- Based on the outcome of the most recent exit interview, we decided to restructure the introduction course. This course up to now was given for both 1st year PhD and MSc MMD students, with emphasis on the methodological and technical spectrum within the NCMLS Graduate School. In the new set-up, the MMD students will experience a tailor-made introduction of the Radboud University campus, PI's of the NCMLS will outline their research topics, students will receive training in specific skills, and, against the background of the diversity of prior education of the international students, will have the opportunity to fill specific knowledge gaps. Together with the "Excellence in Communication" and the "Science and Society" courses, this will fully prepare the students for the upcoming modules that will involve scientific oral and written presentations.

3.2.1 Requirements for academic orientation

Criterion: The curriculum meets the following criteria for the curriculum of programmes with an academic orientation:

- *The students develop their knowledge through a verifiable interaction between education and research within the relevant disciplines.*
- *The curriculum corresponds with current developments in the relevant discipline(s) by verifiable links with current scientific theories.*
- *The programme ensures the development of competences in the field of research.*

Master's programme Molecular Mechanisms of Disease
From the beginning of the Master's programme, students are immersed in the scientific environment of the NCMLS. Since the NCMLS is a research institute that brings together researchers from the Faculty of Medical Sciences and the Faculty of Science of Radboud University Nijmegen, a broad and advanced scientific background is provided to the MMD students, ranging from fundamental (biological, medical, chemical) to translational science.

The NCMLS comprises the Radboud University Nijmegen's most outstanding scientists who are working in the field of life sciences. The recognition of researchers with the predicate "Principal Investigator" (PI) or "junior Principal Investigator" (jPI) is regulated according to verifiable qualitative and quantitative criteria (details in paragraph 3.3.3). The scientific level and achievements of the research themes and individual PI's are evaluated on a regular basis by the Scientific Advisory Committee of the NCMLS, which consists of top scientists from international research institutes (see report of 2005). At the national level, the Standard Evaluation Protocol (SEP) of the Royal Dutch Academy of Sciences (KNAW) judges the quality, productivity, societal relevance and viability. Results of the SEP report of 2005 are listed in **Appendix E**. In addition, teachers from the Faculty of Medical Sciences are required to be trained and certified in teaching abilities and in level of proficiency in English (**Appendix Q**). Altogether, this ensures that MMD students receive teaching and training of research skills by PI's with proven excellence in their field.

The Master's students become part of the NCMLS scientific community from the start of the programme: Throughout the curriculum, students are encouraged to visit NCMLS seminars and forum evenings and special attention is paid to the yearly NCMLS "New Frontiers" Symposium (see paragraph 3.3.1). Also during the courses, students are provided with state-of-the-art knowledge of the respective field and are encouraged to critically discuss the recent research findings of scientists from NCMLS and the rest of the world. In this way, during the courses students develop skills important to a scientist, which are further developed during the research training periods. Although students are under continuous guidance of their supervisors and mentors, all experienced scientists, they are regarded as full junior members of the research community.

An example of gaining in-depth knowledge about a research topic on the cutting edge of science is given during the masterclasses. Masterclasses are unique components of the programme, in which students are made familiar with and involved in exciting, recent developments in the relevant disciplines that have a direct impact on the prevailing paradigms in the field. Not only NCMLS researchers, but also international experts are invited to interactively teach in the masterclasses. The topics of the three masterclasses, which are related to NCMLS research themes, change every year to be able to deliver the most up-to-date information to the students.

In addition to the acquisition of theoretical knowledge and laboratory skills, special attention is given to the development of other skills important for scientists. Students are trained in research methodology, writing research proposals and scientific communication. Finally, a selection of the students can embark on writing a full research proposal for their own PhD project as an

elective course. Since 2008, scholarships are available for the best three research proposals by Master's students from Radboud University Nijmegen Medical Centre. In writing and defending the research proposal, many skills acquired during the Master's programme are needed. As a result, our graduates are renowned for their quick understanding of new knowledge fields and interactiveness during scientific discussions. The fact that our students have no problems to enrol in (international) PhD programmes (>85%) demonstrates that they have developed the competences required by the field. Also the high number of external grants for self written PhD projects (2 NWO TOPtalent, 1 Mozaiek and several international scholarships, see **Table 10**), as well as the publications in peer-reviewed journals (**Appendix T**) indicate that MMD graduates more than meet the requirements of the field.

Comparison with other national and international Master's programmes
(Research) Master's programmes in life sciences and biomedicine show obvious similarities in scientific content, as they all aim to cover the major areas in biomedical research (e.g. oncology, infection and inflammation, developmental disorders). The MMD programme is distinct, however, in a number of ways such as its international orientation, the strict admission criteria and the educational formats. The programme aims to select top 10% students, of whom 50% students with a non-Dutch BSc degree. The MMD programme is strictly a research Master's that explicitly trains the students to enter international PhD programmes. All students that obtained their BSc degree at a Dutch university and ~50% of the international students spend their second research training period in a lab outside the Netherlands. Participation of clinical departments from RUNMC creates strong opportunities for translational research. The teaching format is aimed at achieving a maximum level of independence in planning and performing research projects, but also in communication skills such as writing of grant proposals and scientific publications. The unique teaching format of the masterclasses allows the students to interact with international experts in the field, and to acquire state-of-the-art knowledge and skills in an interactive fashion. For a detailed comparison of the MMD programme with local, national and international Master's programmes see **Appendix B**.

3.2.2 Correspondence between the aims and objectives and the curriculum

Criteria:

- *The curriculum is an adequate realisation of the intended learning outcomes of the programme with regards to the level, the orientation and the subject-/discipline-specific requirements.*
- *The learning outcomes are adequately transferred into the educational goals of the curriculum or parts thereof.*
- *The contents of the curriculum ensure the students' achievement of the intended learning outcomes.*

The curriculum is composed in such a way that students have achieved the final qualifications (see paragraph 3.1.1) when they graduate. **Table 3** indicates in which courses the final qualifications are trained. Course descriptions, including course aims, are published each year in the prospectus. How the curriculum is designed to train students and ultimately attain the intended learning outcomes is described using the Dublin Descriptors as a guideline.

Table 3: Correspondence of the courses to the final qualifications of the MSc programme.

Code	Course	a[#]	b[#]	c[#]	d[#]	e[#]
8IC01	Introduction course		x		x	
8C01	Excellence in Communication	x	x	x		
8SE01	Science & Society					x
8T01	Infection, Immunity and Tissue Repair	x	x	x	x	
8T02	Metabolism, Transport and Motion	x	x	x	x	
8T03	Cell Growth and Differentiation	x	x	x	x	
8MC02	Masterclass Theme 2		x	x	x	
8MC03	Masterclass Theme 3		x	x	x	
8P01	Research & write up: year 1	x	x	x	x	x
	Electives: year 1 [a]					
8MC01	Masterclass Theme 1		x	x	x	
8ST01	Genomics and Statistics	x	x		x	
8P02	Research & write up: year 2	x	x	x	x	x
	Electives: year 2 [a]					

[a]The nature of elective courses varies. The Board of Examiners assesses the individual study programme, including electives.
[#]Final qualifications in paragraph 3.1.1.

Knowledge and understanding
To become an excellent scientist, students must have a broad knowledge and understanding in the field of molecular life sciences and related areas. All theoretical courses contain knowledge components and train skills to quickly acquire extra knowledge where needed. Understanding is vital to be able to acquire the essential knowledge. As these theoretical courses are obligatory for all students, a broad knowledge basis is assured for all graduates. Especially in the Theme-related courses (i.e. Infection; Immunity and Tissue Repair; Metabolism, Transport and Motion; and Cell Growth and Differentiation) knowledge is transferred to the students. Students are assessed on their knowledge during the written tests. Obviously all courses contribute to the knowledge of the students. Elective courses broaden and deepen the knowledge of the students in their own specialisation. Also during the research training periods, knowledge is acquired on the subject of the research project and related areas.

Applying knowledge and understanding
Graduates of the international research Master's Molecular Mechanisms of Disease should be able to formulate, design and perform scientific research at PhD student level and propose plans for follow-up research. Graduates will be required to handle all facets of a PhD research project: extending from initiation of the project, project planning and organisation, to a follow-up research project. Creativity and flexibility in recognising research opportunities within their discipline are therefore essential. This creativity and flexibility focus on the capability of applying their knowledge, insight, skills and attitude in creating new perspectives. A level of knowledge, and insight, skills and attitude, of a starting PhD student are conditional for being able to apply these in the complexity of the research context. Ideally, at the end of a PhD programme the student will have developed an intuition for new perspectives of research. The final qualifications of this Master's programme contribute to the start of that process.

Application of knowledge is trained during the theoretical courses. Examples are Theme-related courses "Metabolism, transport and motion" and "Infection, immunity and tissue repair", in which students are requested to write a research proposal based on knowledge extracted from articles. In addition, during the Theme 3 course "Cell growth and differentiation", the students are involved in a hands-on bioinformatics mini-project. The experience gained in this project is valuable for the following research training periods. Research skills formulated above are introduced in the theoretical courses and further developed during the research training periods. During the training periods, students are gradually trained to perform these processes independently.

Making judgements
Part of the research skills practiced during the Master's is the ability to make judgements both concerning scientific content and societal impact of research. To introduce students to the societal impact of scientific research, they are exposed to ethical issues during the course "Science and society". Students are invited to reflect on the impact of their own research and handle accordingly. Making judgements concerning the scientific content of a research project is trained in each component of the programme: students are taught to critically assess all research data they are exposed to, either during a scientific presentation or in writing.

Communication
A successful researcher should have many talents, some of which concern communication skills. At the end of the programme, the student is skilled in participating in scientific discussions, contributing to his/her scientific specialisation and presenting (orally and in publications) at an international level. Communication aspects of the research work are seen as vital for a successful career and so are substantially incorporated in the Master's curriculum. A researcher is successful in communication when he/she can convince the audience of his/her expertise, clarity, rational and systematic approach. This is the focus of communication training and skills development activities of the programme. Students qualifying for this MSc Molecular Mechanisms of Disease will have acquired this communicative attitude.

Communication skills are trained during almost all phases of the Master's programme. In the introductory courses to the programme, the course Excellence in Communication teaches students how to give excellent scientific presentations and how to be involved in scientific discussions. These skills are further developed during the theoretical courses, where giving oral presentations and participating in scientific discussions are essential parts of the course content. Finally, communication skills are crucial during the research training periods, where plans and results are discussed with fellow researchers in and outside the workgroup. Students must write their second research training period report in the form of scientific publication.

Learning skills
Students will have acquired enough knowledge and skills to embark on research projects related to molecular mechanisms of diseases. Students will also be able to swiftly acquire insight into scientific fields that are not part of his/her specialisation. The problem-orientated curriculum of this Master's programme also appeals to the development of cognitive skills of the student. In the reflective periods and in the dialogue with peers and/or researchers, the student is trained to analyse, summarise, combine, rationalise, deduce, conclude etc. This enables the MSc student to formulate judgements based on supplied information (data) after graduation at the end of the two-year period. Apart from cognitive learning skills, students also develop self-reflection skills. These skills, including assessment of his/her own learning skills, are specifically discussed during the scheduled or unscheduled meetings with the student's personal mentor or with the research training period supervisor.

Relation between the MSc programme and NCMLS research
NCMLS research and education in the MSc Molecular Mechanisms of Disease are intertwined: both are organised along the three research themes:
- Theme 1: Infection, Immunity and Tissue Repair
- Theme 2: Metabolism, Transport and Motion
- Theme 3: Cell Growth and Differentiation

This organisation emphasises the link between research and education. Principal Investigators teach about and involve students in their research topics, in which they are regarded as experts. In this way students get acquainted with ground-breaking developments in the field of molecular life sciences. **Appendix F** lists the NCMLS PI's and jPI's and their NCMLS research theme.

Translational aspects of the MSc programme
A key feature of the programme is the relationship between fundamental research and clinical applications. The location of the programme within the Radboud University Nijmegen Medical Centre is of major importance to achieve this intended learning outcome. Moreover, about half of the students choose to perform the NCMLS research training period in the group of a PI who is clinically oriented. Clinical orientation of the PI's is obvious from their involvement in clinical research institutes (**Appendix F**).

International research training periods:
Since the Master's programme Molecular Mechanisms of Disease puts much emphasis on international competences, students who have completed prior education in The Netherlands are required to take their second research training period abroad (exceptions are possible because of personal circumstances). Indeed, almost all students, including students of other nationalities, take the chance to go abroad or widen their view in another Dutch research institute.

As part of their international experience, the research training periods are arranged by the students themselves. Contacts are generally established via NCMLS researchers, who will only send students to well-established labs with good training facilities. Moreover, students write a research workplan that is assessed by the Board of Examiners. Only workplans and host labs of sufficient quality will be approved. Part of the research training period assessment is the Master thesis, which is written as a scientific article. The Master thesis is assessed by an NCMLS scientist ("external assessor"), who has enough expertise to judge the scientific article produced by the student. The external assessor has a major role in assessing the quality of the international research training period and in grading the work done by the student. It is interesting to note that, almost without exception, MMD students receive an excellent evaluation by the external host institutions they perform their research training periods at (**Appendix S**).

Since international research training periods are more expensive than staying in the Netherlands, students arrange the financial means for their stay abroad by applying for several types of funding. When they apply, students are generally awarded a SNUF scholarship and a student budget of the Faculty of Medical Sciences. Other external funds that are often obtained by the students are Erasmus exchange, KWF Kankerbestrijding, Dutch Kidney Foundation, Huygens Scholarship Programme, Reuma Research etc. Wherever possible, students are supported in the application to the scholarship programmes by the mediating PI, mentor, UMC International Office and the programme coordinator.

Internationalisation
During the curriculum, MMD students are made familiar with the international scientific variety in the field of molecular mechanisms of disease. In practice, MMD students not only discuss the newest research developments with international top researchers (e.g. in masterclasses and NCMLS seminars), but they also obtain insights into critical factors to develop into successful independent researchers. More specifically, MMD graduates have built up an international scientific network independently, mostly during their international research training period, and maintain this international network after graduation. They are experienced in working in an international team and have good communication skills in the English language. MMD graduates are focussed on a high-quality research career without borders. Learning outcomes about internationalisation are addressed 1) during the exit interviews, and 2) in the yearly report of the Academic Educational Institute. In short, graduates manage to work in an international team, experiencing and benefiting from differences in cultural and scientific background. After

the programme, they have built up an international research network. The high number of MMD graduates who started their PhD in an international lab provides evidence of this achieved learning outcome (43%, see paragraph 3.6.1).

3.2.3 Consistency of the curriculum

Criterion: The contents of the curriculum are internally consistent.

The Master's programme offers a sound balance of theory and practice. During the first 4.5 months of the curriculum, students from different backgrounds acquire state-of-the-art knowledge of molecular cell biology and the methodology of scientific research. Students get acquainted with the newest developments in specific subjects during all courses, but in particular during the masterclasses. The acquired knowledge is then applied in practice during the first research training period. The second year is almost entirely focused on developing the specific scientific interests of each student. Both during the (theoretical) elective courses and the second research training period, students follow an individual programme that fits their matured research interest. On top of that, 2nd year student participate in the third masterclass and enrol in a course that highlights genomics and statistics. Whenever possible, the statistics course in the second year uses research data from the first research training period to motivate students to apply the acquired knowledge to their own projects. The knowledge of genomics and statistics is further exploited during the second and final laboratory research period.

The two research training periods train students in the research skills that are needed to become a successful researcher. The first research training period, which is closely supervised by an NCMLS group leader (PI or jPI), trains students in many research skills: research design, practical (laboratory) research, analysis and reporting. The second research training period, which is often performed in an international laboratory, deepens research skills and teaches students to be more independent. The international location contributes to the international orientation of the students: students need to be self-supporting and start building up their international research network. Students consider both research training periods very educative and essential to incorporate the knowledge offered in the theoretical courses.

The quality of the programme of individual students is safeguarded by the Board of Examiners, which must approve each of the individual components before the students embark on it. This system of approval before the courses start ensures that each student has a Master's programme of good quality and has sufficient coverage of the whole field of molecular life sciences. It also prevents students from following courses that are not considered useful.

During the programme, students gradually become more independent, which is reflected in the teaching methods. Whereas during the first theoretical courses students receive more guidance when making an assignment (such as: write a research proposal), student groups work more independently in later courses. During the theoretical courses, students often perform assignments in small groups (2-4 students). Later in the curriculum, during the research training periods, students act independently. This build-up in the curriculum means that contact between students and teachers/supervisors changes from class-teacher contact to group-mentor contact to student-supervisor contact.

3.2.4 Workload

Criterion: The intended curriculum can be successfully completed within the set time, as certain programme-related factors that may be an impediment to study progress are eliminated where possible.

Most of the students are able to complete the entire programme within the allocated two years (85.7% of all graduates). The students that did not graduate within 2 years did so with only slight delay (the remaining 14.3% graduated within a total of 2 years and 3 months). Due to the fact that obligatory courses are scheduled within the first half of the academic year, students with missing components are able to catch up quickly.

The study load of courses in the MMD programme is evaluated and monitored in several ways, including a standard evaluation protocol that goes with the examination (**Appendix Q**). After a course has ended, participating students are asked to assess the study load and other properties in course assessments. These course assessments are then discussed by the MMD programme committee, so that unbalanced study loads can be detected. For example, the curriculum was changed in 2008 to adjust the study load. More ECs were allocated for courses and students were given more time for self study in preparation for exams. Furthermore, students have regular meetings with their personal mentor, in which learning process, scientific interest and workload are discussed.

The general impression arises that the students perceive the MMD programme in the first half year as very intensive. The average self-reported study load of students in the academic year 2007-2008 was 'Very high' (4 on a scale of 1-5). Especially Core Fundamental courses, in which students often have to write and present a project, and at the same time prepare themselves for a written exam, are judged as challenging. These courses reflect the reality of the scientific world, in which researchers must come up with creative ideas under considerable time pressure. Despite the high workload, students have indicated in course evaluations and exit interviews that they also judge these components as most worthwhile, where they develop and deepen their scientific skills.

The perceived high study load is particularly the case for international students, since they have to bridge cultural and educational differences. Nonetheless, this is accounted for in the selection process that ensures students have the capacity and capability to rise to the challenge. From 2005-2009 only one student decided to quit, which was because of family circumstances.

Before students commence with a research training period, a workplan is written by the student and approved by a PI within the NCMLS and the Board of Examiners. This workplan, a representative example of which is given in **Appendix G**, contains a detailed description of the work the student will carry out during the research training period, and as such functions as a safeguard against excessive workloads. During training periods students always have the opportunity to contact their mentors to discuss progress, developments and workload. Most students decide to follow additional theoretical courses alongside their first research training period. The students that have conducted the second research training period abroad indicate it takes time and effort to adjust to their new environment, but that the experience is very worthwhile.

In conclusion, the programme is designed to be ambitious and intensive, but "doable" for talented and motivated students (see **Table 11**). During the programme, students are trained to work hard and deal with time pressure and large amounts of data. The high success rate and almost nominal time of study indicate that the selection procedure and the curriculum are well balanced.

3.2.5 Admission requirements

Criteria:

- *The structure and contents of the intended curriculum are in line with the qualifications of the incoming students:*
- *Master's programme (academic orientation): bachelor's degree and possibly (content-based) selection.*

Admission requirements are laid down in the Education and Examination Regulations (OER), which is found in **Appendix H**.

The MMD Master's programme aims to enrol very talented students (best 10% of the BSc students). The selection procedure to select students with a high potential was established at the start of the Master's programme and has undergone only minor adjustments since (**Appendix I**). Briefly, the selection procedure is as follows:
Based on documents provided, students may be invited for a selection interview (criteria in **Table 4**). Different documents are requested from students with a Dutch BSc degree or an international BSc degree (as indicated in the complete procedure in **Appendix I**). The reason for this is that the high standard of the Dutch BSc graduates is easily recognised, but the variety in international education systems and BSc degrees is enormous. Each application is assessed conscientiously by the coordinator of the Selection Committee for its suitability for the programme.

Table 4: Criteria for a selection interview.

	Candidates with requirement Dutch BSc	*Candidates with requirement international BSc*
BSc Results	Dutch: mean > 7.5	Top 10% of class
English proficiency (both written and spoken)	Dutch BSc is sufficient proof of English proficiency	International test (absolutely minimum): IELTS > 6.5 (preferably >7.0) TOEFL pBT > 550 (preferably > 600) TOEFL iBT > 80 (preferably > 100) TOEFL cBT > 213 (preferably > 250) Native English students do not need to submit test results.
Motivation	Assessed by motivation letter	Assessed by motivation letter
References	Not needed for students from Radboud University Nijmegen BSc at other university: minimum best 20% of students	2 references needed; minimum best 10% of students indicated

Interviews are held in English by at least two members of the Selection Committee. The following points are evaluated during the interview:
- Whether the application (curriculum vitae, motivation etc.) is as stated,
- The knowledge level of the candidate
- Whether the applicant can think and solve problems, and is able to grasp new contents quickly
- Whether the candidate is eager to discuss
- Whether the candidate is able to comprehend questions
- Whether the candidate communicates well
- The applicant's long-term goals and ambitions, including a self-evaluation (SWOT analysis)
- A glimpse of the personality of the applicant, e.g. to assess cultural differences
- Explicit points from the application that need further clarification

- Knowledge deficiencies that need attention before the start of the programme

The interviewers assess whether the student has potential to become a top scientist and whether the basis is sufficient to successfully complete the Master's programme. During the past 5 years, the Selection Committee has gained experience in the selection procedure. The start qualifications and interview results of the admitted candidates are summarised in **Table 5** (details in **Appendix J**). Due to the different grading systems used over the world, students have been divided into groups with a Dutch BSc and an international BSc. It is important to note that selection of students with a Dutch BSc takes place before they have finished their bachelor's research internship.

Minimum scores for language tests required for international students are listed in the OER and reflect the minimum language requirements set by Radboud University Nijmegen. Radboud University language requirements tend to be lower than the high standards set by the MMD programme (indicated in **Table 5**). However, students who just fail to reach the MMD standards, but perform well in the interview, can be admitted.

If candidates are assessed in the interview as being promising, but having deficiencies in knowledge and/or language skills, they have the possibility to apply again later. In most cases, students will need at least one year to upgrade their scientific knowledge or English proficiency, but in specific cases, they may be re-invited to an interview two months later. Furthermore, in case of observed deficiencies, admitted candidates are given to catch up on specific knowledge before the start of the programme. During this self study, they have the opportunity to contact assigned teachers of the programme for support. Finally, part of the introduction course is aimed at recapitulating knowledge obtained during the bachelor's programme.

Table 5: Selection scores for students who have joined the programme

	Students with Dutch BSc (n=29)	*Students with international BSc (n=19)*
Mean BSc results	8.0±0.5 (median=8.0)	Different scoring systems; cGPA (n=5): 3.3±0.2 (median 3.4) [scale 1-4]
Grade BSc internship	8.3±0.5 (median=8.5)	Not applicable
English proficiency	Not applicable	Different scoring systems; TOEFL iBT (n=7) 101±4 (median 102) [scale 0-120] TOEFL pBT (n=3) 597±47 (median 580) [scale 0-677]
Overall interview result	7.9±0.7 (median=8)	7.9±0.6 (median=8) [scale 1-10]

Despite the strict selection criteria, a large diversity still exists within the group of students, which is related to their various scientific, cultural, and religious backgrounds. This diversity enables the students to develop a wider perspective, both in their study and later careers, but also in their personal development. The restructured Introduction Course (8IC01), which comes into action in September 2010, addresses these differences and eases the workload for students to reach the same standards within a short time-frame. Deeper knowledge about certain areas that have not been addressed during the (international) Bachelor's programme (e.g. bioinformatics) can be gained in the elective modules students can choose. In all cases, students can benefit from each other's knowledge and experience which was gained during the diverse Bachelor's programmes.

3.2.6 Duration

Criteria:

- *The research master's programme meets the legal requirements regarding the range of credits:*
- *Research master's programme (academic orientation): 120 credits.*

The Master of Science programme in Molecular Mechanisms of Disease is a two-year, 120 EC, research Master's programme. One EC of the European Credit Transfer System equals 28 hours of study. The Master's programme is only taught full-time. The content of the programme can be found in **Table 2**.

3.2.7 Coherence of structure and contents

Criteria:

- *The educational concept is in line with the aims and objectives.*
- *The study methods correspond with this educational concept.*

The educational concept, study and teaching methods are designed to achieve the major aims of the programme. In the broadest sense, these aims include acquisition of research skills (theoretical and practical), conception of enquiry-based science projects, communication skills (oral and writing), being part of an (international) science community, and responsibility towards society. To give students the best education possible to become an excellent researcher in the field of molecular life sciences, students are immersed in the scientific atmosphere of the NCMLS from the first day onwards. Not only are students introduced to almost all research subject at the NCMLS during the theoretical courses, they are also regarded as junior scientists and are encouraged to attend NCMLS symposia, seminars and workshops as part of the elective course "Knowledge Transfer".

The educational formats that are used to achieve the aims of the programme are centered around five instructional formats: fundamental theory lectures, technical discussion or demonstration, enquiry-based science projects, communication skills training and the research training period (**Appendix K**). In this context, knowledge is seen as a precondition for integration into the research environment and for a research career. Students acquire knowledge whilst being engaged in the educational activities that range from passive knowledge transfer to active knowledge absorption and insight gained in problem-solving projects, during the research training periods and thesis writing. Problem-solving being a main aspect of the research work, the curriculum is characterised as a problem-oriented curriculum. The first research training period is particularly important for achieving the main aim of the programme, as students learn how to do research when working as an apprentice with an excellent researcher. The skills learnt during the courses and first research training period are fully exploited and further developed during the second, international training period, in which the students are expected be able to work (more) independently. Furthermore, the second training period teaches students to build up an international network and arrange formalities (which are an integral part of modern science) independently. During the two years of the programme, the student builds up a level of independency by being able to solve more complex problems with increased autonomy over time. In the presentation of problem oriented tasks, project control gradually moves from teachers to the student.

Table 6: Study methods used in MMD courses.
Descriptions of these methods are found in **Appendix K**

Code	Course	Fundamental theory	Technical discussion	Enquiry-based	Communication skills	Research training
8IC01	Introduction course	x	x			
8C01	Excellence in Communication			x	x	
8SE01	Science & Society	x		x	x	
8T01	Infection, Immunity and Tissue Repair	x	x	x	x	
8T02	Metabolism, Transport and Motion	x	x	x	x	
8T03	Cell Growth and Differentiation	x	x	x	x	
8MC02	Masterclass Theme 2	x	x	x	x	
8MC03	Masterclass Theme 3	x	x	x	x	
8P01	Research & write up: year 1				x	x
	Electives: year 1 [a]	x				
8MC01	Masterclass Theme 1	x	x	x	x	
8ST01	Genomics and Statistics	x	x	x		
8P02	Research & write up: year 2				x	x
	Electives: year 2 [a]	x				

a) Electives can be different in nature. In almost all cases they contain fundamental theory lectures, but all teaching forms may be used.

Table 6 indicates the instructional formats used during the programme components. The components are scheduled sequentially and skills and knowledge gained during one module can be used in the next module. In this way, students are gradually encouraged to perform their tasks more and more independently, culminating in the second research training period. During this training period, students are generally performing their research independently within the research workgroup. International supervisors are often impressed at the independency and scientific maturity of MMD Master's students, which is not only on the level of their PhD students, but occasionally at the level of their postdoctoral researchers.

3.2.8 Learning assessment

Criterion: By means of evaluations, tests and examinations the students are assessed in an adequate way to determine whether they have achieved the intended learning outcomes of the programme or parts thereof.

The students are assessed in different ways depending on the course type.

Written exams (essay questions) are organised at the end of the compulsory core fundamental modules, translational research modules, and Genomics & Statistics course (**Table 2**) and may also be used to assess elective modules. The essay questions are developed by the lecturers of the relevant courses and screened by expert colleagues. Essay questions enable students to test and apply their knowledge and understanding to solve problems described in a different topic or context as those provided in the lectures. A few sample essay questions from a number of courses are given in **Appendix L.**

The students in most of the compulsory courses receive **assignments**, which they carry out either individually or in small groups. Based on their knowledge and understanding, assignments stimulate the creativity of the students, train them to judge established theories, critically analyse problems, and formulate new questions and hypotheses in the field of molecular life sciences. Assignments carried out in small groups stimulate discussion of ideas and train management skills such as decision making and delegation of tasks.

Starting with an intense training in communicative skills (Excellence in Communication in week 3), students present the results of their assignments and summarise scientific papers in oral **presentations** throughout their curriculum. In the masterclasses, they present seminal papers of top researchers in their presence. In this way they learn to communicate in an unrestrictive way at a high level. Students also present the results of their research training period in the respective departments. These presentations represent part of the final grading. In **Appendix M** we provide the template that is used to evaluate the students' presentations, and which is available through Blackboard, the digital learning environment.

The **practical skills** are assessed at the end of each of the two research training periods. In the last part of the first training period, and in their second training period, the students apply their learning skills, as they should be able to choose their own research direction based on their application of knowledge and understanding. The grading of the research training periods is based on the assessment of the research skills, the quality of the report and the oral presentation. In **Appendix M,** we provide the assessment form which is used to grade the students and is available through Blackboard. Each research training period is supervised by an experienced researcher. Apart from the research training period supervisor, a 2nd assessor is assigned to each student for each training period. The 2nd assessor independently grades the report or thesis and, after consulting with the research training period supervisor, establishes the final grade for the research training period. We provide detailed guidelines for research training period supervisors (**Appendix N**) that outline the responsibilities and tasks of the supervisors and students.

The product of the 2nd research training period, the thesis, should be written in the form of a publication that in principle can be submitted to a peer-reviewed journal. In many cases the thesis may not cover all the results of the students' research training period or the thesis format may not be suitable to communicate the results of the training period to the supervisor(s). In those cases the student writes supplemental materials or provides a separate report that covers the remaining data.

Students are informed about the relative weight of the presentations, paper assignments, practical assessments, reports and final written examination at the beginning of the courses.

Assessment guidelines, protocols and forms are developed by the Education Management Team. The Board of Examiners plays an active role in securing the quality of the assessments by checking the assessment protocols. As indicated in the Education and Examination Regulations, only the Board of Examiners can decide whether a student is allowed to take another type of assessment (for example oral examination).

The educational aims of each course are clearly stated for each course in course descriptions that can be found in the prospectus. For convenience, the course descriptions are also published in **Appendix C**.

Table 7: Overview of the various forms of assessments in the curriculum

Course code	Course name	Assessments			
		Essay questions	**Assignments**	**Presentations**	**Practical skills**
8IC01	Introduction course		x[a]	x[a]	
8C01	Excellence in Communication		x	x	
8SE01	Science & Society		x	x	
8T01-a	Infection, Immunity and Tissue Repair; module core fundamental	x	x	x	
8T01-b	Infection, Immunity and Tissue Repair; module translational research	x			
8T02-a	Metabolism, Transport and Motion; module core fundamental	x	x	x	
8T02-b	Metabolism, Transport and Motion; module translational research	x			
8T03-a	Cell Growth and Differentiation; module core fundamental	x	x	x	[b]x
8T03-b	Cell Growth and Differentiation; module translational research	x			
8MC02	Masterclass Theme 2		x	x	
8MC03	Masterclass Theme 3		x	x	
8P01	Research & write up: year 1			x	x
	Electives: year 1 [a]	(x)			(x)
8MC01	Masterclass Theme 1		x	x	
8ST01	Genomics and Statistics	x	x	x	
8P02	Research & write up: year 2			x	x
	Electives: year 2 [c]	(x)			(x)

[a]Assignments and presentations are included in the revisited Introduction Course that will take place for the first time in 2010.
[b]Hands-on bioinformatics project.

As outlined in the MSc MMD Education and Examination Regulations (**Appendix H**), students are allowed one retake per year for written examinations. The retake grade will be the final mark. However, since the academic year 2008-2009, the judicia at graduation (bene meritum, cum laude, summa cum laude) are only based on the initial exam results, not on the results of retakes.

Within the NCMLS, much effort is paid to facilitate talented individuals to fully develop their potentials. In 2007, the first two MMD graduates successfully applied for NWO TOPtalent fellowships, which enabled them to perform PhD studies in their favourite topics. Since this programme ended in 2008, we have developed a similar **individual career development programme** (financed by the RUNMC), in which the best MMD students write their own PhD proposal (in VENI format) and an independent committee reviews and ranks the PhD proposals. Through this elective component, students can show their knowledge and understanding of a given topic and the application of this knowledge and understanding. By formulating their own research questions and objectives, they have to make a critical judgement of the current status of knowledge. In presenting their research proposal before a review committee, they must communicate and discuss their ideas in the best possible way. Finally, they can adapt their

research proposal based on the reviewers' comments and display their flexibility and learning skills in the brief period (5 weeks) between project submission, rebuttal and oral presentation.

Together, the assessments described above test all the Dublin Descriptors that are listed in **Table 1**. Knowledge and understanding (Dublin Descriptor 1) is tested in the written exams, in the assignments, and in the PhD project descriptions. Applying knowledge and understanding (Dublin Descriptor 2) is tested in the written exams, reflected in the choices for research training periods of the students, and in the PhD project descriptions. Making judgements (Dublin Descriptor 3) is tested in the assignments and, for a limited number of students, in the formulation of the PhD research projects. Communication (Dublin Descriptor 4) is tested in the presentations during the Excellence and Communication module, in the interaction between students when they work on joint assignments, and when the students defend their research proposals (core fundamentals and PhD project). Finally, Learning Skills (Dublin Descriptor 5) are tested in both research training periods and in the PhD proposal procedure.

3.3 Staff commitment

3.3.1 Requirements for academic orientation

Criteria: The programme meets the following criteria for the deployment of staff for a programme with an academic orientation (WO):

- *Academic higher education: Teaching is principally provided by researchers who contribute to the development of the subject/discipline.*

The Molecular Mechanisms of Disease Master's programme is part of the Graduate School of the Nijmegen Centre for Molecular Life Sciences. The link with the successful research institute allows us to offer the students the following:
- knowledge and research of world-quality
- state-of-the-art research equipment (that can also be used by students)
- excellent individual researchers who can educate students in the art

The NCMLS Graduate School is well established and conducts excellent research and teaching as can be appreciated from the summary of awarded research grants (below), the results of the 2005 external SEP evaluation (**Appendix E**) and the short curriculum vitae of a selection of the Graduate School's members/MMD teaching staff (**Appendix O**).

In recent years, significant energy has been invested into the external profile of NCMLS which has been boosted by the awarding of NCMLS director Prof. dr. Carl Figdor with the coveted **Spinoza prize** (2006), and the awarding of Prof. dr. Jan Smeitink with the **Princess Beatrix prize** (2006). Between 2002 and 2009, subsidy successes for **Rubicon** (5), **Veni** (23), **Vidi** (17), **Vici** (4), **MEERVOUD** (2) & **Aspasia** (3), **EURYI** (1) and **TOP** (4) together with coordinator roles in EU programmes, such as **FP6** (5) and **FP7** (6) integrated/collaborative projects, are adding to national recognition and demonstrate that the NCMLS has the human resources to perform top research and education. Furthermore, co-ordinator subsidies, such as the **European Training Network / Marie Curie Actions** (3), demonstrate a stimulating research environment for students' training within high quality collaborative European projects. A list of European subsidies and large-scale collaborations is provided in **Appendix P**.

The recognition of individual researchers/teachers with international awards is of great importance to the NCMLS in achieving greater international recognition and of course serves as a measure of the quality of the education given & research performed. In 2009, particular highlights included the awarding of prof. René Bindels (Dept. Physiology), an important teacher within one of the core modules and advisor of the programme, with the Carl W. Gottschalk 2009 Distinguished Lecturer of the American Physiological Society Renal Section, the Robert Franklin Pitts Lecturer 2009 from the International Union of Physiological Sciences (IUPS) and the Homer W. Smith 2009 award from the American Society of Nephrology. The Academia Europaea is an organisation of scientists and scholars who collectively aim to promote learning, education and research, to which prof. Bindels was elected in 2005. Furthermore, Joost Hoenderop was selected as Young Academy 2009 member of KNAW, Roos Masereeuw was awarded the 2009 DPS Schering-Plough Pharmacology Prize, demonstrating the achievements and qualities of academic staff involved in the MMD programme. More information about the achievements of individual researchers who are involved in the organisation and teaching of the programme can be found in **Appendix O**.

The international recognition of the research institute is also shown by the reputation of the annual **'New Frontiers' Symposia.** In the last three years **two Nobel prize winners** (Prof. dr. Peter Agre in 2007, Prof. dr. Aaron Ciechanover in 2008) have given key-note lectures at the 'New Frontiers' symposia with a third Nobel prize winner (Prof. dr. John Walker) invited (and accepted) for the 2010 New Frontiers symposium (www.ncmls.eu/newfrontiers). Moreover, in

2009, the symposium attracted ~50% attendance (out of 430 registrants) from abroad, also highlighting the quality and the increasing visibility of the NCMLS as a centre of excellence. Master's students also participate in the symposia and in this way benefit from the excellent international scientific environment.

Staff members may be affiliated with other local research institutes, for example Institute for Genetic and Metabolic Disorders/Disease [IGMD], Nijmegen Institute for Infection, Inflammation and Immunity [N4i], Research Institute for Oncology [RUCO], the Donders Institute for Brain, Cognition and Behaviour [DI-BCB]), the Institute for Molecules and Materials [IMM]), and the Centre for Society and Genomics (CSG). RUNMC staff members belong to a maximum of two institutes.

Important publications and short *curricula vitae* of course coordinators, members of the Educational Management Team, chair people of MMD committees and other people important for the programme are found in **Appendix O**.

3.3.2 Quantity of staff

Criterion: Sufficient capacity is made available to realise the programme with the desired level of quality.

The MSc Molecular Mechanisms of Disease programme is a two-year research Master's programme of 120 EC, representing a total study load of 3.360 hours. The total teaching workload for the theoretical modules amounts to approximately 1450 hours in 2008, or the equivalent of 0.85 Faculty FTE (**Table 8**). In 2009, a new course "Genomics and Statistics" was carried out for the first time, increasing the number of FTE in theoretical courses to 1.06. On top of that, students are carefully supervised during their research training periods. It is estimated that each student receives (at least) 5 hours of supervision per week, leading to 134 hours (=0.08 FTE) per student for the first training period. As the second training period is generally abroad, the supervision is not considered in this calculation, except for the students who perform their second research training period within the NCMLS. Coaching students in finding an international research training placement and assessing the thesis is included in the calculation.

For specific teaching modules, for example in masterclasses or translational research components, external speakers are invited to teach the students. Many of the external speakers come from abroad and are internationally recognised to be the research leaders of the field. They are however not included in the figures below.

Table 8: Annual teaching capacity and staff-student ratio.

Year	Fte's theoretical courses	Fte's research training periods & mentorship	Total fte's	Number of students	Students / fte
2007	0.64	1.07	1.71	19	11.1
2008	0.85	0.99	1.84	21	11.4
2009	1.06	1.59	2.65	27	10.2

Staff
At the moment, 125 staff members take part in the programme. **Appendix O** lists the curriculum vitae of coordinators and recent publications of other important teachers.

Chair
Prof. dr. Frans Cremers, programme director, chair Education Management Team
Prof. dr. Joost Schalkwijk, chair Programme Committee
Dr. Roos Masereeuw, chair Board of Examiners
Dr. Frank van Kuppeveld, Theme 1 representative Education Management Team
Prof. dr. Martijn Huynen, Theme 2 representative Education Management Team
Dr. Wiljan Hendriks, Theme 3 representative Education Management Team

Course coordinators

Table 9: Coordinators and vice-coordinators of MMD courses in the academic year 2009-2010. Coordinators of masterclasses are different each year.

Course code	Course name	Course coordinator	Vice-course coordinator
8IC01	Introduction course	Wilbert Boelens	Colin Logie
8C01	Excellence in Communication	Carl Figdor	Dagmar Eleveld
8SE01	Science & Society	Annemiek Nelis	Bart Penders
8T01	Infection, Immunity and Tissue Repair	Frank van Kuppeveld	Gosse Adema
8T02	Metabolism, Transport and Motion	Martijn Huynen	Bé Wieringa
8T03	Cell Growth and Differentiation	Wiljan Hendriks	Ad Geurts van Kessel
8MC02	Masterclass Theme 2: TRP Channels	Joost Hoenderop	René Bindels
8MC03	Masterclass Theme 3: Cancer Genomics	Roland Kuiper	
8P01	Research & write up: year 1		
	Electives: year 1		
8MC01	Masterclass Theme 1: Pattern Recognition Receptors	Frank van Kuppeveld	Gosse Adema
8ST01	Genomics and Statistics	Ton Feuth	Joris Veltman
8P02	Research & write up: year 2		
	Electives: year 2		

3.3.3 Quality of staff

Criterion: The staff that is to be deployed is sufficiently qualified to ensure that the aims and objectives regarding content, didactics and organisation of the programme are achieved.

The scientific and organisational qualities from our teaching staff can be deduced from the brief curriculum vitae (**Appendix O**) from the 20 staff members who contribute most to the teaching and organisation of the programme (e.g. member of educational management team, course coordination). The lecturers team consists of established scientists who have earned world-wide recognition through national and international awards and prizes for their contributions to science, their successful track records in acquiring research grants (e.g. see paragraph 3.3.1), and, most importantly, through their publications in high-ranking scientific journals. Collectively, these staff members in the 2004-2008 period published 41 publications with an impact score >10 and 65 other publications that are positioned in the top 5% of journals of subject category (From: RUNMC Research status report 2009).

The scientific quality of all NCMLS staff members has been evaluated in the Radboud University Nijmegen Medical Centre Principal Investigators' (PI) programme. In this programme, all researchers are being evaluated every three years. In this programme, talented young investigators and successful senior researchers were appointed junior PI's (jPI's) and PI's, respectively, based on the following criteria:

1. PI's and jPI's must **have international recognition as research leaders**, as evidenced by e.g. international awards and regular invitations for seminars.
2. PI's occupy crucial positions (first, second, one-before-last, or last author) in at least 2 (jPI) or 4 (PI) peer-reviewed publications with an **impact score >8** in the last 5 years. Papers in the top 5 of subject categories can compensate for small deficits.
3. PI's have acquired at least EUR 500,000 (jPI) or EUR 1,000,000 (PI) of funding in peer-reviewed and often highly competitive research programmes (so-called 2nd and 3rd 'geldstroom') over a period of the last 5 years. In case PI's are joined project leaders, they divide the obtained funding for their PI application.

Appendix F lists the (j)PI's involved in the MSc MMD programme.

To guarantee excellent supervision during the NCMLS-based research training periods, an MMD student can only perform the first research training period at the NCMLS in the group of a (junior)Principal Investigator. Although the daily supervision may be performed by an early-stage researcher (PhD student or PostDoc), the (j)PI is responsible for the proper tutoring of the MSc MMD students. The second research training period, which is abroad for all MMD students that have obtained their BSc in the Netherlands, must also be supervised by an experienced senior scientist. NCMLS (j)PI's facilitate the students' search for a renowned research lab in which a high quality of supervision is guaranteed. Assessment of the research training periods is always done by an external assessor, who is (j)PI as well.

The **teaching qualities** of the MSc MMD staff can be measured based on a novel teaching staff development programme that was introduced in the Radboud University Nijmegen Medical Centre in 2005. In this programme, teachers can obtain teaching qualifications which reflect their experience on specific areas of the biomedical training (description in **Appendix Q**). Courses and personal coaching can help to further develop their teaching capabilities and obtain higher teaching qualifications. Teaching qualifications of PI's and jPI's of the MSc MMD staff in the areas of theoretical teaching and supervision of research training periods are listed in **Appendix F** and **Appendix O**.

The quality of the didactical skills of the MMD lecturers is also monitored by the:

- Curriculum vitae of course coordinators
- Annual evaluation talks ('jaargesprekken') between the lecturer and their supervisors
- Online course evaluations by students in which lecturers are individually assessed
- Programme Committee

The MSc MMD programme is fully taught in English and it is of utmost importance that our lecturers are **proficient in written and spoken English**. Since virtually all MSc MMD teachers perform their research in international networks, their level of English generally is very good. Still, to test their skills, all MSc MMD teachers in the 2009-2010 curriculum year are requested to take the so-called Quick Placement Test. Teachers are only exempted from this test if they have studied or worked for at least 2 years at an international university in which English is the Language of conversation. Lecturers scoring 79 points (out of 100) or lower in the Quick Placement Test are required to follow an English course in the next 2 years. Also lecturers who score higher than 79 points are given the opportunity to participate in the courses. English courses are taught by the University language centre (Radboud in'to Languages) and prepare participants to obtain the Cambridge Certificate in Advanced English or Cambridge Certificate of Proficiency in English.

3.4 Services

3.4.1 Facilities

Criterion: Housing and facilities are adequate to realise the programme.

The maximum number of students in this programme is 24 students per year. Facilities and human resources are sufficient to guarantee optimal training for this number of students.

Education facilities
Education facilities for theoretical courses are mostly housed in the Study Centre Medical Sciences. Within this building, classrooms are available for small-scale education, as implemented in this programme. Classrooms may be used for fundamental theory lectures, technical discussions and demonstrations, enquiry based science projects and communication skills trainings. Some of these instructional formats also make use of the NCMLS facilities. For example, communication skills training is often performed in the seminar room that is generally used by the NCMLS members.

Research facilities
Research training periods take place within the NCMLS departments and make use of all state-of-the-art equipment that is available in the research centre. The research facilities within the NCMLS, such as proteomics, genomics, translational and animal research facilities, are good to excellent and well-organised. Some facilities such as those for imaging and next generation sequencing are world-leading. Students who need these facilities for their research training period have full access to this equipment. Also the labs at which students perform their international research training period are well-equipped. The Board of Examiners evaluates the students' workplans to ensure that the research training period is educational and at a high level.

Computer and information facilities
Students have access to computer facilities is the Faculty of Medical Sciences and at the NCMLS. Furthermore, a wireless network is available at the Study Centre Medical Sciences. Courses and communication is facilitated by the use of the digital learning environment Blackboard (admission to Blackboard available on request). Through the Radboud University libraries, students have access to a very wide range of online journals, as well as textbooks.

Facilities promoting internationalisation
Both incoming and outgoing internationalisation is promoted in this Master's programme:
Incoming:
International candidates receive ample guidance in their application for visa and scholarships, as well as in practical matters such as finding accommodation. These services are offered in a close collaboration of the Radboud University Nijmegen International Office, the UMC International Office and the programme. Scholarships can be obtained externally (such as Huygens Scholarship Programme or Netherlands Fellowship Programme), from Radboud University (such as Radboud Scholarship Programme), or from the Faculty (such as the Radboud University Nijmegen Medical Centre Study Fund). Especially during the first months of the programme, several meetings are organised to get the international students acquainted to The Netherlands. Specific student exchange programmes (both incoming and outgoing) are arranged with the IRUN partner universities in Glasgow and Münster. Furthermore, incoming teaching staff is well supported by the programme, for example during masterclasses.
Outgoing:
Students with a Dutch Bachelor's degree perform their second research training period abroad. Students organise this international experience themselves, but are supported by NCMLS scientists (in contacting host laboratories), by UMC International Office (in arranging visa and finances) and by the programme (in facilitating good communication and arrangements).

Other:
Both students and staff have the opportunity to follow language courses at reduced rates at Radboud in'to Languages. Teaching staff is motivated to obtain English certificates as part of Radboud University's language policy (see paragraph 3.3.3).

3.4.2 Tutoring

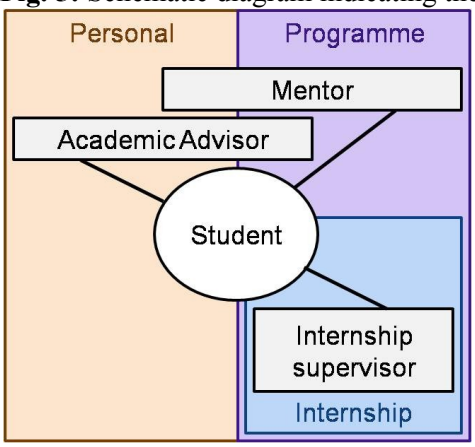
Criteria:

- *There is adequate staff capacity to provide tutoring as well as information provision for students, and these are adequate in view of study progress.*
- *Tutoring and information provision are geared to students' needs.*

Information provision
The small scale of the Master's programme facilitates good communication and monitoring of students' progress. Information about the programme and study progress is provided through a student portal (student web record), Blackboard, prospectus and personal communication. Students can easily contact the programme coordinator, who answers or redirects remaining questions adequately. Students are well informed about the NCMLS activities through weekly NCMLS emails, the NCMLS website and TV monitors in the research centre.

Tutoring
The Master's programme provides excellent tutoring facilities, which are particularly important for international student. The roles of mentor, research training period supervisor and academic advisor are discussed below.

Fig. 5: Schematic diagram indicating the interaction of an MMD student with his/her tutors.



The role of the Mentor
Right from the start, each student is assigned a mentor, who is a senior NCMLS scientist. The Mentor provides support and guidance to enable the student to carry out his/her learning process within the specified timeframe. The Mentor will monitor progress of the student with respect to his/her specific learning goals, ambitions, interests and results in the educational components and give feedback; he/she can advise the student regarding his/her choices for the elective subjects; he/she stimulates the student to reflect on his/her learning process and to improve him/herself. In particular, the mentor will act as mediator should conflicts arise during any phase of the programme. Individual reflection issues can be discussed and confidentiality will be maintained if requested by the student.

The role of the Research Training Period Supervisor
Research training period supervisors and daily supervisors play a major role in the development of the student's research skills. Research training period supervisors must be senior scientists (Principal Investigator or junior Principal Investigator), whereas daily supervision and lab introduction may be done by a PhD student or PostDoc. The Research training period supervisor

provides the means, both in material and intellectual support, to enable the student to carry out his/her research project. In particular, the supervisor arranges regular meetings to discuss progress. Also the supervisor will support the student, by giving feedback and asking the student to reflect, on his/her progress in achieving the end/final qualifications that are to be expressed in the written report or thesis.

The role of the Academic Advisor
The Academic Advisor helps students with or redirects students to experts in case of personal affairs. Furthermore, as part of UMC International Office, the Academic Advisor provides information about, help with and advice on matters concerning internationalisation, both to international students in The Netherlands, or to students (arranging research training periods) abroad.

The role of older student "mentors"
As international students may experience problems in adjusting to Dutch systems and culture, older students and alumni may guide new students during the first months of their study. Actually, prospective students receive contact details of selected current students when they have been admitted, which facilitates good preparation for the start of the programme.

Radboud University facilities
Radboud University Nijmegen provides excellent tutoring and counselling services to its students, including student psychologists, counsellors and advisors. Facilities are available both in English and Dutch.

3.5 Internal quality Assurance

The educational programmes of the Radboud University Nijmegen Medical Centre have an excellent standard of internal quality assurance. This internal quality assurance system is described in the 'Handbook for Quality Control of Education at Radboud University Nijmegen' (*Handboek Kwaliteitszorg Onderwijs Radboud Universiteit Nijmegen)*. In this handbook the scenario for internal quality assurance is presented.

In the Master's programme Molecular Mechanisms of Disease, all components of the programme are evaluated on a regular basis, both during and after the component, after which measures for improvement are formulated and implemented. The protocol for the programme's quality assurance of theoretical courses is included in **Appendix Q**. Evaluation and actions for improvement of the different components are discussed below.

The quality of the Master's programme is actively guarded and managed by the OMT. Initiatives for improvements to the programme may come from student evaluations (such as course evaluations, exit interviews or comments from the Programme Committee or Board of Examiners), but are in many cases adjustments driven by developments in the field that are observed by the OMT and the NCMLS management. Within the NCMLS, the outline of the programme may be discussed during NCMLS PI retreats, where many of the teaching staff are present. The close link between the NCMLS and the Master's programme is assured by regular attendance of the NCMLS Theme Leaders to the meetings of the Education Management Team.

3.5.1 Evaluation of output

Criterion: The programme is periodically evaluated, also in light of verifiable targets and objectives.

The Educational Management Team and the Programme Committee (see paragraph 3.5.2) keep a close watch on the evaluations described below, monitoring the proposed changes, and request further changes if needed. Based on the online evaluations, bottlenecks can be determined. The scores in the online evaluations must be at least 3 ("neutral"), but should preferably be 4 or more (good to very good).

Evaluation of theoretical courses

During course: Students are encouraged to evaluate theoretical courses while they are being taught. The course coordinator is available for feedback. This allows the course coordinator to make adjustments to the course to connect better to the student group involved.

After course: When the course has finished, students are asked for feedback in an online evaluation. Response rates are generally high for these evaluations, thus representing the students' opinion about the course well. Afterwards, an evaluation discussion is organised, in which two students evaluate the course in the presence of the course coordinator(s) and the programme coordinator. Points for improvement for the next year are discussed in the meeting.
An example evaluation report is provided in **Appendix Q**

Evaluation of research training periods

During training period: Students meet their research training period supervisors on a regular basis. In these meetings, progress and problems are discussed. There is also room to discuss the quality of the supervision if needed. Furthermore, mentor meetings are scheduled halfway both first and second research training period, in which progress and procedures are discussed. If problems arise during the training period, the mentor may have a mediating role.

After training period: Since academic year 2007-2008, research training periods are evaluated in an online evaluation.

General programme issues

During programme: Issues that are not directly related to a specific course or research training period may be evaluated during meetings of the Programme Committee or by personal communication to the programme coordinator.

After programme: Students who are about to graduate are invited for an exit interview, in which both general and specific programme issues are discussed.

3.5.2 Measures for improvement

Criterion: The outcomes of this evaluation form the basis of verifiable measures for improvement that contribute to the achievement of the targets and objectives.

The outcome of the evaluations and discussions is translated into suggestions for improvements, which the OMT implements accordingly.

Improvement of theoretical courses

During course: The course coordinator adjusts the course when regarded useful.

After course: Proposed changes are discussed during forum discussion. The course coordinator is responsible for implementation of these changes. Changes are monitored in the evaluation of the next version of the course.

Example: The module "Cell Growth and Differentiation" contains a bioinformatics project. Evaluation of the module indicated that because of the diversity in background of the students, not all students could optimally participate in the project. Major changes to the project were implemented in the academic year 2008-2009, providing a better introduction to the bioinformatics tools. Participation was increased without reducing the academic level of the course.

Improvement of research training periods

During training period: Because students discuss their research training period with their supervisor regularly, it is possible to implement changes to the content and supervision of the research training period directly.

After training period: In the evaluations, students can indicate whether the OMT should contact their research training period supervisors. At this stage, the OMT may give feedback to the supervisors and suggest changes in supervision procedures. Furthermore, through the evaluation the quality of organisational matters of the research training periods can be assessed. Points that are considered (rather) negatively are improved by the OMT.

Example: The first online evaluation of research training periods indicated that the guidelines for the report and thesis were not particularly clear. Guidelines have been improved and checked by a student.

General improvements to the programme

During:	Discussions in the Programme Committee indicated points for improvements in the programme. Suggested improvements were implemented by OMT when considered useful.
After:	During the exit interview, the programme as a whole is evaluated. This evaluation gives good indications for the most important points for improvement. The OMT is responsible to take measures concerning matters that come up in an exit interview.
Example:	Students recently indicated in a meeting of the Programme Committee that they would benefit from more (personal) feedback to their presentations during the courses (apart from the Excellence in Communication course). The OMT designed an oral presentation feedback form that can be used to give personal feedback to the students. Course coordinators were requested to provide feedback immediately. The OMT still needs to monitor the implementation of this feedback protocol closely.

3.5.3 Involvement of staff, students, alumni and the professional field

Criterion: Staff, students, alumni and the relevant professional field will be actively involved in the internal quality assurance system.

The quality of the Master's programme is closely guarded by several committees (see **Fig. 1**):

- Education Management Team (OMT) [**Appendix A.1**]. The OMT is responsible for daily and long-term management of the programme. On a regular basis, the OMT performs a SWOT (strength, weakness, opportunities, threats) analysis of the programme. It implements changes to the programme, suggestions for which generally come from the OMT itself or the NCMLS management, but may also be given by the Programme Committee or Board of Examiners. Suggestions for major changes to the programme are assessed by Programme Committee and Board of Examiners.
- Programme Committee [**Appendix A.2**]. The programme committee consists of students and teaching staff and has a role in guarding the quality of the programme, in particular concerning the Education and Examination Regulations. It provides solicited and unsolicited advice to OMT and other organisational bodies concerning educational matters. The programme committee is involved in the evaluation protocol as outlined above.
- Board of Examiners [**Appendix A.3**]. The Board of Examiners takes care of the quality of the individual Master's programmes by assessing the individual study plans. The Board of Examiners critically assesses the changes suggested by OMT concerning programme and procedures.
- Selection Committee [**Appendix A.4**]: The Selection Committee conducts the selection of new students. In this way, it takes care of the quality of the candidates. As indicated in paragraph 3.2.5, the selection procedure is done carefully and adequately.

Apart from these formal committees, the NCMLS Director and Theme Leaders assess the programme regularly. These members from the scientific field meet twice a year with the OMT to discuss more general matters of the programme. These discussions ensure that the Master's programme connects well with the needs from the relevant professional field.

Finally, the programme has set up an Alumni Organisation, run by MMD graduates. The Alumni Organisation organises social and/or scientific gatherings for MMD graduates and students. Alumni are occasionally asked for feedback on issues relating to the programme.

The programme is embedded in the Faculty of Medical Sciences and Radboud University Nijmegen. The education development bodies of these institutions may be counselled on general

matters concerning assessments, educational methods, evaluation methods etc. The Programme Director is member of the Educational Council of the Faculty of Medical Sciences, thus assuring good cross-talk between the different curricula.

3.6 Output

3.6.1 Achieved learning outcomes

Criterion: The achieved learning outcomes correspond with the aims and objectives regarding level, orientation and subject-/discipline-specific requirements.

Internal quality assessment
In order to graduate, students must have completed all steps of the programme, passed all required and elective courses and must have achieved the final qualifications that are described in paragraph 3.1.1. A good indication for the achieved level is found in the results for first (34 EC intra-NCMLS) and second (45 EC international) research training period.

Research training period results are defined by professional performance and attitude (as assessed by the supervisor), quality of end product (assessed by supervisor and external assessor) and oral presentation of the research training period (assessed by supervisor). The end products of the research training periods are complementary: the first training period is concluded with a report that shows that the student has mastered the field of research and is competent to design, perform, interpret and discuss research. The second training period is concluded with report in the format of a scientific article. Articles based on either research training periods may be published in scientific journals (see **Appendix T**). Scientific articles are considered the best objective quality indication in the scientific field.

Probably due to the strict selection, results (of research training periods) are relatively high. Grades for first training period vary between 7.0 and 9.0 (average 8.3), grades for second training periods are generally higher and range between 7.5 and 10.0 (average 8.7). For the 2nd (generally international) research training period, the external (NCMLS) assessor plays an important role as he/she independently grades the report, which is an important component of the grade of the research training period. **Appendix S** lists titles, research themes and grades for all training periods performed so far. Ten students have been selected for whom the reports and theses of the research training periods are submitted to the accreditation committee. These students were chosen to represent the variation in research themes and grading.

External quality assessment
Apart from the results obtained during the programme, external assessment of the programme is important. The following points are (external) indications for the quality of the programme and will be discussed below:
- Employment of graduates: enrolment in (international) PhD programmes and other employment
- External funding for self-written PhD projects
- Publication in peer-reviewed scientific journals

Employment:
After completion of the Master's programme, most graduates (90%) move into a PhD programme. As indicated in **Table 10**, a little less than 50% of the graduates chooses to pursue their PhD at Radboud University, generally within the NCMLS. Graduates are well accepted by other PhD programmes at prestigious institutes, such as the National Cancer Institute in Cambridge and John Hopkins School of Medicine in Baltimore, Maryland. The high number of graduates pursuing a PhD abroad emphasises the international orientation of the Master's students. Two graduates (10%) chose a career without pursuing a PhD. These graduates are employed as junior researchers at Crucell (biotech company) and Maastricht University. All graduates are active in the field of biomedical research.

Table 10: Employment and funding of MMD graduates (PhD positions only)

Cohort	Number of graduates	Total number of PhD students (and %)	PhD at Radboud Univer-sity	PhD at other institutes	Own funding
2005	3	3 (100%)	2	Free University Amsterdam	2 *NWO TOPtalent
2006	8	6# (75%)	3	John Hopkins School of Medicine (USA) Karolinska Institute (Sweden) National Cancer Institute (UK)	
2007	10	10 (100%)	4	Copenhagen University (Denmark) Friedrich Miescher Institute for Biomedical Research Basel (Switzerland) Sabanci University (Turkey) Ludwig Maximilians Universität München (Germany) Melbourne University (Australia) National University of Ireland, Galway (Ireland)	1 *NWO Mozaiek grant 1 *MIRS + MIFRS (Melbourne University) 1 *UMC St Radboud PhD proposal competition

#other 2 graduates are employed as junior researchers in a biotech company (Crucell) or at Maastricht University

External funding

The skills to develop research and write research proposals are unique skills taught during the Master's programme. It is expected that graduates have an advantage when writing research proposals compared to graduates from non-research Master's programmes. Indeed, it is found that our students are successful in obtaining external funding for their research projects. So far, 4 out of 21 graduates (19%) have obtained their own external funding by writing their own research proposal in highly competitive programmes such as NWO TOPtalent and NWO Mozaiek. Furthermore, one student obtained grants from Melbourne University (Melbourne international research scholarship and Melbourne international fee remission scholarship) by writing her own project. Considering the limited possibilities for MSc students in general to apply for funding for their self-written research projects, this is a very high number that confirms that the students have well attained the final achievements of the programme.

Apart from external research proposal competitions, Radboud University Nijmegen Medical Centre has created its own PhD proposal competition since 2009. So far, two MMD students have obtained this funding: one has started her PhD in September 2009; the other is scheduled to start in September 2010.

Publications in peer-reviewed scientific journals

MMD students are trained to write scientific articles; the end product of the second research training period is required to be an article-like report. Peer-reviewed articles based on MMD research training periods are listed in **Appendix T**. Students may be first, second or later author, but in all cases have contributed significantly to the research. As a matter of fact, not only results from the second training period, but also from the first training period may be published. Publications are a measure of the internationally-recognised high quality of research performed by the Master's students during their training period and demonstrate that the students get involved at the forefront of state-of-the-art research.

Taken together, the final qualifications (listed in paragraph 3.1.1) have been reached for the MMD graduates. MMD students can do research independently and present and discuss the results in the international research community. He/she can also present the results as a scientific article. MMD graduates stand out because of their ability to quickly acquire new knowledge, their eagerness and skills to discuss scientific topics and their pronounced international orientation.

3.6.2 Study progress

Criteria:
- *Target figures that are comparable to other relevant programmes are formulated to express the expected success rate.*
- *The programme's success rate complies with these target figures.*

The Master's programme Molecular Mechanisms of Disease aims to have a success rate of 90 percent, i.e. 90% of all students who started the programme have to graduate after maximum 3 years. For the 21 students that graduated thus far, the average MSc study period was 2 years and 1 month. The programme expects to achieve such a high success rate because of diligent candidate screening as well as good monitoring and mentoring of the students. Success rates from the beginning of the programme till now are given below in **Table 11**.

Table 11: Success rate for cohorts 2005-2007, 2006-2008 and 2007-2009

			Cumulative % of students graduating after ..		
Cohort	Number of students	Left early	2 years	2.5 years	3 years
2005-2007	3	0	67%	100%#	
2006-2008	8	0	50%	100%*	
2007-2009	11	1	91%^		

#one student started later in the year 2005. He managed to graduate within 2 years, but was registered longer.
*one of the students who did not graduate after two years had been unregistered for several months because of care leave.
^one student left the programme because of family circumstances.

For the cohort 2006-2008 the main impeding factor appeared to be finishing the first research training period. Students already started their second research training period without having completed the first (i.e. completion of final report). As a measure to facilitate timely graduation, the programme now requires that students have completed their first training period and have the mark registered before they can embark on the second training period. This measure appears to be effective.

List of abbreviations

BSc	Bachelor of Science
CSG	Centre for Society and Genomics
DI-BCB	Donders Institute for Brain, Cognition and Behaviour
EC	European Credit of study load, equal 28 hours of study
ECTS	European Credit Transfer System
FTE	Full-time equivalent
IGMD	Institute for Genetic and Metabolic Diseases
IMM	Institute for Molecules and Materials
IWOO	Academic Educational Institute (Instituut voor Wetenschappelijk Onderwijs en Opleidingen)
jPI	Junior Principal Investigator
KNAW	Royal Dutch Academy of Sciences (Koninklijke Nederlandse Academie der Wetenschappen)
MSc	Master of Science
MMD	Molecular Mechanisms of Disease
MSO	Market Research, Strategy and Development (Marktverkenning, Strategie en Ontwikkeling)
N4i	Nijmegen Institute for Infection, Inflammation and Immunity
NWO	Netherlands Organisation for Scientific Research (Nederlandse organisatie voor Wetenschappelijk Onderzoek)
NCMLS	Nijmegen Centre for Molecular Life Sciences
NVAO	Netherlands-Flanders Accreditation Organisation (Nederlands-Vlaamse Accrediatieorgansiatie)
OER	Education and Examination Regulations (Onderwijs en Examenregeling)
OMT	Education Management Team (Onderwijs Management Team)
PhD	*philosophiæ doctor*
PI	Principal Investigator
RUCO	Research Institute for Oncology
RUN	Radboud University Nijmegen
RUNMC	Radboud University Nijmegen Medical Centre
SEP	Standard Evaluation Protocol (KNAW)
SWOT analysis	Strength, Weakness, Opportunity, Threat Analysis

Appendices

Appendix A: Composition and tasks of MMD committees

Appendix B: Comparison to other Master's programmes

Appendix C: Detailed course descriptions

Appendix D: Elective courses: requirements and examples

Appendix E: Scores SEP Report 2005

Appendix F: UMC (junior) Principal Investigators and involvement in the MSc MMD programme

Appendix G: Example of research training period workplan

Appendix H: Education and Examination Regulations (OER)

Appendix I: Selection procedure

Appendix J: Details of admitted student

Appendix K: Teaching methods

Appendix L: Example questions of essay examinations

Appendix M: Assessment forms

Appendix N: Guidelines for research training period supervisors and external assessors

Appendix O: Brief CVs of major contributors to the programme and top publications of NCMLS key players

Appendix P: Overview of European subsidies and large-scale collaborative projects

Appendix Q: Description RUNMC Teaching Qualifications

Appendix R: Evaluation procedure for theoretical courses
R-1: Evaluation procedure
R-2: Online questionnaire – general questions
R-3: Online questionnaire – open questions
R-4: Online questionnaire– individual teachers
R-5 : minutes forum discussion

Appendix S: List of performed MMD research training periods

Appendix T: High impact publications based on MMD research training periods

Appendix A: Composition and tasks of MMD committees

A.1 MMD Master's Educational Management Team

The Educational Management Team ('Onderwijs Management Team – OMT') consist of the programme director, the programme coordinator, a student member, and three NCMLS representatives, which meet on a fortnightly to monthly basis. The MMD OMT is involved in the main aspects of the MSc MMD, such as the selection of students, mentorship assignments, initiation of new modules, selection of new masterclass topics, and the evaluation of the courses (see paragraph 3.5). In addition, they are involved in student recruitment activities, in budget planning and monitoring.
Twice a year, they meet with the NCMLS Director and the three theme leaders to discuss major changes and long-term planning of the MSc MMD.

MMD Educational Management Team members	**Position**	**Department**
Frans Cremers	**Programme director**	**Human Genetics**
Clasien Oomen	Programme coordinator	Academic Education Institute (IWOO)
Frank van Kuppeveld	Theme 1 representative	Medical Microbiology
Martijn Huijnen	Theme 2 representative	CMBI
Wiljan Hendriks	Theme 3 representative	Cell Biology
Pascal Miesen	Student member	Not applicable
Advisors		
Carl Figdor	Advisor (NCMLS director)	Tumor Immunology
Gosse Adema	Advisor (theme 1 leader)	Tumor Immunology
Be Wieringa	Advisor (theme 2 leader)	Cell Biology
Hans van Bokhoven	Advisor (theme 3 leader)	Human Genetics

A.2 MMD Master's Programme Committee

The MMD Programme Committee consists of three MMD students, three lecturers and a secretary. Meetings are regularly attended by the following advisors: the programme director, programme coordinator and a Faculty of Medical Sciences student assessor. This committee principally is responsible to maintain the high quality of this topmaster. They assess the yearly evaluation reports from the module coordinators and advice the MMD OMT on these matters. Their positive advice is required for the Education and Examination Regulations ('Opleidings en Examen Reglement – OER'). Advice is also given for the corresponding Rules and Regulations.

MMD Programme Committee members	**Position**	**Department**
Joost Schalkwijk	**Chair**	**Dermatology**
Ad Geurts van Kessel	Member	Human Genetics
Peter van der Kraan	Member	Rheumatology
Alsya Affandi	Student member	Not applicable
Clive Michelo	Student member	Not applicable
Lucas Brouwers	Student member	Not applicable
Jur Koksma	Secretary	Academic Education Institute (IWOO)

A.3 MMD Master's Board of Examiners

The Board of Examiners safeguards that students entering the programme have sufficient knowledge in the molecular life sciences area and wet-lab expertise. Dr. Johan van der Vlag coordinates the student selection (see **Appendix D**). Furthermore, this board evaluates the student's internship workplans, the elective components (in- and outside the RUN), and addresses any disputes between lecturers and students. The MSc MMD Programme Director or Programme Coordinator are regularly present at the meetings of this Board, which results in fast communication between the Board of Examiners and the OMT.

MMD Board of Examiners members	**Position**	**Department**
Roos Masereeuw	**Chair**	**Pharmacology & Toxicology**
Hans van Bokhoven	Member	Human Genetics
Wiljan Hendriks	Member	Cell Biology
Ger Pruijn	Member	Biochemistry
Johan van der Vlag	Member	Nephrology
Linda Taylor	Secretary	Academic Education Institute (IWOO)

A.4 MMD Student Admission Committee

After the eligibility of the candidate students (see paragraph 3.2.5) has been checked by the MSc MMD Programme Coordinator and the coordinator of the Student Admission Committee, a team consisting of 2 or 3 members of the Student Admission Committee interviews candidate MMD students. This committee consists of NCMLS PI's from all NCMLS subthemes. To safeguard a proper comparison between the candidates, the interview teams always contain one of the theme representatives (M. Huijnen, F. van Kuppeveld, W. Hendriks). The interview team assesses the candidates' qualities based on predefined criteria and submit a written report to the MMD Board of Examiners and Educational Management Team, which decide on the acceptance of the candidates (selection procedure in **Appendix I**).

MSc MMD Student Admission Committee members	**Theme**	**Department**
Johan van der Vlag (coordinator)*	**3c**	**Nephrology**
Gosse Adema	1b	Tumor Immunology
Roland Brock	1b	Biochemistry
Peter Deen	2b	Physiology
Harry Dolstra	1b	Central Heamatology
Jan van Hest	3b	Organic chemistry
Wiljan Hendriks	3b	Cell Biology
Joost Hoenderop	2b	Physiology
Anneke den Hollander	3a	Ophthalmology
Martijn Huijnen	2a	CMBI
Joop Jansen	1b	Central Haematology
Roland Kuiper	3a	Human Genetics
Frank van Kuppeveld	1a	Medical Microbiology
Ronald van Rij	1a	Medical Microbiology
Jo Zhou	3a	Human Genetics

*Member of the Board of Examiners

Appendix B: Comparison to other Master's programmes

1. Comparison to other (inter)national Master's programmes

The MMD Master's programme was compared to other (research) Master's programmes that promote similarities with regard to their objectives, scientific content and student background. In general, the structure of all programmes was comparable with respect to the balance between acquisition of theoretical knowledge and practical skills.

Molecular Life Sciences	Radboud University Nijmegen	Master's	Local
Molecular Medicine	Erasmus University Rotterdam	Research Master's	National
Molecular Biomedicine	Wilhelms Universität Münster	Research Master's	International
Molecular Medicine	Imperial College London	Research Master's	International

Comparison to a local Master's programme
Within Radboud University Nijmegen, the Molecular Life Sciences (MLS) programme of the Faculty of Science is most comparable to the MMD programme, as it is 2-year curriculum in life sciences conducted in English. The structure of the curriculum is similar to the MMD with respect to the proportion of the theoretical components and research training periods (2 rotations). The MLS programme is open to students with international BSc degrees, although not many enter into the programme (< 5% foreign students). The programme is not actively recruiting international students, nor does it offer scholarships for international students. Since the MLS programme builds on its (Dutch) Bachelor's programme, the admission to the Master's phase does not include selection of students based on quality, whereas the MMD selects students that were in the top segment of the Bachelor's phase. Importantly, MMD is strictly a research Master's programme, whereas the MLS also offers options in the curriculum for graduation in Management, Education or Communication. A major distinction is the scientific orientation of the programmes: whereas in the MMD programme the participation of clinical departments within the NCMLS and the setting in the medical centre create unique opportunities for translational research and provides a strong biomedical signature, the MLS programme has a strong orientation towards physics and chemistry. Another difference is the mentor system: MMD students are assigned a senior scientist as mentor, who helps them in taking important decisions during the programme, whereas MLS has no such system.

Comparison to a national research Master's programme
There are about 14 postgraduate schools in biomedical sciences in the Netherlands. We have selected the MSc Molecular Medicine programme at the Erasmus University Rotterdam (MM-EUR) for comparison. The MMD and MM-EUR share similar final qualifications and aim to educate and prepare talented students to enter a PhD programme. Since the MM-EUR programme offers medical students the opportunity to combine their study with a research Master's, there are two different study programmes: one for biomedical BSc and one for medical students. The MMD and MM-EUR programmes are similar with respect to study load and theoretical courses, but differ in the structure and order of theoretical and practical components. The MM-EUR starts directly with lab rotations, and the programme includes 3-4 short lab rotations in total and a one-year research training period, which is only occasionally performed abroad. In contrast, MMD starts with theoretical courses, followed by two longer research training periods that are combined with elective courses. The two programmes share an international orientation and a focus on translational medicine. About 50% of the students with a non-Dutch Bachelor's degree join in either MMD and MM-EUR. Furthermore, both programmes have some sort of mentor system.

The research areas in Nijmegen and Rotterdam show partial overlap (Infection and Host response, Oncology), but are distinct in the other areas. The MM-EUR programme has a focus on development, endocrinology and aging, whereas MMD is strong in energy & metabolism. In addition, MMD has, through its links with the departments of the Faculty of Science (not present in Rotterdam), the possibility to explore the fields of chemical biology and biophysics ("from molecule to man").

Appendix B

Comparison to international Master's programmes abroad
There are various international programmes that offer similar courses and opportunities for students in the field of life sciences. For comparison, we have chosen the Molecular Biomedicine programme of the Wilhelms University Muenster, Germany (MB-WUM) and the Molecular Medicine programme of the Imperial College London, UK (MM-ICL).

Molecular Biomedicine programme of the Wilhelms University Muenster, Germany
The MB-WUM programme is similar in structure to the MMD programme as it offers a 2 year curriculum of 120 EC, divided over 30 EC theoretical part and 90 EC research training periods (3 rotations). The number of students that enrol is comparable, but the proportion of students from abroad is lower than that of the MMD (< 10%). No scholarship system for international students exists. The programme aims at selection of the top 60% of the students, which are required to have a BSc in Biosciences. The Master degree creates the basis for the pursuit of the equivalent of a PhD degree (Dr. rer. nat.). The programme is accredited by the Central Evaluation and Accreditations Agency to ensure that educational goals and guidelines meet international quality standards. Both the medical and science faculty participate in either of the programmes. Wilhelms University Muenster and Radboud University Nijmegen are members of IRUN (International Research Universities Network), a European network of broad-based research universities. IRUN aims to promote and facilitate the exchange of researchers, lecturers and students. This may open opportunities to student and staff exchange, joint curriculum development and joint degree programmes for Master's students and PhD candidates.

The scientific contents of the programme partly overlap with that of the MMD (Inflammation, Neuroscience, Oncology), but is also focused on different areas (cardio-vascular, reproductive medicine).

Molecular Medicine programme of the Imperial College London, UK
Although many aspects of its educational aims and scientific content overlap, the MM-ICL programme is distinct from the MMD because of its one-year curriculum, comprising four months courses and a seven-month research component. The MM-ICL programme aims to attract highly motivated UK and international students. Student selection is applied, as the programme only admits candidates with at least a second class honours degree in a science-based subject from a UK academic institution or an equivalent overseas qualification. The educational aims with respect to intellectual and practical skills are comparable to those of the MMD and the programme aims to provide a solid foundation for those who intend to go on to study for a PhD. Tuition fees are significantly different (3 to 4-fold higher) from those required to enrol in the aforementioned programmes offered in Nijmegen, Rotterdam and Muenster.

The theoretical content is aimed at fundamental principles of molecular and cellular biology and modern technologies of molecular biology. These are applied to investigation of disease areas that partly overlap with those of the MMD: infectious diseases, genetic diseases, cancer and haematology.

Appendix B

2. Schematic comparison

Table B: Schematic comparison with other Master's programmes. Programmes have been selected based on similarities in field of knowledge, research orientation and international orientation.

	Molecular Mechanisms of Disease	Molecular Life Sciences	Molecular Medicine	Molecular Biomedicine	Molecular Medicine
	RUN	RUN	EUR	WUM	ICL
Programme information					
Research Master	Yes	No	Yes	Yes	Yes
Duration (year)	2	2	2 or 4	2	1
Duration (EC)	120	120	120	120	? 60
Theoretical courses (EC)	41	30 # (48)	33	30	? 30
Total research training periods (EC)	79	90# (72)	87	90 (?)	? 30
Number of lab rotations	2	2	4	3	1
Students enrolled/year	8-16	20-30	12-16	14-18	
international students/year (%)	~60%	<5%	~50%	0-10%	
Graduates enrolled in PhD (%)	14/21 (5 unknown)	Unknown		Unknown	
Average graduation time (year)	2.1	Unknown	Parttime and fulltime different	~2.1	
Selection	Yes	No	Yes	Yes	Yes
Top %	Top 10%	-	*	Top 60%	
Method	Motivation, BSc results, Interview	-	Motivation, BSc results, entrance exam	Motivation	
BSc	Biosciences	Molecular life sciences	Medicine, biology etc	Biosciences	Medicine/ basic science
Orientation	Research	Research, communication, education, Management	Research	Research	Research
Mentor system	Yes	No	Yes	Yes	Yes
Staff					
Number of Faculty members involved	125	?	52	40	
Faculties involved	Medical & Science	Science	Medical	Science & Medical	Medical
Finances					
Tuition fee EU (per year)	€1,620	€1,620	€1,620		£3,225
Tuition fee non-EU (per year)	€8,165	€8,165	€12,250		£20,300
Cost of living (min./month)	€650	€650	€800	€500	£1,000
Scholarships for international students	Yes	Only national	Only national	No	

*Molecular Medicine Rotterdam selects students who can easily follow the Master's programme parallel to their medical education

#Molecular Life Sciences at Radboud University Nijmegen: two research training periods of 45 EC are included in the programme. Of this 45 EC, 36 EC is dedicated to practical training, 3 EC to a theoretical component and 6 EC to writing a Master's thesis.

3 Comparison of the final qualifications

3.1 MSc Molecular Life Sciences Radboud University Nijmegen

Competences and final qualifications

Professional competences:

- Is capable, based on broad knowledge of molecular action mechanisms of biological and biomedical processes, combined with specialist knowledge and research experience in at least one sub-area of this field, of independently setting up and conducting research designed to acquire new knowledge and insights in this research area.
- Is capable of independently identifying, critically reading and comprehending relevant, up-to-date international literature from different disciplines and integrating them in their entirety.
- Is capable of formulating new presentations of questions and hypotheses in the field of molecular life sciences and of selecting the correct paths and research methods for resolving them, making allowances for the availability of services and resources.
- Is capable of setting up and conducting a scientific experiment independently, including the related controls, as well as interpreting and evaluating the results obtained in terms of well-founded scientific conclusions.
- Is capable of describing his or her research results clearly in a written report, in accordance with the standards of an academic article.
- Is capable of independent professional practice whereby, depending on the chosen variant, the emphasis is on conducting fundamental scientific research (under supervision), transferring or applying existing scientific knowledge.
- Is capable, based on a critical analysis of his or her research results, of breaking new ground in research areas.

Cognitive and Communicative Competences:

- Is capable of insight and problem-related reflection with a critical attitude towards scientific insights.
- Is capable, based in part on an ability to abstract, of analyzing a scientific problem by reducing it to testable sub-problems, in which the analysis distinguishes the essentials from secondary matters.
- Is capable of achieving a synthesis from solutions of sub-problems and to place them in a scientific context, thereby contributing to the general development of theories.
- Is capable of socially-responsible professional practice, with a view towards the ethical consequences of research in the field of molecular life sciences, along with the ability to reflect on the potential effects on and endurance of society.
- Is capable, through self-reflection and conversations with others, of assessing his or her own performance.
- Is capable of following general scientific progress in the field of molecular life sciences, particularly within his or her chosen specialization.
- Is capable, in addition to his or her current specialization, of working at a specialist level of another branch of molecular life sciences.
- Is capable of communicating with professional colleagues working in the same field about his or her scientific knowledge at a specialist level.

3.2 Erasmus MC – Master of Science Molecular Medicine

End Goals - Erasmus MC combined Research Masters (December 2008):

- The student is able to put in words a relevant problem and translate this into a research question.
- The student is able to conduct elaborate literature investigations, related to the research question.
- The student is able to translate a research question into a research proposal.
- The student is able to apply knowledge on research methods and biostatistic analytical methods, as well as ethical principles, when drafting a research proposal.
- In collaboration with others, the student is able to set up and conduct a research project, collect data, analyze data, and come to conclusions.
- The student is able to write down research findings in the form of a draft manuscript, that in collaboration with a research supervisor is developed into a scientific article, suitable for publication in an international, peer-reviewed magazine.
- The student is able to estimate the relevance of basic scientific results for clinical practices.
- The student is able to translate a clinical research question into an advice for basic scientific investigation.
- The student is able to propose new healthcare policies, based on relevant research findings and literature investigations.

After having completed the MSc program, the majority of our students with a background in Medicine (from within Erasmus MC) will continue their medical training, while maintaining an interest in biomedical science. When they finish their research training periods, it will be possible for them to continue in the research project started during their MSc training, or engage in a new research project, within the framework of a PhD training program. Several medical students who received the MSc Molecular Medicine degree are now combining their work and training as clinicians with advanced research training as PhDs, both at basic and clinical research levels.

As of September 2006, the program is open to BSc graduates in medicine, biochemistry, biotechnology, or biology from outside Erasmus MC, and also to BASc graduates from Dutch higher vocational training programs in biomedical laboratory techniques (*HBO-BML*). Upon obtaining the MSc Molecular Medicine degree, these students appear to be preferred and qualified candidates for PhD positions within Erasmus MC and other high-ranking and international research institutions. One of our MSc graduates now holds a PhD position at the University of Manchester, and another works at Ghent University.

Some of our graduates will be future candidates to hold key positions in university medical centers, as scientists and teachers, or in related management positions. They are equally well equipped to obtain a research-related position outside an institute of higher education. Thus far, we haven't seen this happen.

3.3 MSc Molecular Biomedicine Westfälische Wilhelms Universität Münster

Programme Requirements / Qualification Profile of the Graduate

The MSc program in biology is research oriented and offers a broad variety of specialization possibilities. The program introduces methods and concepts of scientific research such as experimental design, implementation and evaluation. Beyond the scientific education, the program trains key skills required for academia and today's employment market such as project management, communication as well as capability to work in a team.

The following qualifications are to be procured by the MSc program in Biology:

- An exhaustive understanding of a current biological research area. Students should learn how to link specific scientific knowledge to more fundamental knowledge in other areas of science and make such links recognizable;
- Skill that help students pursue on-going, self-determined studies beyond the requisites of the program; studying as a motor for personal advancement;
- Knowledge required to recognize complex scientific interconnections and the ability to critically analyse and discuss new advancements in an interdisciplinary context as well as the ability to, under consideration of social and ethical aspects, render a critical judgement and do science responsibly;
- The ability to develop scientific ideas and projects as well as the autonomous use of scientific methods and concepts to analyze and resolve problems in the area of biology including knowledge required for design, implementation and evaluation of experimental research projects;
- Skills required to critically discuss problems and advancements in biosciences and adjacent scientific disciplines with colleagues in a responsible manner and on the cutting-edge of current research as well as the ability to convey such research to the public;
- Ability to manage and lead a team of employees to successful scientific projects in a responsible manner and under consideration of all (legal) regulations.

3.4 MSc Molecular Medicine at Imperial College London

3.4.1 Educational aims/objectives of the programme

The programme aims to:

- Provide postgraduate students with backgrounds in either basic science, medicine, dentistry or veterinary science with an advanced academic and laboratory research training in modern cellular and molecular medicine, with emphasis on the interface between the basic and clinical aspects of the subject.
- Produce postgraduates equipped to pursue careers in molecular medicine, in academia, in hospitals, in industry, the public sector and non-governmental organisations;
- Provide a solid foundation for those who intend to go on to study for a PhD;
- Develop understanding of processes at the molecular and cellular level;
- Provide a training in laboratory and research skills;
- Provide a supportive learning environment;
- Attract highly motivated students, both from within the UK and from overseas;
- Develop new areas of teaching in response to the advance of scholarship and the needs of vocational training.

At the end of the taught element students should have a good understanding of:

- The molecular and cellular mechanisms involved in the development and regulation of cells and tissues under normal and disease states
- Advanced molecular and cellular biology methodology
- Gene Expression and its role in disease
- Molecular Genetics and its application to study disease
- Practical techniques in molecular and cellular biology and medicine.

At the end of the seven months research component the students will have:

- Experienced a thorough training in the methods and ethos of laboratory research including:
  - The design of a good research project

- Designing and planning of experiments
- Trouble shooting for experimental problems
- Data presentation, analysis and interpretation
- Literature searching
- Critical review
- Preparation and presentation of work for publication (in the form of a written report)
- A clear understanding of good laboratory practice, including safety.

3.4.2 Programme Learning Outcomes

Knowledge and Understanding

Knowledge and Understanding of:

1.1. Fundamental principles of molecular and cellular biology;
1.2. Modern technologies of molecular biology;
1.3. Molecular biology applied to investigation of disease, including infectious diseases, genetic diseases, cancer, haematology;
1.4. Practical research techniques, including essential molecular biology methodologies; Southern blotting, library screening, isolation of recombinant DNA, PCR and DNA sequencing technologies;
1.5. Detailed knowledge and understanding of the essential facts, concepts, principles and theories relevant to the student's chosen research project;
1.6. Management and communication skills, including problem definition, project design, decision processes, teamwork, written and oral reports, scientific publications.

Skills and other Attributes

Intellectual Skills: able to

2.1. Understand the nature of disease in terms of molecular and cellular biology
2.2. Integrate and evaluate information from a variety of sources
2.3. Formulate and test hypotheses
2.4. Be creative in the solution of problems and in the development of hypotheses
2.5. Plan, conduct and write-up a programme of original research.

Practical Skills: able to

3.1. Plan and execute safely a series of experiments;
3.2. Use laboratory equipment to generate data;
3.3. Analyse experimental results and determine their strength and validity;
3.4. Prepare technical reports;
3.5. Give technical presentations;
3.6. Use the scientific literature effectively;
3.7. Use computational tools and packages.

Transferable Skills: able to

4.1. Communicate effectively through oral presentations, computer processing and presentations, written reports and scientific publications;
4.2. Apply statistical and modelling skills;
4.3. Management skills: decision processes, objective criteria, problem definition, project design and evaluation, risk management, teamwork and coordination, extension needs;

4.4. Integrate and evaluate information from a variety of sources;
4.5. Transfer techniques and solutions from one discipline to another;
4.6. Use Information and Communications Technology;
4.7. Manage resources and time;
4.8. Learn independently with open-mindedness and critical enquiry;
4.9. Learn effectively for the purpose of continuing professional development

Appendix C: Detailed course descriptions

Detailed course descriptions are published online each year in the prospectus available at http://www.studiegids.science.ru.nl/2009/en/fmw/prospectus/Molmech/.

Introduction Course - new format

A new introduction course is under development. This paragraph contains preliminary information about the new course, which will be first given in September 2010.

Isis code	Course year
8IC01	1st year master's MMD

Coordinator
Dr. J.G.J. Hoenderop

Main objectives
After completion of the course, students should:

- Be acquainted with the MMD programme, NCMLS, Radboud University Nijmegen (Medical Centre) and Nijmegen.
- Be able to list the three NCMLS research themes and describe the common ground of the topics within each theme. The student should be able to give examples of the research that is done within the NCMLS.
- Have active knowledge concerning the basics of each of the research themes.
- Be able to search journal articles within the applicable databases. The student can use Endnote for correct referencing in a scientific article.'
- Be able to produce correct, functional and attractive pictures from raw data using Excel and Photoshop/Graphics software.

Relation
This is an introduction course for MSc students Molecular Mechanisms of Disease.

Key words
Introduction, Molecular biology, Genetics, Cell biology, Immunology, NCMLS, Molecular Life Sciences

Examination
The Introduction Course is assessed based on three assignments".

Literature
Core textbooks:

- Parham, *The Immune System*, Taylor & Francis Inc, 3rd edition (2009)
- Lodish: Molecular Cell Biology, 6th edition

Lecture notes, assignments and literature.

Appendix C

Excellence in Communication

Isis code	Course year
8C01	1st year Master's MMD

Coordinator
Prof. Dr. C. Figdor

How to deliver an outstanding scientific presentation in molecular medicine
In order to excel as a scientist within the field of molecular mechanisms of disease, one not only has to gain practical and theoretical knowledge on how to perform superior experiments and to read literature, but one must develop skills in order to communicate with his/her fellow scientists or to explain scientific theories to a lay audience. This holds true for both oral presentations (at lab meetings, journal clubs but also scientific conferences) and poster presentations. Within the biomedical research area, students must become aware that this is a multidisciplinary arena in which biochemists, physicists, cell- and molecular biologists, immunologists, microbiologists, virologists, together with medical researchers and specialists in bioinformatics, all from within their own discipline, seek to unravel the molecular mechanisms that drive living cells and their malfunction in pathological situations. This means that whatever he/she presents must be appealing to all of these disciplines without becoming superficial. This is a real challenge! It is expected that the students have mastered basic communication during their bachelors training.

Main objectives
To gain knowledge and training in two major scientific communication skills:

- To make and present an excellent poster
- To master the advanced PowerPoint slide making tools
- To prepare and deliver an outstanding oral presentation
- To be appealing to both medical and life sciences oriented audiences

Requirements
BSc in Biology, Molecular Life Sciences, Biotechnology, Biochemistry, Biomedical Sciences or similar. Course is also open to PhD students from the NCMLS.

Relation
Part of the master's programme Molecular Mechanisms of Disease.

Key words
Poster/Oral presentation, PowerPoint

Examination
This will be carried out on the basis of

- Quality and content Poster
- Presentation of poster
- Quality and content PowerPoint slides
- Oral presentation
- Participation in discussion

Literature
Assignments and literature are the main materials for this course.

Appendix C

Science and Society

Isis code	Course year
8SE01	1st year MSc MMD

Coordinator
Mrs. dr. A.P. Nelis

During this short course, students will be introduced to the societal and ethical aspects of the molecular life sciences. In particular, the course provides a 'tool-box' to analyse societal and ethical problems. The course aims to provide students with tools and concepts that will allow them to a) recognise ethical questions and b) to address these questions by means of both practical and theoretical analyses. Three main subjects will be addressed during this module:

1. Clinical or bed-side ethics
2. Bio-ethics
3. Technology Assessment (TA)

These subjects will be explored through a series of case studies including *stem cell research*, *genetic testing*, *genetic screening* and *gene-therapy*.

Main objectives
Aim of the course is to introduce students to concepts and tools that allow them to address and assess the ethical and societal aspects of the life sciences in general and their own work in particular. The objectives are:

- to be familiar with different concepts and theories to analyse the ethical and societal issues concerning the molecular life sciences.
- to have the skills to apply concepts and theories from both ethics and Technology Assessment to concrete cases
- to articulate - on the basis of these concepts and theories - a personal view or opinion.

Relation
Part of the Master's programme Molecular Mechanisms of Disease

Key words
Ethics, Societal Issues, Technology Assessment

Examination
Assessment will be carried out on the basis of:

- Assignments during meetings (short case studies)
- Participation during the meetings
- Final paper (2000 words max.)

Literature
Prior to each meeting, students will be asked to read one or two articles. These articles, as well as information about the different assignments, will be available two weeks prior to the first meeting.

Appendix C

Metabolism, Transport and Motion

Isis code	Course year	Scheduled
8T02	1st year MSc MMD	period 2

Coordinator
Prof. dr. M. Huynen

This course focuses on the NCMLS Research theme 2: Metabolism, Transport and Motion. The module consists of two parts: Core Fundamental (28 Sept – 12 Oct) and Translational Research (15 – 23 Oct). The lab orientation day of Theme 2 takes place on 13 October 2009. The lab orientation day of Theme 1 takes place on 14 October 2009.

Core Fundamental

Among the >5000 small (in)organic compounds that occur in mammalian cells, water molecules, energy and redox metabolites like ATP, NAD(P)H, and ions like Ca2+, Mg2+, K+, Na+ and others form one of the most important levels of organization of the cell. Pyridine metabolites like ATP and NAD(P)H are synthesised or utilised in core-pathways of metabolism (glycolysis - OXPHOS) and involved as fuel, electron donors, or co-factors in virtually all relevant interactions between micro- and macromolecular components of the cell. Especially the importance of energy and redox regulation (topic of Theme 2a) of cell growth, and maintenance of viability and stress response is now well appreciated. Mitochondria are central in this regulation, and abnormal functioning of these organelles and associated pathways is intimately linked to neuromuscular disease, aging, cancer and metabolic syndrome/diabetes via apoptosis control and metabolic signalling. Similarly, defects in systems for membrane transport of water, drugs and metabolites, regulation of ion levels (channels and ion pump ATPases), or actomyosin-based control of cell dynamics (topic of sub theme 2b), which directly or indirectly rely on the use of ATP and control the intracellular distribution of ions and small molecular compounds, are cause of disease, including inheritable channelopathies, renal disorders or abnormal sensitivity to pharmacological agents.

In this course we will use examples from own research to illustrate how the processes of energy and redox metabolism or pump, motor or transport systems are coupled, and what the importance of cellular compartmentalisation is in this coupling in health and disease In particular, the consequences of defects in this integrated network occurring in various inherited and acquired disorders will be discussed. We will also explain how knowledge of transcriptome, proteome and metabolome data at the bioinformatics level can be integrated and used for candidate disease gene and pathway prediction. Studies in this area range from "molecule to bedside" and therefore require multidisciplinary approaches. This core fundamental course emphasizes the development of problem solving and conceptual skills by using conventional lectures, computer-based interactive learning, and small enquiry based theoretical science projects. Students are offered a comprehensive series of introductory lectures on the topics that go beyond basic (Bachelors) knowledge of biochemistry and cell-biology textbooks. Students will be asked to read background literature and use information from websites to make themselves familiar with knowledge on the significance of metabolite profile analysis, (reverse) genomics and proteomics for the study of channelopathies, drug transport, cell dynamics and mitochondrial disorders. Emphasis will be on the value of combined approaches using biochemical, molecular biological, cell biological, physiological and biophysical (microscopy) methodology for clinical diagnosis and therapy. In the last part of the course, students are expected to define a research area of interest, and - based on one or two key papers from literature - conceive a rationale and matrix for a small research project within this area, guided by tutors. A small written report on the research project proposal should be prepared and an oral presentation must be given. After this course students are expected to understand the essence of metabolic and physiological investigations and think and behave as (junior) scientists in the field.

Translational Research
In the translational research part of Metabolism, Transport and Motion (NCMLS Theme 2), the molecular aspects of certain disorders of energy metabolism (e.g. mitochondrial disorders) and transport (e.g. disorders of renal water transport) will be covered from bench to bedside. There will be special emphasis on the clinical and fundamental aspects of these diseases, the burden for the (often young) patients, and the latest developments in diagnosis, therapies and prevention (e.g. by special diets or enzyme replacement therapy). Students will learn to appreciate the value of a multidisciplinary approach, linking genetic defects to their phenotypic consequences and to a better understanding and treatment of these diseases.

Appendix C

Main objectives

Core Fundamental

Make students familiar with the biomedical significance of energy and redox components in the "small molecular world" and how the role of these components is integrated in the larger cellular network for growth, differentiation, viability control and ion homeostasis. Specifically, students will be

- Able to appreciate the significance of "metabolic, transport and cell dynamics research" for molecular life sciences,
- Aware of current possibilities and developments in the field, and
- Able to implement the newly obtained knowledge in the planning of their future research activities.

Translational Research

Make students familiar with the clinical appearance of defects in energy metabolism and transport and with the biomedical research towards the molecular mechanisms, diagnosis, treatment and prevention of these diseases. Students will gain knowledge of the various diagnostics for disease classification and of the options for treatment. Specifically the students will

- Be able to understand the clinical consequences of molecular defects in the metabolism and transport of small molecules.
- Be aware of current possibilities and developments in the field of diagnosis, treatment and prevention of these diseases.
- Be able to use the knowledge about the link from molecular mechanisms of energy metabolism and transport to disease in their future research in the biomedical field.

Relation

This is a core module of the Master's programme Molecular Mechanisms of Disease.

Key words

Energy and redox metabolism, regulation of Ca2+ and Mg2+ physiology, water, drug and metabolite transport, bioinformatics of metabolic pathways, metabolic disease.

Examination

The assessment of the module Metabolism, Transport and Motion consists of three parts: Core Fundamental project proposal (weight 1/3), Core Fundamental assay question examination (weight 1/3) and Translational Research assay question examination (weight 1/3). All components must be graded 6.0 or higher to pass the module.

Assessment Core Fundamental

The students will be monitored throughout the course. The assessment will be carried out on the basis of the following criteria:

- Product value of the project proposal at end of course (incl. level of participation, presentation of research proposal)
- Essay Question Exam (must be graded 6.0 or higher to pass the module)

Assessment Translational Research

The assessment will be carried out on the basis of an Essay Question Exam (4 questions, must be graded 6.0 or higher to pass the module)

Literature

- Assignments and literature are the main materials for this course (See course manual on Blackboard). Core textbook: Lodish: Molecular Cell Biology, 6th edition; specifically chapters 5, 7.4, 8.1, 9.7, 15, 16, 17, 18, 21.1, 21.2, 21.3

Appendix C

Cell Growth and Differentiation

Isis code	Course year	Scheduled
8T03	1st year MSc MMD	period 3

Coordinator
Dr. Wiljan Hendriks

The module consists of two parts: Core Fundamental (26 Oct - 11 Nov) and Translational Research (13 - 20 Nov). The course is interrupted for the NCMLS symposium "New Frontiers in Pattern Recognition Receptors Symposium" on 5 and 6 November. A Lab Orientation Day will take place on 12 Nov.

Core Fundamental

The students will be familiarised with the broad spectrum of current research on Cell Growth and Differentiation (NCMLS theme 3). Novel concepts and modern techniques within the fields of (epi)genetics and chemical biology will be presented. Principles and applications of functional genomics and proteomics will be introduced in the context of development, growth and differentiation and the consequences of deregulation thereof. Students will be equipped with state-of-the-art bioinformatics tools and use it on contemporary research questions in the field.

The Core Fundamental course consists of a theoretical part that is followed by a computer-practical part. During the first four days a series of lectures on the various topics is scheduled. Emphasis is on getting the students themselves actively involved in the learning process, for example by enabling them to prepare for the lectures by means of core articles that are provided and by stimulating the posing of questions and participation in discussions with the lecturers. Subsequently, practical and transferable skills will be trained by means of a hands-on bioinformatics project. Students will obtain an original data set that should be analysed and mined according to instructions provided. At the end of the course they will orally present their findings, illustrate how the results were obtained and discuss implications.

Translational Research
The students will be familiarised with various aspects of translational research in the field of Cell Growth and Differentiation, ranging from molecule to patient care. Current state-of-the-art technologies will be introduced and their application in various inherited and acquired (cancer) disorders, including target gene discovery, gene expression profiling, mutation scans, genomic profiling, (clinical) imaging and bio-informatics, will be dealt with. In addition, applications in (pre-symptomatic) screening and genetic counselling will be reviewed.

Main objectives

- Extend the students' knowledge on key regulatory processes in cell growth and differentiation, esp. in relation to health and disease
- Familiarise students with several research areas within NCMLS research theme 3
- Provide basic training in bioinformatics
- Introduce molecular and clinical aspects of hereditary cancer, including genetic counselling
- Provide insight in gene-based diagnostics of cancer, from gene expression to target validation
- Introduce students to molecular imaging in animals and humans; PET, MR and bio-photonics
- Provide an overview of micro-array and genomic profiling technologies and its application in clinical genetics

Relation
This is a core module of the master's programme Molecular Mechanisms of Disease.

Key words
Transcription regulation, genetic mechanisms of disease, genetic and epigenetic mechanisms, genomics, signal transduction, chemical biology, protein modelling, protein networks, bioinformatics.

Examination
The assessment of the module Cell Growth and Differentiation consists of three parts:

Appendix C

- Core Fundamental essay question examination (weight 1/3)
- Core Fundamental bioinformatics project (weight 1/3)
- Translational Research essay question examination (weight 1/3).

All components must be graded 6.0 or higher to pass the module.

Literature

- Assignments and literature references, the main materials for this course, will be provided (See course manual on Blackboard).
- Core textbook: Lodish: *Molecular Cell Biology*, W.H.Freeman & Co Ltd, 6th edition (2007); specifically chapters 4, 5, 6, 7, 8, 20

Appendix C

Infection, Immunity & Tissue Repair

Isis code	Course year	Scheduled
8T01	1st year MSc MMD	period 4

Coordinator
Dr. F. van Kuppeveld

The module focuses on NCMLS Research Theme 1: Infection, Immunity and Tissue Repair. The module consists of two parts: Core Fundamental (23 Nov – 9 Dec) and Translational Research (10 Dec – 18 Dec). A lab orientation day takes place on 14 October 2009. The orientation days on 1 and 2 December can either be used to visit more labs, or to write the workplan for the first research training period.

Description NCMLS Theme 1: Infection, Immunity and Tissue Repair

Our immune system consists of a dazzling collection of cells and regulatory pathways that protect us from dangers from outside and within. The immune system has the challenging task to eliminate pathogenic micro organisms and eradicate arising tumours, while preventing auto-reactive immune responses harmful to the host. In order to perform this dual task, many activating and inhibitory circuits are in place to either activate or down regulate immune responses. Key molecules include proteins form multiple extra-cellular and intra-cellular protein families, such as toll-like receptors, C-type lectins and suppressors of cytokine signalling (SOCS). Crucial cells involved in balancing the immune system include the professional antigen presenting dendritic cell and the regulatory T cell (sub theme 1b). Deregulation of the immune balance results in inflammation and/or auto-immune related disorders. They can either be acute or chronic in nature and involve a complex interplay between many different cell types, including immune- and non-immune cells. Multiple protein families, like cytokines and proteases, are involved in these processes that ultimately lead to tissue-damage and destruction. Unravelling the molecular basis of both the events that trigger the initation of these diseases and those that fuel disease progression consist one of the major challenges in molecular medicine today (subtheme 1a). Full understanding of the molecules and regulatory mechanism in immune cells and non-immune cells will allow application of immune-modulatory strategies in diseases ranging from infection and cancer to autoimmunity and transplantation.

The wish to replace damaged/non-functional organs/tissues combined with the shortage of donor organs triggered the rise of a new multidisciplinary scientific research field: Tissue engineering. Tissue engineering aims at no less than the creation of new tissues/organs, in- or outside the body. Organs are composed of cells embedded in a scaffold. Scaffolds not only provide the strength and structure for an organ, but also create the specific molecular microenvironment in which cells function, e.g. migrate, proliferate and differentiate. Tissue engineering nowadays include research involving i) construction of organ-specific scaffolds, ii) development of ceramic implants and most recently iii) the implementation of pluripotent stem cells that have the capacity to differentiate in multiple distinct cell-types (theme1c).

Core Fundamental

In this core fundamental course theme 1 the molecular mechanisms of diseases will be covered from bench to bedside. Students will learn to appreciate the value of a multidisciplinary approach in solving complex molecular networks as well as multi-factorial diseases.

Translational Research
In the translation research course Infection, Immunity and Tissue Repair, the molecular aspects of discriminating self from non-self, certain immune-related disorders (Crohn's disease, autoimmune diseases, rheumatoid arthritis) and an infectious disease (malaria) will be covered from bench to bedside. There will be a special emphasis on the clinical and fundamental aspects of these diseases, the burden for the patient, and the latest developments in diagnosis, therapies (e.g. tissue engineering) and prevention of these diseases. Students will learn to appreciate the value of a multidisciplinary approach in better understanding and treating multi-factorial diseases.

Appendix C

Main objectives
Core Fundamental
Make students familiar with immune regulatory cell-types and circuits, and their biomedical significance in the occurrence and treatment of diseases. Students will
gain knowledge in the importance of molecular diagnostics in disease classification and treatment, and recent developments in tissue engineering, tissue pathology and repair.

Specifically, student will

- Be able appreciate the significance of regulatory pathways within the immune system and their involvement in immune-related disorders.
- Be aware of current developments and applications of tissue engineering and tissue repair.
- Obtain insight in the application of molecular diagnostics in disease management.
- learn to define research questions and translate knowledge into a future research project

Translational Research

Make students familiar with biomedical and clinical research towards the molecular mechanisms, diagnosis, treatment, and prevention of disease. Furthermore, students will gain knowledge in the importance of molecular diagnostics in disease classification and treatment. Specifically, students will be able to:

- Understand the molecular mechanism and clinical importance of discriminating self from non-self in the pathophysiology of infectious and autoinflammatory disorders
- Understand the clinical consequences of molecular defects in the immune balance and the role of inflammation
- Understand the difficulties of intervention strategies (e.g., vaccination) to combat malaria
- Obtain insight in the application of molecular tools in the diagnosis, management, treatment, and prevention of disease

Relation
The is a core module of the master's programme Molecular Mechanisms of Disease.

Key words
Immune-regulation, dendritic cells, (auto)immune diseases, infection, stem cells

Examination
The assessment of the module Infection, Immunity and Tissue Repair consists of three parts:
- Core Fundamental research project proposal (including participation and presentation) (weight 1/3),
- Core Fundamental assay question examination (weight 1/3) and
- Translational Research assay question examination (weight 1/3).

Literature
- Assignments and literature are the main materials for this course (See course manual on Blackboard).
  Core textbook: Parham, *The Immune System*, Taylor & Francis Inc, 3rd edition (2009)

Appendix C

Masterclass Theme 2: TRP Channels

Masterclasses are different each year. The paragraph describes the masterclass of academic year 2009-2010.

Isis code	Course year
8MC02	1st MSc MMD

Coordinator
Dr. J.G.J. Hoenderop

Master classes are unique components of the Master's programme Molecular Mechanisms of Disease and are dedicated to topics within the three main themes of the programme and the NCMLS. In these 1-week intensive courses, in-depth knowledge is gained on a specific "hot" research topic. Topics are changed every year to keep up-to-date with research on the cutting edge of science. During these courses, distinguished researchers from international partner universities present the latest research developments in their field, introducing new research topics and challenging questions. Students are expected to participate actively by preparing questions for the international guest lecturers, presenting literature meetings and chairing the seminars that the lecturers present to the whole research institute.

The transient receptor potential (TRP) superfamily of proteins consists of cation-selective ion channels with diverse functions. Yeast cells utilize a TRP channel to perceive and respond to hypertonicity. Nematodes have TRP channels at the tips of neuronal dendrites in their 'noses' to detect and avoid noxious chemicals. Male mice use a pheromone-sensing TRP channel to discriminate males from females. Humans employ TRP channels to appreciate sweet, bitter and umami (amino acid) tastes, and to discriminate between heat and cold. In each of these cases, TRPs mediate sensory transduction, not only in a classical sense, for the entire multicellular organism, but also at the level of single cells. Mammalian homologues of the Drosophila TRP gene encode a family of 28 ion channel proteins. They are widely distributed in mammalian tissues. The molecular structure that is conserved among all members of the TRP family is a channel subunit, containing six transmembrane spanning domains and a pore region, that most probably assemble into tetramers to form unique ion channels allowing the influx of cations into cells. TRP channels can be divided by sequence homology into at least six subfamilies, designated TRPC (canonical or classical), TRPV (vanilloid), TRPM (melastatin), TRPP (polycystins, PKD-type), TRPA (for ankyrin), TRPML (for mucolipin), and the more distant subfamily TRPN (N for "nomp" no mechano-receptor potential). Their important physiological roles are best illustrated by associated diseases as polycystic kidney disease, prostate cancer, glomerulosclerosis, lysosomal storage disorders and hypomagnesemia.

NCMLS lecturers: Drs. J. van der Wijst, Dr. S. Verkaart, Dr. P. SanCristobal, Dr. J. Hoenderop, Prof.dr. R. Bindels

International lecuturers:
Prof.dr. Craig Montell (United States), Dr. K. Schlingmann (Germany)

Main objectives
Upon completion of this course, participants should be able to:

- Describe the phylogenic relationship of the TRP superfamily
- Discuss the distinct features and functions of subfamilies of the TRP channels
- Identify molecular mechanisms of channel (in)activation of the TRP channels
- Identify techniques to study TRP channel function
- Identify potential key regulatory domains within the TRP proteins
- Establish a causal relationship between TRP-associated diseases and channel regulation

Requirements
The module "8T02 Metabolism, Transport and Cell Motility" (or equivalent) is required for this course.

Relation
This unique component of the MSc MMD is dedicated to topics within the three main themes of the programme and the NCMLS. Distinguished researchers from international partner universities present the latest research developments in their field, introducing new research topics and challenging questions.

Appendix C

Key words
TRP channels, ion channels

Examination
Assessment will be carried out on the basis of:

- Quality of journal club (1/3),
- preparation of questions to speakers and participation in discussions and minisymposia (1/3),
- presentation of future research (1/3).

Literature
selected articles (announced on Blackboard)

Appendix C

Masterclass Theme 3: Cancer Genomics

Masterclasses are different each year. The paragraph describes the masterclass of academic year 2009-2010.

Isis code	Course year
8MC03	1st year MSc MMD

Coordinator
Dr. R.P. Kuiper

Master classes

Master classes are unique components of the Master's programme Molecular Mechanisms of Disease and are dedicated to topics within the three main themes of the programme and the NCMLS. In these 1-week intensive courses, in-depth knowledge is gained on a specific "hot" research topic. Topics are changed every year to keep up-to-date with research on the cutting edge of science. During these courses, distinguished researchers from international partner universities present the latest research developments in their field, introducing new research topics and challenging questions. Students are expected to participate actively by preparing questions for the international guest lecturers, presenting literature meetings and chairing the seminars that the lecturers present to the whole research institute.

Cancer Genomics:

Cancer is a genetic disease which arises as a result of a sequence of somatically acquired changes in the DNA of cancer cells. The main objective of Cancer Genomics is to identify these genetic changes and distinguish the abnormalities that are causally implicated in oncogenesis (driver mutations) from random mutations that do not confer growth advantage (passenger mutations), which should eventually lead to the discovery of new drug targets. Furthermore, the identification of novel gene defects and genomic variants in the germline of individuals that cause predisposition to specific cancer types not only provides increased knowledge to the process of cancer initiation, but also has major impact on genetic counselling and clinical management of families involved.
The recent development of high-throughput technology to perform genome-wide analysis of the human genome has introduced a new era in the search for abnormal genes underlying the development of human cancer. These technologies include high-resolution genotyping and copy number arrays, whole-genome expression arrays and, most recently, next generation deep sequencing.

Guest speakers:

Prof dr. Bryan Young, Prof. dr. Ian Tomlinson

Main objectives
Upon completion of this course, participants should be able to:

- Explain the characteristics of cancer genes and their mutations
- Understand the role genes may play in cancer predisposition
- Discuss the genomic strategies used to identify novel targets in cancer
- Describe the approaches used to distinguish driver mutations from passenger mutations and normal variation in the genome
- Understand the challenges and opportunities of the new technologies in cancer genomics

Requirements
The module "8T03 Cell Growth and Differentiation" (or equivalent) is required for this course.

Relation
This unique component of the MSc MMD is dedicated to topics within the three main themes of the programme and the NCMLS. Distinguished researchers from international partner universities present the latest research developments in their field, introducing new research topics and challenging questions.

Appendix C

Examination
Assessment is based on:

- Quality of journal club (1/3),
- preparation of questions to speakers and participation in discussions and minisymposia (1/3), presentation of future research (1/3).

Literature
selected articles (announced on Blackboard)

Remarks
This course is aimed at students of the MSc programme Molecular Mechanisms of Disease, who started in September 2009. The course is also open to NCMLS PhD students. For attendance please contact the programme coordinator ( mmd@ncmls.ru.nl).

Appendix C

Genomics and Statistics

Isis code	Course year
8ST01	2nd MSc MMD

Coordinator
Drs. A.B. Feuth; Dr. J.A. Veltman
This course focuses on the NCMLS Research theme 3a: Genetic and epigenetic pathways of disease. The module consists of two parts: Genomics (26 – 29 Oct) and Statistics (9 –20 Nov).

Genomic studies provide scientists with methods to analyze genes and their products en masse. In the past 10-15 years genomics technologies and approaches have evolved rapidly and their application has fundamentally changed our ability to study the molecular basis of cells and tissues in health and disease. The introduction of microarrays in clinical genetics and oncology for example has increased diagnostic and prognostic possibilities. Large genome-wide association studies are giving us insight into the common genetic variants associated with common disease, although these explain only a minor fraction of the genetic burden. A new and exciting development is affordable whole genome sequencing, which will allow us for the first time to have the complete overview of an individual's genetic make-up, with all its variants and complexity. Insight in the biology of many diseases obtained by these methods will offer novel and personalized treatment possibilities. Widespread applications of genomics for personalized medicine however require associations of tens to hundreds of thousands of genomic variants and/or gene expression patterns with clinical information. The interpretation of these large amounts of data requires the development of extensive computational power and adequate statistical methods. The recent advances in technology provide the possibility to obtain large genomic datasets that contain information on large number of variables, while the sample sizes are moderate to small. Often the data generated by these techniques come in the form of a matrix, where rows represent observations and columns represent entities (gene, metabolite or protein). These data sets are generally very large and often the number of observations is small compared to the entities themselves. It becomes a major challenge to find significantly expressed entities in a biological context.

In the first week of the course we will focus on genomic technologies and applications in clinical genomics and oncogenomics . An overview will be given of genomics research in Nijmegen and the rest of the Netherlands, and you will be challenged to think about the future of these developments. The second part, taking place during the last two weeks, will concentrate on statistics related to genomics. We will start with a recapitulation of basic statistical principles and procedures: descriptive and inferential statistics, testing and p-values, confidence intervals, linear regression analysis and analysis of variance (ANOVA). Then we will focus on basic techniques frequently used in genomics: logistic regression, cluster analysis, principal components analysis (PCA) and methodological issues as experimental design and power and sample size. Databases will be available to perform these types of classical analyses using SPSS. The last week will be devoted to two recently published examples concerning genetics and psoriasis and genetics and urinary bladder cancer respectively. In studying these datasets you will be confronted with design issues, questions as to which strategy to choose, performing parts of the analysis, correctly interpreting the results.

Main objectives
Genomics:
Upon completing the genomics part of this course the learner should be able to:

- Understand the basic make-up of the human genome, its structure and its variations
- Discuss the different genomics technologies, their capacities and limitations
- Choose the appropriate genomics technology for different research and clinical applications
- Understand, work and interpret genomics data
- Discuss the future of genomics

Statistics:
Upon completing the statistics part of this course the learner should be able to:

- Choose an appropriate basic statistical technique to analyze data gathered in the context of medical scientific research.

Appendix C

- Perform basic statistical analyses with the aid of the computer package SPSS and interpret the results and report conclusions
- Describe roughly the statistical background of some analysis techniques that are frequently applied in the area of genomic research.

Requirements
BSc in Life Sciences

Key words
Genomics, oncogenomics, genomic technologies, statistical analysis of genomic datasets

Examination

- The students will be monitored throughout the course. The assessment will be carried out on the basis of the following criteria:
  Level of participation in discussions and plenary sessions during the course (weight ¼)
- Creative ideas and presentation of "Future of Genomics Research" on Thursday Oct 29th (weight ¼)
- Written examination on Friday Nov 20th (weight ½)

- **Literature**
  Book: Andy Field, *Discovering Statistics Using SPSS*, Sage Publications, London, second edition, 2006
- Selected articles:
  - Amos CI. *Successful design and conduct of genome-wide association studies.* Hum Mol Genet. 2007 Oct 15;16 Spec No. 2:R220-5.
  - Craddock N, O'Donovan MC, Owen MJ. *Genome-wide association studies in psychiatry: lessons from early studies of non-psychiatric and psychiatric phenotypes*. Mol Psychiatry. 2008 Jul;13(7):649-53.
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  - Karlin S. *Statistical signals in bioinformatics.* Proc Natl Acad Sci U S A. 2005 Sep 20;102(38):13355-62.
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  - Matthews AG, Haynes C, Liu C, Ott J. *Collapsing SNP genotypes in case-control genome-wide association studies increases the type I error rate and power.* Stat Appl Genet Mol Biol. 2008;7(1): Article23.
  - Rodriguez-Murillo L, Greenberg DA. *Genetic association analysis: a primer on how it works, its strengths and its weaknesses*. Int J Androl. 2008 Dec;31(6):546-56.
  - Veltman JA. *Genomic microarrays in clinical diagnosis.* Curr Opin Pediatr. 2006 Dec;18(6):598-603.
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Study path

The module consists of: a genomics part (4 course days), and a statistics part (10 days).
The following forms of education are used:

- Fundamental theory lectures
- Technical discussion or demonstration
- Practical PC work
- Communication skills

Remarks
This course is interrupted by the module 8MC01 Master class Theme 1.

Appendix C

Master class Theme 1: Pattern Recognition Receptors

Masterclasses are different each year. The paragraph describes the masterclass of academic year 2009-2010.

Isis code	Course year
8MC01	2nd year MSc MMD

Coordinator
Dr. F. van Kuppeveld

Master classes are unique components of the Master's programme Molecular Mechanisms of Disease and are dedicated to topics within the three main themes of the programme and the NCMLS. In these 1-week intensive courses, in-depth knowledge is gained on a specific "hot" research topic. Topics are changed every year to keep up-to-date with research on the cutting edge of science. During these courses, distinguished researchers from international partner universities present the latest research developments in their field, introducing new research topics and challenging questions. Students are expected to participate actively by preparing questions for the international guest lecturers, presenting literature meetings and chairing the seminars that the lecturers present to the whole research institute.

This master class is connected to the NCMLS symposium "New Frontiers in Pattern Recognition Receptors" on 5 and 6 November.

Summary
Upon infection by viruses, multi-cellular organisms mount a multi-faceted and effective defense, consisting of innate and adaptive immune mechanisms. A critical issue for a successful immune response is the ability to discriminate self from non-self. One mechanism to achieve this distinction is through the recognition of 'pathogen-associated molecular patterns' (PAMPs) by pattern recognition receptors (PRRs). PAMPs are small molecular motifs that are conserved among classes of microbes, but absent from the host, such as bacterial cell wall components. PAMPs that signal the presence of virus are often virus-associated nucleic acids, such double-stranded RNA and unmethylated CpG motifs.

In recent years, innate antiviral immunity has received considerable interest through three major breakthroughs. i) The discovery of toll-like receptors (TLRs), their viral ligands, and associated signaling pathways. TLRs are PRRs that recognize a range of microbial and viral ligands, and are critical for activation of innate immune response, and for priming adaptive responses; ii) The identification of RIG-I like receptors (RLRs) as cytosolic sensors for viral RNA. TLRs are mainly expressed by cells of the immune system; RLRs, in contrast, are expressed on many non-immune cells. Upon viral infection, RLRs are activated and induce the production of type I interferons. These potent antiviral cytokines, in turn, induce the transcription of many genes, resulting in an antiviral state in both infected and uninfected cells. iii) The demonstration that RNA interference is an important antiviral mechanism in plants, in insects, and, perhaps also, in mammals. RNAi is a mechanism for double stranded RNA-guided post-transcriptional gene silencing. Double stranded RNA is processed into small interfering RNA (siRNA) that mediate the recognition and cleavage of target RNA in a sequence specific manner. The observation that many viruses suppress the TLR, RLR or RNAi pathways underlines the importance of these mechanisms in antiviral defence.

Main objectives

After participating in the master class the students should

- have a solid understanding of innate antiviral defence mechanisms;
- be able to present a literature presentation on a subject related to pattern recognition receptors;
- have the necessary background for the subsequent NCMLS "New Frontiers" symposium on pattern recognition receptors.

Requirements
The module "8T01 Infection, Immunity and Tissue Repair" (or equivalent) is required for this course.

Appendix C

Relation

This unique component of the MSc MMD is dedicated to topics within the three main themes of the programme and the NCMLS. Distinguished researchers from international partner universities present the latest research developments in their field, introducing new research topics and challenging questions.

Examination
Assessment will be carried out on the basis of:

- Quality of journal club (1/3),
- preparation of questions to speakers and participation in discussions and minisymposia (1/3),
- presentation of future research (1/3).

Literature
selected articles (announced on Blackboard)

Remarks
This course is aimed at students of the MSc programme Molecular Mechanisms of Disease, who started in September 2008. The course is also open to NCMLS PhD students. For attendance please contact the programme coordinator (mmd@ncmls.ru.nl).
The master class is connected to the NCMLS symposium "New Frontiers in Pattern Recognition Receptors" on 5 and 6 November. Students need to register for this symposium separately.

Appendix C

8KT01 & 8KT02: Knowledge Transfer year 1 and Knowledge Transfer year 2

Knowledge transfer is an elective component that is facultative in the year 1 (8KT01) and compulsory in year 2 (code: 8KT02). The size ranges from 0 to 2.0 EC in the first year and from 2.0 to 4.0 EC in the second year. The credits for Knowledge Transfer will be added for first and second year. Therefore, the credits will be 2.0 EC < KT < 6.0 EC. All ECs on top of that will be indicated on the master's certificate, but are not included in the 120 EC Master's programme.

Objective

To strengthen scientific communication and learning skills MMD students are expected to attend a number of 'Knowledge Transfer' events throughout the course, organised by the NCMLS or by a foreign institute. These expose the student to several aspects of scientific research and bring them into contact with excellent researchers. The student follows a programme of local Seminars and Workshops and Forum evenings developed in collaboration with prominent national and international scientists. Students performing their internship at foreign institutes, can attend seminars, workshops and courses at the institute.

Adminstration

The student is responsible for keeping a record of the knowledge transfer components. For this goal, a form is available from Blackboard. This excel file allows you to easily calculate the size of your knowledge transfer. A short summary needs to be made for each component and should be integrated in the excel file (alternatively, the numbered summaries may be provided in a separate file). Please check the form for details on the length of the summaries. The excel file should be posted to the Blackboard personal student group before July 31st. Please send an email to c.oomen@owi.umcn.nl to inform the file has been posted.

Options for Knowledge transfer

Several options to fill your Knowledge Transfer are listed below. Please check the NCMLS website and Blackboard MMD student community for extra options.

NCMLS Seminars

To provide the student with a broad knowledge of research topics related to Molecular Mechanisms of Disease. Often distinguished researchers are invited from abroad to share their knowledge on latest developments in fundamental science or to introduce the audience to the state-of-the-art technological advances.

The students will have the choice to attend several NCMLS Seminars during their presence at the institute. The programme is available from http://www.ncmls.eu/NCMLS/Subjects/Events.asp. A complete list of events is sent out by email by the NCMLS. One seminar has the weight of 0.1 EC.

Student attending a foreign institute during the second Research Training period will be required to attend similar local events. The student is responsible to make arrangements (with possible help of the mentor), in order to accommodate these education requirements at foreign institutes.

NCMLS Forum Evenings

The NCMLS forum evenings aim to provide the student with a broad knowledge of research topics related to Molecular Mechanisms of Disease. Often distinguished researchers are invited from abroad to share their knowledge on latest developments in fundamental science or to introduce the audience to the state-of-the-art technological advances.

The students will have the choice to attend several NCMLS Forum evenings during their presence at the institute. The programme is available from http://www.ncmls.eu/NCMLS/Subjects/Events.asp. Each forum evening is rewarded with 0.15 EC.

Appendix C

Student attending a foreign institute during the second Research Training period will be required to attend similar local events. Arrangements should be made on an individual basis in order to accommodate these education requirements of the student at foreign institutes.

NCMLS PhD Workshops

MMD students can follow NCMLS PhD workshops. These workshops can provide students with a broad knowledge of research topics related to Molecular Mechanisms of Disease. The NCMLS Workshop are organised by PhD students and involve an afternoon programme. Often distinguished researchers are invited from abroad to share their knowledge on latest developments in fundamental science or to introduce the audience to the state-of-the-art technological advances. In addition, at least three presentations are given by PhD students. The goal is to create exchange of knowledge in an informal setting, to encourage participation of M.Sc. students in scientific debate.

Students can choose which workshops they will follow; the programme is available from http://www.ncmls.eu/NCMLS/Subjects/Events.asp. One workshop is rewarded with 0.30 EC. Students attending a foreign institute during the second Research Training period can attend similar local events. Arrangement should be made on an individual basis via the mentor of each student, in order to accommodate these education requirements of the student at foreign institutes.

NCMLS conference: New Frontiers in Pattern Recognition Receptors

MMD students can follow NCMLS conference New Frontiers in Pattern Recognition Receptors on 5-6 November 2009. More information on this conference can be found on the NCMLS website. Students need to register via this site. This two-day conference is awarded with 0.5 EC.

Internship presentation for MMD students

Students who have concluded their first internship should present their internships for their fellow MMD students and the first-year students. NCMLS members are also invited to attend this presentation. It depends on the number of students presenting, how many ECs this meeting is awarded. Please check Blackboard for details.

Time	**Attendance with presentation (second-year MMD students)**	**Attendance without presentation (first-year MMD students)**
Half day	0.3 EC	0.15 EC
Whole day	0.5 EC	0.25 EC

MMD course evaluation meeting

For each course, two students are asked to evaluate the course in an evaluation meeting with the course coordinator. The selected students should prepare the meeting to be able to represent all students. They will be sent the results of the multiple choice student evaluation. The following questions will be addressed during the meeting:

- What are the most important positive comments?
- What are the most important negative comments?
- Which conclusions do you reach after re-checking the aims of the course?
- What can you say about the scores for the multiple-choice student evaluation that are negative? Can you explain these results?
- Which are your most important suggestions for improvement of the course?
- Other comments..

A summary of the evaluation meeting is made and is sent to the course coordinator and the students involved. Students should check this summary; comments should be sent to c.oomen@owi.umcn.nl. Each MMD

course evaluation meeting is rewarded with 0.1 EC.

MMD recruitment representation

Students are encouraged to represent MMD in a recruitment presentation at the university where they did their Bachelor's degree. Recruitment representation can be awarded with 0.20 EC, or more if this can be argued. To earn this, the student must organise the following:

- Arrange the presentation with appropriate person at the university
- Prepare and deliver the presentation
- Write a short evaluation report (1 page) and send it to the programme coordinator

MMD Master fair representation

Students may be asked to join in a master fair presentation with the goal to recruit new students. Participation in a master fair is rewarded with 0.05 EC per hour. The student are expected to:

- prepare a (PowerPoint) presentation for the fair
- be involved in the preparation of the fair (for example by contacting the appropriate persons)
- be actively involved during the representation at the master fair
- write a short evaluation report about the recruitment activities and send it to the programme coordinator.

National and International Conferences

To provide the student with a specialised knowledge related to his/her research project or to one of the subthemes of the NCMLS, the student may attend national and international conferences.

A limited budget from the MMD programme is available to cover some of the costs of national conferences. Although students are allowed to attend international conferences, no compensation is given from the MMD programme. Students may apply for a limited budget to cover some of the costs of the conference by sending a letter to the OMT (education management team, secretary C. Oomen) that includes a short essay, outlining the motivation for the attendance, and a budget. Funding for both national and international can also be applied for from other institutions, such as the internship department or funding bodies. A list of funding possibilities for both internships and conferences can be found in the Blackboard MMD Student Community.

Attendance at a conference is awarded with 0.25 EC per day if the student has no own contribution. If the students contributes a poster or an oral presentation, the conference is awarded with 0.5 EC per day. To earn this, selected talks need to be summarised in the Knowledge Transfer Form, as indicated on the form.

Time indication

Activity	**ECs awarded**
Seminar in Nijmegen or elsewhere	0.10 EC
NCMLS forum evening (2 hours)	0.15 EC
PhD workshop (half day)	0.30 EC
MSc MMD course evaluation meeting	0.10 EC
MSc MMD recruitment presentation	0.20 EC
MSc MMD masterfair representation	0.05 EC/hour
National or international conference with own oral or poster presentation	0.5 EC/day
National or international conference without own oral or poster presentation	0.25 EC/day

Appendix D: Elective courses: guidelines and examples

Objective

The elective components of the MMD programme offer the possibility to gain broader and more in-depth knowledge and skills in the field of molecular life sciences. It is also possible to follow elective courses to fill knowledge gaps (e.g. bioinformatics courses, animal physiology).

Guidelines

- The study load of elective courses should be at least 1.5 EC (5 work days). Shorter courses can be part of Knowledge Transfer.
- Electives must be in the area of life sciences and must be at academic level
- Electives must be examined and graded. Exception is Knowledge Transfer, which is not graded.
- Students should discuss their choices of elective components with their Mentor.
- *Before the start of an elective component, the component must have been approved by the Board of Examiners as part of the study plan* (see paragraph 2.2). Students are responsible for submitting their (preliminary) study plan to the Board of Examiners at least two weeks before their meeting.
- The first year should include 2.0 EC of Elective courses, the second year 9.5 EC. The study load of either year can be exchanged. As the opportunities during the second year are generally limited, students are encouraged to follow more elective courses during the first year. The first internship may take a bit longer because of that.
- In the second year, one of the electives *must* be Knowledge Transfer (between 2.0 and 4.0 EC, see paragraph 2.2).

In year 1, elective courses can take place from January to July, depending on the course. Elective courses can be a module where students are studying every day for a certain number of days/weeks, or the courses can be every morning/afternoon for a certain number of weeks/months. It is very important to discuss your ideas and choices with your Mentor as early as possible so that you we can make the arrangements in time. In year 2, elective courses can take place throughout the year, also at the host institution of the second internship. However, between September and December there is most time available.

The following paragraphs describe several options for elective courses.

Courses from other Master's and PhD programmes

Elective courses can be courses from other Master's and PhD programmes. Several options are listed below. **The choice is not limited to this list!** If you choose other courses, you need to include a copy of the module description in the study plan.

- **FNWI courses** are listed in the Prospectuses for Medical Biology Masters, Molecular Life Science Masters etc., which are available online at: http://studiegids.science.ru.nl/. Click on ‘Faculty of Science', subsequently on the master programme you are interested in (e.g. ‘Master's Biology and Master Medical Biology' or ‘Master's Molecular Life Science') and on ‘Courses'.
- **UMC courses** are listed in the Prospectues for Biomedical Sciences and Medicine, which are available online at: http://studiegids.science.ru.nl/. Click on ‘Faculty of Medical Sciences', subsequently on the master programme you are interested in (e.g. ‘Master Biomedical Sciences') and on ‘Courses'. Information is also available from StIP (tel. 15065) at the Study Centre Medical Sciences, (route number 84). Please note that the number of places available in these modules are limited and registration needs to be arranged in time.
- **NCMLS courses** are listed online at http://www.ncmls.eu/
- **External courses** may be MSc or PhD student courses. Below some information sources are listed, though these are not elusive. MSc courses can be taken free of charge, when a student registers for a second study. Students may apply at the OMT-MMD (education management team) for some financial allowance. Please send a request letter by email to c.oomen@owi.umcn.nl. A database of courses can be found at http://www.etplatform.eu/database.

Appendix D

University	*Programme*	*Course descriptions*
	MSc Molecular Medicine	website
Erasmus University Rotterdam	Postgraduate school Molecular Medicine	website
	Postgraduate school MGC	website
Free University Amsterdam	MSc Oncology	course catalogue (click on Faculteit der Aard- en Levenswetenschappen; English will appear after that)
Utrecht University	MSc Biology of Disease (part of biomedical sciences)	course catalogue
	MSc Molecular and Cellular Life Sciences	
Westfälische Willems Universität Münster	MSc Molecular Biomedicine	course catalogue (Fortgeschrittenen Modul; website in German)

Approved courses at the Radboud University Nijmegen

Courses that are listed below are approved by the Board of Examiners. They still need to be included in the study plan, but the summary does not need to be included. **The choice is not limited to this list!**

ISIS	*Title*	*EC*	*Teachers*	*Time*
5T003	Chemical mutagenesis and carcinogenesis*	5.5	Dr. Bos	September
5AM08	Research and development of drugs	5.5	Dr. R. Masereeuw	December
BM001C	Capita Selecta: Molecular and cellular neurobiology	3	Prof. Jenks, Prof. Roubos and Prof. Martens	March -June
BM004B	Capita Selecta: Apoptosis	3	Dr. Boelens, dr. van Kuppeveld	December
BM007B	Working with Radionuclides Level 5B http://www.ru.nl/amd/cursussen/opleidingen/#4	2	Dr. de Leeuw and Dr. Moerman	30 Nov-4 Dec 2009 (English); other dates Dutch
BM009B	Capita Selecta Molecular Biology: Gene expression, chromatin and disease	3	Dr. Logie, dr. Lohrum, Prof. Stunnenberg, dr. Veenstra	Dec -March
BM012B	Capita selecta: Human fertility and infertility	3	Dr. ir. De Boer	Sept-Nov
BM016C	Capita Selecta: Cellular imaging in four dimensions	3	Dr. Willems, Dr. W. Koopman, Dr. J. Fransen	March -June
BM020B	Capita Selecta: Trends in Plant Science	3	Prof. dr. ir. G.C. Angenent, Prof. dr. A.G.M. Gerats and Prof. dr. C. Mariani	Sept - Nov
BM024D	Laboratory animal science and alternatives: http://www.umcn.nl/cdl	3	Dr. ir. P.P.A.M. Leenaars	
BM027B	Capita Selecta: Post-transcriptional regulation in health and disease	3	Dr. Lubsen; Dr. Pruijn and Dr. Swart	March -June

Appendix D

BM032B	Capita Selecta: Endocrinology	3	prof. dr. G. Flik dr. P.H.M. Klaren	March -June
CMBI101	Computational drug discovery	4	Prof. Vlieg and dr. Schaftenaar	Spring
CMBI103	Bioinformatics of protein structure	4	Prof. Vriend	Spring
CMBI104	Bioinformatics seminars: data, technique and applications	4	Prof. Vriend	Autumn
FFIL202A	Evolution and the Mind	3	Prof. Luthy	Sept-Dec
SM023B	Magnetic Resonance II	5	Prof. Wijmenga and Prof. Kentgens	Spring
SM024	Magnetic Resonance IIIa; Advanced Biomolecular NMR	3	Prof. Wijmenga	Spring

Further details of any of the above courses are available from the prospectus website and may be discussed with your Mentor.

Courses that will be approved by the Board of Examiners as part of Knowledge Transfer

ISIS	*Title*	*EC*	*Teacher/coordinator*	*Time*
FC001B	Introduction Science Communication	3	Dr. J.G. van der Born	First quarter

Individual courses
It is possible to do individual courses. Examples of these courses may be:

- (Self study) *preparation for another course*, for example entrance requirements
- Write an *article for a peer-reviewed journal*: Internship 1 is concluded with a standard report as usual. The extra four weeks are used to write an article that is submitted to a peer-reviewed journal. The submitted article is assessed.
- *Conduct thorough literature study and write a review based on these findings (scriptie):* Internship 1 is concluded with a standard report as usual. The extra four weeks are used to conduct a literature survey on a research subject related to Internship 1 or 2 (but not exactly the same) and write a review based on the findings. This literature review may be published. The literature survey is assessed. Guidelines for the scriptie are published on Blackboard (MMD Student Community - information).
- *Writing a grant application for a PhD studentship* (for example UMC St Radboud PhD programme, NCMLS Graduate School programme; or a Mozaiek grant).

Individual courses need to be described in the study plan. You will need to find and confirm a teacher who can be the Examiner of the individual component. The description of the individual component needs the following information. The form for applying for an individual subject can be found on the MMD website. This description needs to be signed by the prospect Examiner and contains the following information:

- Brief content description (title/objectives/methods)
- Course level (to be confirmed by the teacher involved)
- Time investment (in EC, as indicated in prospectus/course catalogue)
- Means of examination
- Address of the university or institute and teacher(s) involved

Appendix E: Scores SEP Report 2005

Theme *Theme leader*	Subtheme *Subtheme leader*	Academic staff	Assessment	Score
1: Infection, Immunity and Tissue Repair *Prof. dr. G.J. Adema*	1a: Infection and Autoimmunity *Prof. dr. J. Schalkwijk*	49.06 fte	Quality	4
			Productivity	4
			Relevance	4
			Vitality and feasibility	4
1: Infection, Immunity and Tissue Repair *Prof. dr. G.J. Adema*	1b: Immune Regulation *Prof. dr. G.J. Adema*	44.67 fte	Quality	4-5
			Productivity	5
			Relevance	4
			Vitality and feasibility	4
1: Infection, Immunity and Tissue Repair *Prof. dr. G.J. Adema*	1c: Tissue Engineering and Pathology *Dr. A.H.M.S.M. van Kuppevelt*	23.72 fte	Quality	4-5
			Productivity	4-5
			Relevance	4-5
			Vitality and feasibility	4-5
2: Metabolism, Transport and Motion *Prof. dr. B. Wieringa*	2a: Energy and Redox Metabolism *Prof. dr. B. Wieringa*	27.95 fte	Quality	4-5
			Productivity	4-5
			Relevance	4
			Vitality and feasibility	4
2: Metabolism, Transport and Motion *Prof. dr. B. Wieringa*	2b: Membrane Transport and Intracellular Motility *Prof. dr. R.J.M. Bindels*	36.81 fte	Quality	4-5
			Productivity	4-5
			Relevance	4
			Vitality and feasibility	4
3: Growth and Differentiation *Prof. dr. H.G. Stunnenberg*	3a: Functional Genomics *Prof. dr. H.G. Stunnenberg*	43.09 fte	Quality	4-5
			Productivity	4-5
			Relevance	4-5
			Vitality and feasibility	4-5
3: Growth and Differentiation *Prof. dr. H.G. Stunnenberg*	3b: Neural Development *Prof. dr. G.J.M. Martens*	15.16 fte	Quality	4
			Productivity	3-4
			Relevance	4
			Vitality and feasibility	3-4
3: Growth and Differentiation *Prof. dr. H.G. Stunnenberg*	3c: Signalling Networks *Prof. dr. J. van Zoelen*	14.11 fte	Quality	3-4
			Productivity	4
			Relevance	4
			Vitality and feasibility	3-4
3: Growth and Differentiation *Prof. dr. H.G. Stunnenberg*	3d: Protein Structure and Design *Prof. dr. W. de Jong*	12.26 fte	Quality	4-5
			Productivity	4
			Relevance	4
			Vitality and feasibility	4-5

Remark:
Theme 3 has been changed considerably and is reintegrated as two subthemes:

Appendix E

	(Sub)theme	(Sub)theme Leader /
3	Cell Growth and Differentiation	Prof. dr. J.H.L.M. van Bokhoven
3a	Genetic & Epigenetic Pathways of Disease	Prof. dr. J.H.L.M. van Bokhoven
3b	Chemical and Physical Biology	Prof. dr. ir. J.C.M. van Hest

Appendix F: RUNMC (junior) Principal Investigators and involvement in the MSc MMD programme

RUNMC (Junior) Principal Investigators (criteria in paragraph 3.3.3) and group leaders from the Faculty of Science who are involved in the MSc MMD Programme. (Junior) Investigators whose first research institute is another, clinical research institute are indicated in italics.

Theme 1a: Infection and Autoimmunity
Theme 1b: Immune Regulation
Theme 1c: Tissue Engineering and Pathology
Theme 2a: Energy and Redox Metabolism
Theme 2b: Membrane Transport and Cell dynamics
Theme 3a: Genetic & Epigenetic Pathways of Disease
Theme 3b: Chemical & Physical Biology

PI: RUNMC Principal Investigator (criteria in paragraph 3.3.3)
jPI: RUNMC junior Principal Investigator
N-PI/N-jPI: Group leaders from the Faculty of Sciences still have to be assessed according to RUNMC criteria.

Teaching qualifications as used in RUNMC in two fields: theoretical teaching and supervision research internships. A description of the (levels of) teaching qualifications is found in **Appendix Q**.

surname	first name	subtheme	(j)PI	Teaching qualification		# currently supervised PhD students	# PhD students with completed theses	Affiliation to other institute
				theoretical	research			
Theme 1: Infection, Immunity and Tissue Repair								
van Kuppeveld	Frank	1a	PI	CQ	AQ	4	4	N4i
Melchers	*Willem*	1a	PI	BQ	BQ	9	12	N4i
Netea	*Mihai*	1a	PI	SQ	BQ	7	6	N4i
Pruijn	Ger	1a	N-jPI	n.a.	n.a.	7	14	
Radstake	Tim	1a	jPI	n.a.	n.a.	5	2	N4i
Rij, van	Ronald	1a	jPI	n.a.	n.a.	2	0	N4i
Sauerwein	*Robert*	1a	PI	n.a.	n.a.	14	8	N4i
Schalkwijk	Joost	1a	PI	AQ	AQ	5	22	N4i
Zeeuwen	Patrick	1a	jPI	n.a.	BQ	5	1	N4i
Adema	**Gosse**	**1b**	PI	BQ	AQ	6	16	Oncology
Boerman	Otto	1b	PI	BQ	AQ	11	17	Oncology
Brock	Roland	1b	PI	SQ *	AQ	8	11	
Dolstra	Harry	1b	jPI	SQ	BQ	7	3	Oncology
Figdor	Carl	1b	PI+	BQ	n.a.	3	26	Oncology
Hilbrands	*Luuk*	1b	PI	AQ	BQ	5	6	N4i
Jansen	Joop	1b	PI	BQ	BQ	8	7	Oncology
van der Reijden	Bert	1b	PI	BQ	AQ	5	4	Oncology
de Vries	Jolanda	1b	jPI	BQ	AQ	1	2	Oncology
Jansen	John	1c	PI+	CQ	AQ	25	42	
van Kuppevelt	Toin	1c	PI	AQ	AQ	14	9	Oncology
Theme 2: Metabolism, Transport and Motion								
Heerschap	Arend	2a	PI	BQ	BQ	9	20	Oncology
van den Heuvel	*Bert*	2a	PI	BQ	BQ	10	17	IGMD
Huynen	Martijn	2a	PI	CQ	SQ	5	5	IGMD
Nijtmans	*Leo*	2a	jPI	n.a.	n.a.	4	3	IGMD

Appendix F

Smeitink	*Jan*	2a	PI+	SQ	BQ	15	10	IGMD
Wieringa	**Bé**	**2a**	PI	AQ	AQ	5	30	IGMD
Bindels	René	2b	PI+	AQ	AQ	12	27	IGMD
Deen	*Peter*	2b	PI	AQ	BQ	4	8	IGMD
Friedl	Peter	2b	PI	n.a.	n.a.	7	6	Oncology
Hoenderop	Joost	2b	PI	BQ	AQ	11	12	IGMD
Knoers	*Nine*	2b	PI	BQ	n.a.	5	9	IGMD
Koenderink	Frans	2b	PI	CQ	AQ	10	16	IGMD
Masereeuw	Roos	2b	jPI	AQ	AQ	5	6	IGMD
Russel	Jan	2b	jPI	BQ	n.a.	4	3	N4i
Theme 3: Cell Growth and Differentiation								
van Bokhoven	**Hans**	**3a**	PI	BQ	BQ	8	8	DCN
Brunner	Han	3a	PI	BQ	n.a.	6	13	IGMD
Cremers	Frans	3a	PI	CQ	n.a.	6	13	
Geurts van Kessel	Ad	3a	PI	BQ	BQ	8	15	Oncology
Hollander, den	Anneke	3a	jPI	n.a.	BQ	7	0	IGMD
Kremer	Hannie	3a	PI	BQ	BQ	2	7	DCN
Logie	Colin	3a	N-jPI	n.a.	n.a.	1	1	
Lohrum	Marion	3a	N-jPI	n.a.	n.a.	2	0	
Roepman	Ronald	3a	jPI	BQ	BQ	2	3	
Schalken	Jack	3a	PI	n.a.	n.a.	5	30	Oncology
Schenck	Annette	3a	jPI	n.a.	BQ	2	0	DCN
Stunnenberg	Henk	3a	N-PI	n.a.	n.a.	8	13	
Veenstra	Gert Jan	3a	N-jPI	n.a.	n.a.	4	1	
Veltman	Joris	3a	jPI	BQ	BQ	4	1	IGMD
van Hest*	Jan	3b	N-PI	n.a.	n.a.	17	6	
Rutjes	Floris	3b	N-PI	n.a.	n.a.	18	25	
van Zoelen	Joop	3b	N-PI	n.a.	n.a.	6	17	

Index

*	has applied for higher teaching qualification; to be assessed
n.a.	has not applied for teaching qualifications for RUNMC teaching qualifications
SQ	start qualification
BQ	basic qualification
AQ	advanced qualification
CQ	complete qualification

Notes

Research internship supervision qualifications include SQ, BQ and AQ

Theoretical teaching qualifications include SQ, BQ, AQ and CQ

Appendix G: Example of research training period workplan

Work plan MMD Internship 1

study plan internship1_defv7.doc

§ This form will be completed **by the student**, and signed by the NCMLS supervisor and student.
§ The signed form will be sent at least 2 weeks before the meeting of the Board of Examiners to Mrs.C. Knibbeler, Board of Examiners MSc MMD. Onderwijs en Studentenzaken, Huispost 162, P.O. Box 9101, 6500 HB Nijmegen, The Netherlands.

Name and initials student	Student number
Miesen P.	0 6 0 9 5 3 6

Title of research internship

Role of TRIAD1 in stress responses

Start date (dd-mm-yyyy)	Estimated end date (dd-mm-yyyy)	Isis code
18-01-2010	31-07-2010	8P01

Host department, institution, city, country

Central Hematology Laboratory

Name of primary supervisor (PI or aspiring PI)	E-mail address primary supervisor
Bert van der Reijden	B.vanderReijden@chl.umcn.nl
Name of NCMLS External Assessor	**E-mail address NCMLS External Assessor**
Fons van de Loo	A.vandeLoo@reuma.umcn.nl
Optional: Daily supervisor (e.g. PhD student)	**E-mail address Daily Supervisor**
Davide Monteferrario	D.Monteferrario@chl.umcn.nl

A. Research Question(s) & Background (max. 150 words, written by student)

Leukemia is caused by disturbances in proliferation, apoptosis or differentiation of hematopoietic cells - processes known to be controlled by many biological pathways. One of these pathways is the ubiquitin-proteasome-system (UPS) which regulates several proteins involved in blood cell development.
TRIAD1 is a component of the UPS as it functions as E3 ubiquitin ligase. Interestingly, several associations to pathways that are implicated in malignant leukemic transformation have been reported. It has been shown that one of the TRIAD1 interacting proteins (HOIP) is also involved in the activation of the canonical NFκB response. Furthermore, TRIAD1 gets upregulated during the unfolded protein response (UPR). The UPR has been suggested to play an important role in modulating cell sensitivity to chemotherapy as well as in the development of neutropenia. This study therefore aims to further clarify the role of TRIAD1 in these two cellular stress responses.

B. Specific aims (max. 100 words, written by student)

To activate the canonical NFκB survival pathway, ubiquitylation of the upstream activator NEMO by the LUBAC (HOIP-HOIL complex) is essential. HOIP in turn has been shown to interact with TRIAD1 in a Yeast-2-Hybrid screen. This study aims to determine whether this interaction is also occuring *in vivo* and to investigate a possible role for TRIAD1 in the activation of NFκB.
TRIAD1 has been shown to be upregulated upon ER-Stress in the context of UPR. However, this induction needs to be validated by independent methods. Thus, studies to discover how TRIAD1 influences cell sensitivity to UPR-inducing agents will be performed.

Appendix G

C. Methods (list maximum of 8 methods, written by student)

Proposed methods used to study TRIAD1 function are:

- Transfection
- Transduction
- Immunoprecipitation
- Immunofluorescence
- FACS
- EMSA
- Western Blot
- (q)PCR

D. Plan of investigation (max. 200 words, written by student)

The dynamic of the interaction between TRIAD1 and LUBAC needs to be validated in a physiological, cellular setting. Therefore immunoprecipitation studies will be performed. Furthermore, cellular co-localization of Triad1, Hoip and Hoil will be investigated by immunofluorescence analysis. Finally, the influence of TRIAD1 on NFκB activation will be studied by NFκB reporter cell lines assays and EMSA.
The induction of TRIAD1 during the UPR will be further confirmed by western blot and immunoflourescence using newly available anti-TRIAD1 antibodies. Afterwards, the effect of either TRIAD1 overexpression or knockdown on cell sensitivity towards UPR inducing agents, such as DTT and tunicamycin, will be tested by mean of colony forming assays. By this approach we wish to determine whether TRIAD1 plays a biological role in modulating cellular responses against induced ER stress.

E. Other activities foreseen during the internship (number of department seminars, literature meetings etc.; don't include elective courses; max. 100 words)

During my internship at the central hematology lab I will participate in several other activities including both internal and external meetings. On a weekly basis there will be department seminars and meetings with other research groups from different laboratories in the NCMLS (e.g. the Tumor Immunology Lab). A special meeting for members of the research group I am working with will also be held every week. Besides this, every second week I will attend a Journal Club. A highlight during my internship will for sure be the Dutch Hematology Congress which I will visit on January 27th and 28th.

Signature of the NCMLS supervisor:	Date (dd-mm-yyyy):

Signature of the student:	Date (dd-mm-yyyy):

NB: for approved (unaltered) components: description does not need to be submitted again

Appendix H: Education and Examination Regulations (OER)

Research Master's programme in Molecular Mechanisms of Disease

Education and Examination Regulations 2009 (format curriculum 2008)
(OER: Onderwijs en Examen Regeling)

Appendix H

Paragraph 1 General Rules

Section 1.1 Applicability of the regulations

These regulations apply to the teaching and (interim) examinations in the Master's programme in Molecular Mechanisms of Disease, further referred to as 'the programme'.

The programme is presented in the Nijmegen Centre for Molecular Life Sciences (NCMLS) research graduate school, a joint graduate school of the Radboud University Nijmegen Medical Centre and the Faculty of Science, Mathematics, and Computing Sciences, both part of Radboud University Nijmegen and further referred to as 'the faculties'.

Section 1.2 Definitions

Those concepts appearing in the regulations, which also occur in the Higher Education and Scientific Research Act (HESRA), will have the meaning ascribed to them in this act.
The following definitions apply to these regulations:

a. the Act:
   the Higher Education and Scientific Research Act of 8 October 1992 (GG 593) as it currently stands
b. the programme:
   the Master's programme referred to in section 7.3a, subparagraph 1b of the Act
c. student:
   a person registered at Radboud University Nijmegen for education in and (interim) examinations of the programme
d. teacher:
   any person giving classes to students, including guest speakers
e. Bachelor's degree programme:
   the Bachelor's programme referred to in section 7.3a, subparagraph 1a of the Act
f. research training period:
   a practical project as referred to in section 7.13, subparagraph 2d of the Act, in one of the following forms:
   - practical training and experience
   - writing a Master's thesis
   - writing an assignment
   - participating in workshops
   - conducting a literature study
   - participating in some other educational activity designed for the acquisition of certain skills.
g. interim examination: an assessment of the student's knowledge, insight and skills with regard to a particular teaching unit, as well as an evaluation of that assessment by at least one examiner appointed for this purpose by the Board of Examiners.
h. Master's examination / final examination: a review of the student's academic achievements in which the Board of Examiners assesses whether or not all interim examinations of all teaching units that are part of the Master's programme have been successfully completed. In addition to the evaluation of the outcomes of such assessments, the examination may also include its own, separate assessment by the Board of Examiners of the knowledge, understanding and skills of the candidate (in terms of Article 7.10 of the Act).
i. Board of Examiners:
   the Board of Examiners of a programme instituted in terms of section 7.12 of the Act (see also RU Structure Regulations)

j. Examiner: the person appointed by the Board of Examiners to specify, set and mark interim examinations in terms of section 7.12 of the Act
k. EC: academic credits in accordance with the European Credit Transfer System: 1 credit equals 28 hours of study. The study load for one year equals 60 credit points, which is equivalent to 1680 hours of study
l. Institution: Radboud University Nijmegen
m. Mentor: a senior scientist who is appointed to guide a student throughout the programme.

Section 1.3 Aim of the programme

The aim of the MSc research programme Molecular Mechanisms of Disease is to provide MSc students with a multi-faceted education in the domain of Molecular Life Sciences related to disease, particularly in the fields of Molecular Medicine, Cell Biology and Translational Research. The intention is to create highly qualified researchers who can successfully carry out internationally oriented PhD projects in the area of Molecular Life Sciences, with a focus on pathological processes in living cells; or who can participate in clinical research programmes contributing to the innovation of translational research at the interface of molecular and medical science.

After successful completion of the programme, an MSc student should:

- be capable of autonomously formulating a research problem, designing and performing scientific research and be equipped with the communication skills to be able to participate in scientific discussions at an international level
- have an overview of the research field of Molecular Life Science and be capable of participating in multi-disciplinary research projects. The MSc student should also have fundamental and advanced knowledge of the latest developments in the area of Molecular Life Sciences
- be able to write at the level of published articles in international peer-refereed journals. Furthermore, the MSc student must be able to present his/her work in the English language before an international scientific audience
- be able to propose plans for continuing their research in a PhD programme and should possess the knowledge, insight and research skills necessary for the execution of such a PhD project of international standard
- be able to assess and accommodate the societal and ethical impact of scientific research at relevant moments and in relevant situations in his/her scientific career.

Section 1.5 Type of programme

1. The programme is a full-time programme.
2. In a case of pregnancy or concern over children, the Board of Examiners may allow the individual programme to be adapted at the request of the student.

Section 1.6 Title awarded on completion of the programme

The degree of Master of Science (MSc) will be awarded.

Section 1.7 Academic weight

The Master's examination has a weight of 120 (2 x 60) credits in accordance with the European Credit Transfer System.

Section 1.8 Language

Classes and interviews are conducted in English and all (interim) examinations are written in English, unless the Board of Examiners decides otherwise.

An advanced command of English is required for participation in classes and examinations, as stated in the Code of Conduct Foreign Languages of Radboud University Nijmegen, article 7.2.c. This

requirement is satisfied if the student can submit a testimonial of a TOEFL test or an equivalent test certifying a minimum score of 550 (paper test), 213 (computer test) or 79 (Internet test). For native speakers and students who have completed their prior education in English, a General Certificate of Education (grade C) or equivalent is sufficient. It is assumed that students who have studied to Bachelor's or an equivalent level in the Netherlands will have a sufficient level of English and do not need to submit a TOEFL test or equivalent.

Section 1.9 Additional students

Students undertaking certain components of the Master's in Molecular Mechanisms of Disease are expected to adhere to the Education and Examination Regulations, but responsibility for ensuring this does not lie with the Board of Examiners of Molecular Mechanisms of Disease.

Paragraph 2 The Master's programme

Section 2.1 The composition of the Master's programme

1. The programme consists of the following theoretical modules: 8IC01, 8C01, 8SE01, 8MC02, 8MC03, 8T01, 8T02, 8T03, 8P01, 8MC01 8ST01 and 8P02 (see Table 1).
1. Study plan: The individual Master's programme must be submitted as a study plan. Guidelines for the study plan are found in the prospectus. The study plan should include all of the Master's programme, including descriptions of the two internships and the elective courses. A preliminary study plan is submitted to the Board of Examiners for approval of the individual modules, as soon as these are known. The preliminary study plan can be changed and additions can be made at any time. The preliminary study plan must be approved by the Board of Examiners before the start of an individual module. The final study plan is submitted before the application to the Master's examination, which is assessed according to the final approved study plan.
2. In the first year students will complete a Research Training Period (8P01) of 26 weeks, including the writing of a full written report, preferably structured as an article. This internship has to be approved by the Board of Examiners as part of the individual study plan. Both research training periods (8P01 and 8P02) are guided by a supervisor, but students will be encouraged to use their own initiative and acquired knowledge. The research training periods are assessed on the basis of: professional attitude and activities, an oral presentation and a written report (8P01) or Master's thesis (8P02).
3. The student must follow elective courses with a study load worth 2.0 credits in the first year and 9.5 credits in the second year. One of the electives should be Knowledge Transfer, as described in the prospectus. The Knowledge Transfer elective should be worth 0-2.0 credits in the first year and 2.0-4.0 credits in the second year. Other electives have a minimum study load worth 1.5 credits (5 work days) and may be chosen from other Master's or PhD studies, or may be composed as an individual course (code: VKO/IND). Electives have to be approved by the Board of Examiners in the individual study plan.
4. The student completes a second Research Training Period (8P02) of 31 weeks (45 credits), including the writing of a Master's thesis as described elsewhere.

5.

Table 1: Credit points guide for year 1 and 2.

Code	Course	Year 1	Year 2	Grade/pass
8IC01	Introduction course	1.5	-	P
8C01	Excellence in Communication	1.5	-	G
8SE01	Science & Society	1.5	-	G
8MC02	Master Class Theme 2	1.5	-	G
8MC03	Master Class Theme 3	1.5	-	G
8T01	Infection, Immunity and Tissue Repair	5.5	-	G
8T02	Metabolism, Transport and Motion	5.5	-	G
8T03	Cell Growth and Differentiation	5.5	-	G
8P01	Research & write up: year 1	34	-	G
	Electives: year 1 [a]	2	-	G [b]
8MC01	Master Class Theme 1	-	1.5	G
8ST01	Genomics and Statistics	-	4	G
8P02	Research & write up: year 2	-	45	G
	Electives: year 2 [c]	-	9.5	G [b]
	Total	**60**	**60**	

[a] Electives year 1 may include up to 2 credits for Knowledge Transfer
[b] Knowledge Transfer is graded "Passed" (P)
[c] Electives year 2 include between 2.0 and 4.0 credits for Knowledge Transfer

Section 2.2 The form of tuition

The MSc student's programme entails three different forms of tuition:

- *(Compulsory) theoretical modules*: these courses may consist of five distinct forms of tuition: lectures and demonstrations, discussions, enquiry-based projects, communication skills training and the research training period.
- *Research internships:* the programme includes two practical training periods, in which the student conducts research under the supervision on a scientist. The research training periods are concluded with an article-like report (8P01, 1st research training) or a master's thesis (8P02, 2nd research training). The work plans for the research training period must be approved by the Board of Examiners before the start of the training period.
- *Elective courses:* elective courses may be either theoretical or practical courses, which the student uses to specialise himself/herself. Examples of elective courses are found in the prospectus. Elective courses must be approved by the Board of Examiners as part of the study plan before the start of the course.

Students receive support and guidance from their personal mentor throughout the programme, as described in the prospectus. The research training periods are supervised by an internship supervisor.

Paragraph 3 Assessment of the programme

Section 3.1 The form of assessment

1. The assessments are in the form of written examinations or assignments, or presentations.
2. All components of the programme are assessed, but not necessarily graded.
3. The Board of Examiners may decide that a student's work can be assessed in another form if a student requests this in writing.
4. Students with disabilities are allowed to write examinations in a manner best suited to their particular disability. If necessary the Board of Examiners will obtain expert advice before taking a decision.
5. In the case of oral examinations (sections 3.1.3 and 3.1.4), the examination is carried out by at least two teachers from the MMD Master's programme.

Section 3.2 Determination and announcement of interim examination results

1. Written examinations, including assignments, are evaluated by teachers from the relevant course (the examiners).
2. The Examiner determines the result of a written examination within four weeks from the day on which it was written.
3. The Examiner provides the faculty administration (Academic Education Institute: IWOO) with the information required for announcing the student's result via the KISS service (KISS is the institution's internet student services).
4. Repeat examinations are only permitted once per academic year per subject. Between the date of announcing the result and the date of the retake examination there will be a period of at least two weeks. Students who have passed an interim examination for a course are allowed to retake that interim examination only once. In all cases, the grade most recently obtained counts toward the Master's examination. If all students pass the interim examination at the first sitting, the Examiner is not obliged to provide a retake examination.
5. The results of all courses are numerically graded on a scale of 1-10, including half grades, where 6.0 is a pass and 10 is outstanding. The grade 5.5, however, cannot be given.
6. In the examination papers the student's attention is drawn to the right of inspection as defined in 3.4.1 below, as well as the possibility of appeal to the Radboud University Council of Appeal for Examinations up to four weeks after the Examiner's decision.
7. The Examiner must keep written examination and assessment papers for the period of a year. The student can inspect his/her examination paper for up to four weeks from the date that the results are released.

Section 3.3 Cheating

If cheating or plagiarism is suspected or proven during an examination or written assignment, the Board of Examiners can bar students from taking any further part in the relevant examination, as described in article 12 of the Rules and Regulations of the Board of Examiners.

Section 3.4 Period of validity

1. The credits for courses completed in the programme are valid for four years.
2. In individual cases the Board of Examiners may extend the validity of a successfully completed course for a stipulated period.
3. Students must achieve 48 credit points in the first year in order to progress to the second year.

Section 3.5 Right of Inspection

1. On request, the student may inspect her/his evaluated work during a period of four weeks after the announcement of the result of a written interim examination.
2. During the period stipulated in 3.4.1, all interested parties may be notified of the questions and assignments in the relevant interim examination, and if possible of the norms according to which the student's examination was evaluated.
3. In contrast to the articles above, the Board of Examiners may decide that an inspection meeting is organised and announced on an assigned moment at an assigned place. If the student cannot be present because of circumstances beyond his/her control, an extra opportunity of inspection is offered, as described in the article above.

Section 3.6 Dispensation

If so requested and after hearing the Examiner, the Board of Examiners can allow a student dispensation for a research period and/or for electives.

Section 3.7 Final grade / Master's examination

1. The Board of Examiners determines the final grade once the student has submitted adequate proof that interim examinations have been successfully completed and the required academic standard thereby has been achieved, according to the approved Study Plan.
2. Before determining the final results the Board of Examiners will give a definitive evaluation of the Master's thesis.
3. The result of the Master's examination is determined by the Board of Examiners at least four times per academic year, on dates that are published before the start of the academic year.

Section 3.8 Degree

1. Candidates who have successfully completed the Master's examination and the thesis will be awarded the Master of Science (MSc) degree.
2. The awarded degree will be recorded on the examination certificate.

Section 3.9 *Judicia*

The Board of Examiners will judge whether the Master's certificate should be accorded the distinctions of *bene meritum*, *cum laude* or *summa cum laude.* The criteria for these *judicia* are described in article 14 of the Rules and Regulations of the Board of Examiners.

Paragraph 4 Prior Education

Section 4.1 Admission requirements for Master's programme

1. To be admitted to the programme, candidates must:
    a. have a Bachelor of Science (BSc) degree in the life sciences such as Cell Biology, Molecular Medicine, Biomedical Sciences, Biochemistry, Biotechnology or Molecular Biology or have completed training which the Board of Examiners deems to be of a comparable level
    b. have BSc examination results in the top 10% of their group, the Board of Examiners may make exceptions in special cases
    c. have chosen the research-oriented specialisation in their BSc programme, where possible
    d. have an excellent command of English
    e. submit an MMD application form.

2. In addition to the prior education or the qualities of the candidate, at least two members of the entrance selection committee will hold an individual interview (conducted in English) with the candidate. Admission to the programme is dependent on the interview.

Paragraph 5 Tuition

Section 5.1 Administration of academic progress

1. The Faculty will record students' individual academic results.
2. The Faculty will provide each student with access to their results at least once every semester.

Section 5.2 Teaching

1. The Faculty is responsible for the introduction and teaching of students registered for the programme, also in regard to guidance in respect of possible avenues of study both within and outside the programme.
2. Students who regularly, or over an extended period, achieve little or no academic result will be invited for an interview with the Mentor to discuss whether to continue or terminate their studies. In the case of persistent unsatisfactory results, the Mentor will consult the Board of Examiners in order to furnish compelling advice for the student abandoning the programme.

Paragraph 6 Concluding regulations

Section 6.1 Transitional regulations

The Education and Examination Regulations (OER) apply to students who commence the programme in September 2009 or later.

Section 6.2 Determining this OER/Amendments

1. Determining or amending the Education and Examination Regulations (OER) is the responsibility of the Dean of the Faculties after consultation with the Programme Committee and consent by the Joint Faculty Meeting.
2. In terms of these regulations, an amendment may not influence any other decision taken by the Board of Examiners about a student that would disadvantage the student in any way.

Section 6.3 Declaration

The Dean of the Faculties is responsible for declaring these regulations, the regulations and guidelines laid down by the Board of Examiners and any amendments to these documents in an appropriate manner. Any interested party can obtain a copy of the documents referred to from the Faculty Office.

Section 6.4 Coming into effect

These regulations will come into effect on 31 August 2009.

Appendix I: Selection procedure

MSc MMD student selection procedure and documents (short version June 2009)

General procedure

The application procedure is given on our MMD website: http://www.ru.nl/master/ncmls-mmd/admission_amp/enrolment/. Students send preliminary inquiries and a full application (filled-in MMD form [**attachment 1**], with motivation and transcripts) to MMD@ncmls.ru.nl. Two independent references should be given on a standard MMD form (**attachment 2**) and directly send to MMD@ncmls.ru.nl. The programme coordinator in 2009 and 2010 is the contact person for the students and checks for completeness of the applications and references.

The interview coordinator assesses whether former education, references, the theoretical level and motivation of the students positions them in the top 10%. In case of doubt, theme representatives or international NCMLS colleagues are consulted, and a decision is taken whether an interview will be scheduled.

Students from Radboud University Nijmegen and students who can travel to Nijmegen

For students from the Radboud University Nijmegen or international students that can travel to Nijmegen by train or airplane (max. reimbursement €200), 3 or 4 interviews are scheduled consecutively on one day in Nijmegen by the programme coordinator. The coordinator sends a general e-mail to the applicant with key words of the topics of the three NCMLS themes and internet sites with free access to text books (for an example, see **attachment 3**). The interview in most cases will be held between 2 and 3 weeks after the coordinator sends the interview-invitation e-mail to the candidate.

International students

For international students which are living too far away, the interview is done by telephone, but a skype/webcam interview would be preferred. The interview coordinator invites two members of the MSc MMD selection committee for the interview. One of the two members always is an NCMLS theme representative, which will safeguard that selection criteria are not too different. Preferably, the interviewers belong to different NCMLS themes (see below).

The NCMLS theme representative together with the international student plans the date/time for the long-distance telephone/skype interviews, fills-in the interview score sheet (attachment 4), and communicates the result to the interview coordinator and to C. Oomen. After a decision is taken by the interview coordinator, C. Oomen e-mails the candidate the result of and feedback on the interview.

UMC St Radboud sponsorship

Based on the availability of external (industry, foundations) or internal (UMC St Radboud, Radboud Scholarship Programme) funding, a ranking of the international (mostly non-EU) students must be made. It is our long-term goal to annually provide 6 scholarships for international MMD students. The Board of Examiners is responsible to make this ranking. The Interview coordinator and the NCMLS theme representatives write and advice on the ranking to the Board of Examiners.

Application deadlines 2009-2010:

All international students without private funding:	1 December
Non-EU students with private funding	1 February and 15 March
EU students	1 March and 1 April

Most of the interviews with international students will take place between 15 November and 15 February, as the deadlines for Huygens Fellowship Programme and the Netherlands Fellowship Programme are at 1 February and 1 March (for most countries), respectively. Other interviews can be

scheduled up to May. Visa applications for non-EU students should be started as soon as possible (students must prepare all formal documents), but not later than 1 June.

1.1 MMD Interview-Procedure

In order to evaluate whether our interview structure/questionnaire contains the necessary questions, the goals of the interview are given below. For every goal, sample questions have been made by each interviewer, which do not have to be literally asked, but which are thought to help us to formulate a structure of the interviews and appropriate scoring of the individual parts. Most parts are scored on a scale from 0-10 in order to be able to compare different candidates that are interviewed by three different interview-committees.

1.1.1 Goals of the interview

Evaluate:

1. Whether the resume (CV, motivation etc.) is as stated,
2. The knowledge level of the candidate
3. Whether the applicant can think and solve problems, ability to grasp quickly new contents
4. Whether the candidate is eager to discuss
5. Whether the candidate is able to comprehend questions
6. Whether the candidate communicates well
7. The applicant's long-term goals and ambitions, including a self-evaluation (SWOT analysis)
8. A glimpse of the personality of the applicant, e.g. to assess cultural differences
9. Explicit points from the application that need further clarification

1.1.2 The actual questionnaire

1. Evaluate whether the resume (CV, motivation etc.) is as stated:

   Why do you want to participate in our programme?
   Describe the most interesting/least interesting course you have followed in your bachelor's phase and why? If you could change a certain aspect in your bachelor's programme, which one would that be?
   How would you describe your ideal master's programme? Which contents are important for you?
   Describe the for you at the moment most burning scientific question?

2. Evaluate the knowledge level of the candidate :

   Every committee member should prepare 2-3 real knowledge-question from his area on the bachelors level, e.g. end-exam level question of a end-phase bachelors course.

3. Evaluate whether the applicant can think and solve problems, ability to grasp quickly new contents

   Show a figure of one of your recent manuscripts to the candidate, explain the background and ask for interpretation. By telephone interview: check in before how to get this to the candidate just before the interview (FAX, mail?). Pictures can also be sent using Skype.
   Further questions arising from these results?
   Can you suggest the next experiments to try to answer these questions?

4. Evaluate the candidate's eagerness to discuss
5. Evaluate the candidate's ability to comprehend questions
6. Evaluate the candidate's communicative behaviour.

Appendix I

7. Evaluate the applicant's long-term goals and ambitions, including a self-evaluation (SWOT analysis)

   Where do you see yourself 3 years after the successful completion of the programme?
   Which have been your strongest/weakest subjects so far, why?
   Do you learn better from books, from other people or from doing?
   If you encounter a very difficult part of a subject, how do you go about mastering it? Give a concrete example!
   Describe your technical expertise until today, what are your strengths/weaknesses? How did you obtain this expertise?

8. Evaluate a glimpse of the personality of the applicant, e.g. to assess cultural differences

   How would you feel about getting in front of group of experts to describe your research project?
   If you did not understand what was being explained to you, how would you go about this?
   If your research project was not working out, and you thought you knew why, whom would you tell about it?
   What other qualities besides technical expertise would you think you need to acquire to become a good scientist?

9. Explicit points from the application that need further clarification
   To which other graduate programme/alternative career route have you applied? If you are accepted at several programmes, on what will you base your decision where to go to?

10. Overall score (1-10)

Appendix I

Interview score sheet:

1.2 MMD interview summary

Student:
Interview date:
Interviewers:
Exam questions:

	Category	**Comments**	**Score (1-10)**	
1	CV, motivation			
2	Knowledge (exam questions)			
3	Ability to grasp concepts			
4	Eagerness to discuss			
5	Ability to comprehend questions			
6	Communicative behaviour.			
7	Long-term aims (SWOT analysis)			
8	Personal qualities			Use + / - system for 8 & 9
9	Other course or career options			
10	Overall impression/average score			

11	Observed Knowledge Gaps / Recommended Reading		

Appendix J: Details of admitted students

Table A: Background of admitted students

Start year	Number students	Dutch BSc (%)	International BSc (%)	Male (%)	Female (%)	Mean NL BSc result	Mean interview result (all)
2005	3	2 (67%)	1 (33%)	1 (33%)	2 (67%)	8.8	8.7
2006	8	4 (50%)	4 (50%)	1 (13%)	7 (87%)	7.3	7.6
2007	11	6 (55%)	5 (45%)	3 (27%)	8 (73%)	7.9	7.9
2008	11	7 (64%)	4 (36%)	3 (27%)	8 (73%)	8.1	7.8
2009	16	9 (56%)	7 (44%)	8 (50%)	8 (50%)	8.1	8.0
TOTAL	**49**	**28 (57%)**	**21 (43%)**	**16 (33%)**	**33 (67%)**	**8.0**	**7.9**

Table B: Degrees of admitted students

	Start year 2005	Start year 2006	Start year 2007	Start year 2008	Start year 2009
RUN Bachelor MLS	1	2	4	1	4
RUN Bachelor (Medical) Biology	1	1	1	4	5
RUN Bachelor BMS	0	0	0	1	0
Other Dutch WO Bachelor	0	1	0	0	1
Dutch HBO Bachelor#	0	0	1	2	0
EER Bachelor	0	2	2	0	1
Non-EER Bachelor/master	1	2	3	3	5
Total	**3**	**8**	**11**	**11**	**16**

#candidates with a Dutch HBO Bachelor who were admitted to the programme are always international students who are well above the scientific level of the HBO

Other Dutch Bachelor's: Molecular Life Sciences of Maastricht University
EER Bachelors include: BSc Genetic Engineering, BSc Chemical Biology, BSc Biotechnology, BSc Medical biotechnology
Non-EER Bachelors and masters include: BSc Pharmacy, BSc Biology, MSc Applied Microbiology, BSc Molecular Biology, Genetics, Biochemistry, MSc Microbiology, BSc Molecular Biology and Genetics, MSc Biochemistry and Molecular Biology, BSc Pharmaceutical/Chemistry/Research Sciences

Appendix J

Table C: Nationalities of admitted students

	Start year 2005	Start year 2006	Start year 2007	Start year 2008	Start year 2009	Total
Belgium	1					**1**
Brazil					1	**1**
Bulgaria		1				**1**
Canada		1				**1**
China			2			**2**
Finland		1				**1**
Germany		1	2	4	7	**14**
India					1	**1**
Indonesia				2		**2**
Netherlands	1	3	4	3	3	**14**
Pakistan			1			**1**
Poland			1			**1**
Romania					1	**1**
Syria	1					**1**
Turkey			1	1	2	**4**
Vietnam		1		1		**2**
Zambia					1	**1**
Total	**3**	**8**	**11**	**11**	**16**	**49**

Percentage Dutch students: 29%
Percentage EER students: 39%
Percentage non-EER students: 32%

Appendix K: Teaching methods

Education is concentrated around five instructional formats: lectures and demonstrations, discussions, Enquiry based projects, communication skills training and the Research Training period. Please refer to the following key used throughout the programme.

Fundamental theory lectures
These lectures are designed in the following way. The beginning of the lecture gives a 5 min refreshment of the required knowledge for the remainder of the lecture. This required knowledge has been previously obtained at B.Sc. level. The lecture continues on a more advanced level integrating different new aspects of fundamental theory in addition to referring to latest developments in state-of the art technology. The lectures allow students to expand their knowledge and insight into various aspects of Molecular Mechanisms of Disease, using an integrated approach to each topic. These lectures are aimed at motivating and stimulating students to explore their ambitions, interests and learning abilities.

Technical discussion or demonstration
These sessions are designed in the following way. The beginning of the lecture gives a 5min refreshment of the presupposed required knowledge in technology for the remainder of the lecture. This required knowledge has been previously obtained at B.Sc. level. The session continues on a more advanced level integrating different new aspects of fundamental theory and concentrating on latest developments in state-of the art technology thereby allowing students to expand their practical knowledge and ability to process data arising from technological application. Demonstrations or self-study project will be used as a teaching method. This teaching format will allow student to gain insight into how to apply knowledge is applied in a technological setting. The emphasis will be on problem-solving using various aspects of technology in Molecular Mechanisms of Disease.

Enquiry Based Science projects
This component is largely a self-study project. At the beginning of the project, however, guidance will be given in the form of a short explanatory lecture. Scientific references/publications will be made available and the internet will be also used as a source of information. In all cases this component will involve group debate or discussion (max. 6-7 students per group). Each student will be given the opportunity to do the following: write a report, present results to a larger audience (including mentor and course directors) and guide large discussion. Students will be required to develop research project proposals, for example, using critical analysis of current developments in Molecular Mechanisms of Disease to evaluate a novel problem. The students skills in critical analysis, application of current knowledge, problem-solving, organising the process (as in project management) analysis of results, reflecting on their own progress together educated judgement to arrive at solutions to current research problems will be encouraged. A tutor will be available for consultation purposes for one hour each morning and one hour each evening. Evaluations will be on the basis of (a) written research proposals (b) presentations of results to a large group (c) discussion of results with other group. Product- en process instructions will be given at a level assuming reasonable independence in handling self-study. At the end of the masters programme students can handle a level of marginal instruction making use of the support of the staff when needed.

Communication skills training
This component will be an integral part of each students training and will be assessed at several stages during the entire programme. The student will develop skills to argue and discuss using their acquired knowledge. They will therefore develop several cognitive, reflective and learning skills related to problem-solving and communication. Communication skills training will involve furthering their skills in critical analysis of data, presentation of results together with skills to defend/debate a particular (own) scientific approach. Students will be trained in scientific writing and in how to approach problem-solving in terms of introduction, methodology, discussion of results and conclusions supported by sound scientific reference. Products will often be presented in written or oral form to an audience of peers, tutors and supervisors.

Appendix K

Research Training Period (and practical research)

Practical research will be guided closely by the supervisor (or co-supervisor) during the first two weeks of each practical research project. After these two weeks, the student will be expected to conduct his/her research experiments in an independent fashion. Consultation will be possible at least once every two days (for 30 min) with the immediate supervisor (co-supervisor) on day-to-day progress and consultation with student mentor is possible all through the project should problems arise. Suggestions will be given by immediate supervisor to further progress of the research project if requested. The student will however be encouraged to use own initiative based on acquired knowledge to proceed. A formal review of progress will take place after each 6 month period (See Appendix B). The student will gain knowledge and insight into new techniques during the training period, will gain insight on how to apply the latest technology and practical knowledge to define and solve current research problems in designing and executing his own research project. The student will be supported by her/his supervisor in forming a critical analysis and applying an integrated approach to problem-solving, thus also improving learning skills. Research project management will also be further developed during this period.

Appendix L: Example questions of essay examinations

Example questions and model answers of essay questions are provided by the course coordinators and published on Blackboard.

8T01 Infection, Immunity and Tissue Repair – Core Fundamental

The molecules CD28 and CTLA4 receptors on T cells both can interact with the ligands B7.1 (CD80) and B7.2 (CD86) on antigen presenting cells.

A) Describe the differences in the affinity of CD28 and CTLA4 for their ligands and of their expression on resting and activated T cells. Is the expression of B7.1 (CD80) and B7.2 (CD86) on antigen presenting cells also regulated and, if so, which type of stimuli (up to 4) do regulate their expression?

B) Next to immune-activating molecules also immune-inhibitory signals exist to control the immune system. Describe at least 2 immune-inhibitory molecules of the immune system. Indicate how they act and how we can make use of these inhibitory molecules to fight cancer.

C) CTLA4 plays an important role in the modulation of immune responses. Investigators active in the fields of autoimmune diseases like to inhibit the immune system while those active in the field of infectious diseases like to boost immune responses against the pathogen. Both group of investigators are interested in CTLA4. Explain why CTLA4 is of interest to both research groups and described an experimental approach how each group will make use of the "CTLA4 knowledge" to reach their purpose, e.g. immune inhibition versus immune stimulation.

8T01 Infection, Immunity and Tissue Repair – Translational Research

Targeted therapies in haematological malignancies

A) What are differences/similarities of hematopoietic and leukemia stem cells?

B) Mutations occur in a successive manner to cause full blown leukemia. What are the implications of this finding for therapy?

C) What laboratory diagnostics are being performed to identify patients with chronic myeloid leukemia? What are their specific advantages and disadvantages?

8T02 Metabolism, Transport and Motion –Core Fundamental

Abnormal increase of mitochondrial potential (e.g. by the use of inhibitors like oligomycin) may lead to "over-reduction" of molecules in the electron transport chain (ETC) and to increased "leakage" of electrons. Ultimately this may result in overproduction of ROS.

A) Give the names of the two main sites of ROS production in the ETC (i.e. give Roman numerals and names + short descriptions of complexes where this occurs). Also describe the compartments where these ROS molecules are initially released

B) and may be most harmful.

C) Give the name (or chemical formula) of the most abundant species of ROS.

8T02 Metabolism, Transport and Motion – Translational Research

What is the most frequently occurring molecular defect in Dent's disease? Explain the pathophysiological consequences of this defect with respect to low-molecular weight proteinuria.

Appendix L

8T03Cell growth and differentiation – Core Fundamental

A) Describe (in no more than 10 lines) the technology by which adult cells can be reprogrammed into induced pluripotent stem (iPS) cells.

B) Describe the possibilities and limitations for the use of iPS cells in treatment of
   i) leukemia
   ii) Parkinson's disease (reduced number of dopamine producing neurons)
   iii) breast cancer
   iv) cystic fibrosis (lung disease as a result of a point mutation in a chloride channel)

8T03Cell growth and differentiation – Translation Research

A) Describe the main advantages and disadvantages of conventional karyotyping as well as microarray-based "molecular karyotyping". Indicate for both which genomic abnormalities can or cannot be detected.

B) Which tests are essential to proof the clinical relevance of a microdeletion detected by microarray-based technologies?

Appendix M: Assessment forms

Judge Signature:_____(name will be removed before form is available to presenter)

Oral Presentation Judging Form – Research Review 2009

Presenter's name: Mr. Ms. (circle one) _____ Dept._____

Presentation: _____ Check if a _____ No-show –or _____ Non-Student presenter (Not eligible for a prize)

Overall Score:	5 Award Winner	4 Consider For Award	3 Good but Not great	2 Fair/ Adequate	1 Poor	**Total Points:** (from below)	

Comments:
"Same-Department Judge"- Please include comments specifically evaluating the research component of the presentation.
"Different-Department Judge"- Please focus on how effectively the presenter communicated their research to someone outside the field.
NOTE: These comments will be used in the case of a tie, or in order to rank the award winners.

Please evaluate the following with 5 to 1 as a **Strength** (5) to **Weakness** (1).

Content:

1. **Introduction**: clear objectives and background	
2. **Introduction**: motivation for research understandable for a general audience	
3. **Methodology**: clearly explained for general audiences	
4. **Quality of Proposed Research/Results/Finding**: logical, clear, pertinent	
5. **Conclusion**: supported by presented information, clear summary	

Presentation:

6. **Presentation**: voice clear, loud enough, voice modulations appropriate, eye contact maintained, pace	
7. **Organization and Timing**: logical sequence, appropriate time management of talk	
8. **Audiovisuals**: well organized, appropriately used throughout talk, simple to understand, not cluttered	
9. **Style**: liveliness, stage presence	

Context and Connection:

10. **Understanding of Subject**: mastery of study and related areas, clear and effective response to questions	
11. **Originality and Significance**: knowledge of significance and originality, impact in life sciences	

Appendix M

Assessment form for research internship MSc Molecular Mechanisms of Disease

UMC St Radboud

- To be completed by the Internship Supervisor (Principal Investigator at host institute) and External Assessor (NCMLS PI)
- The final grade is given by the External Assessor after consulting the Internship Supervisor
- The student will sign this form and submit it to StIP.

Name and initials student

Student number

Title of research internship

Start date (dd-mm-yyyy)

End date

Submission date of written report

Host department institution, city, country

Name Internship Supervisor

Name External Assessor (from NCMLS)

Email address Internship Supervisor

Email address External Assessor

Assessment

The internship is assessed by the External Assessor (who assesses the report only in part A) and the Internship Supervisor (who assesses professional attitude/activities in part B and report in part C). The final mark is given by the External Assessor, after consulting the Internship Supervisor. A final mark of 9 or higher must be motivated in part G.

A. Assessment of written report of this internship – External Assessor

To be completed by External Assessor

		Insufficient	6) Sufficient	7) Fair	8) (Very) good	9) Excellent	10) Exceptional	Not applicable
1	Overall quality of the report's layout	□	□	□	□	□	□	□
2	Quality of figures and tables	□	□	□	□	□	□	□
3	Quality of the abstract	□	□	□	□	□	□	□
4	Quality of the introduction	□	□	□	□	□	□	□
5	Justification of the scientific problem	□	□	□	□	□	□	□
6	Justification of the research design	□	□	□	□	□	□	□
7	Description of the research materials and methods	□	□	□	□	□	□	□
8	Description of the data analysis	□	□	□	□	□	□	□
9	Description of the results	□	□	□	□	□	□	□
10	Scientific quality of the discussion	□	□	□	□	□	□	□
11	Correct citations / references	□	□	□	□	□	□	□
12	Overall writing skill grammar use in report	□	□	□	□	□	□	□

Overall assessment of written report of this research internship. Grade (1-10) Half grades are possible (e.g. 6.5 or 7.5). 6=sufficient, 7=fair, 8=(very) good, 9=excellent, 10=exceptional.	

Appendix M

Assessment

The internship is assessed by the Internship Supervisor (who assesses professional attitude/activities and report) and the External Assessor (who assesses the report only). The final mark is given by the External Assessor, after consulting the Internship Supervisor. A final mark of 9 or higher must be motivated in part G.

B. Assessment of the student's professional attitude and activities during internship

To be completed by Internship Supervisor

		Insufficient	6) Sufficient	7) Fair	8) (Very) good	9) Excellent	10) Exceptional	Not applicable
1	Interest in scientific context of research topic	□	□	□	□	□	□	□
2	Acquisition of topic-specific knowledge	□	□	□	□	□	□	□
3	Use of literature	□	□	□	□	□	□	□
4	Thoroughness in the design of research activities	□	□	□	□	□	□	□
5	Efficiency and organisation skills	□	□	□	□	□	□	□
6	Practical skills	□	□	□	□	□	□	□
7	Dealing with colleagues	□	□	□	□	□	□	□
8	Self-sufficiency in research activities	□	□	□	□	□	□	□
9	Attendance, participation and enthusiasm	□	□	□	□	□	□	□
10	Scientific quality of presentation	□	□	□	□	□	□	□
11	Quality of slides of presentation	□	□	□	□	□	□	□
12	Verbal presentation skills	□	□	□	□	□	□	□

Overall assessment of the student's professional attitude and activities during the master. Grade (1-10) Half grades are possible (e.g. 6.5 or 7.5). 6=sufficient, 7=fair, 8=(very) good, 9=excellent, 10=exceptional.	

C. Assessment of written report of this internship – Internship Supervisor

To be completed by Internship Supervisor

		Insufficient	6) Sufficient	7) Fair	8) (Very) good	9) Excellent	10) Exceptional	Not applicable
1	Overall quality of the report's layout	□	□	□	□	□	□	□
2	Quality of figures and tables	□	□	□	□	□	□	□
3	Quality of the abstract	□	□	□	□	□	□	□
4	Quality of the introduction	□	□	□	□	□	□	□
5	Justification of the scientific problem	□	□	□	□	□	□	□
6	Justification of the research design	□	□	□	□	□	□	□
7	Description of the research materials and methods	□	□	□	□	□	□	□
8	Description of the data analysis	□	□	□	□	□	□	□
9	Description of the results	□	□	□	□	□	□	□
10	Scientific quality of the discussion	□	□	□	□	□	□	□
11	Correct citations / references	□	□	□	□	□	□	□
12	Overall writing skill grammar use in report	□	□	□	□	□	□	□

Overall assessment of written report of this research internship. Grade (1-10) Half grades are possible (e.g. 6.5 or 7.5). 6=sufficient, 7=fair, 8=(very) good, 9=excellent, 10=exceptional.	

Appendix M

D. Summary grade awarded by Internship Supervisor (Principal Investigator at host institute)

Signature of Internship Supervisor	Date	grade (1-10)

E. Summary grade awarded by External Assessor (NCMLS Principal Investigator)

		grade (1-10)

F. Final grade

(The final grade is given by the External Assessor after consulting the Internship Supervisor)

Signature of External Assessor	Date	grade (1-10)

G. Comments

You are kindly asked to give a short commentary or advice for the benefit of the student. Please motivate final marks of 9.0 or higher.

Signature of the student	Date

Appendix N: Guidelines for research training period supervisors and external assessors

Content

1.1 Summary:

- The first MMD research training period is performed at the NCMLS from end of January to and including July. This period includes the writing of a research training period report. The deadline for the research training period mark is 1 October.
- The second research training period is generally performed at a research institute or university outside The Netherlands from January up to and including July. This period includes the writing of a Master's thesis. The deadline for the research training period mark is 15 August.
- Research training periods are supervised by a Principal Investigator (PI) at the local institute. The final assessment is done by the External Assessor (PI from NCMLS), after consulting the Research training period Supervisor.

1.2 MSc MMD Programme objectives

This highly selective programme provides a sound balance of theory and practice: major goal is to generate basic knowledge in molecular life sciences and translate that into clinical experimental research in patients.

At the end of the programme students will be qualified to :

- Move into an international PhD programme
- Apply critical and independent problem solving to the field of molecular life sciences
- Manage projects in biotechnology companies or pharmaceutical industry

We enrol a maximum of 24 students per year, each of whom is allocated a personal mentor as well as research supervisors. This individual approach guarantees excellence, especially during the research training period.

1.3 Overview of the MSc MMD programme

The Molecular Mechanisms of Disease (MMD) Master's is a full-time two-year international programme of Radboud University Nijmegen, which takes place at the NCMLS (Nijmegen Centre for Molecular Life Sciences) graduate school. The programme is composed of theoretical and practical components, which focus on the NCMLS research specialisations:

- Theme 1: Infection, Immunity and Tissue Repair
- Theme 2: Metabolism, Transport and Motion
- Theme 3: Cell Growth and Differentiation

Students are also able to make use of certain components of other Master's and PhD programmes within the Radboud University Nijmegen and courses at other Universities (Elective Courses).

The programme covers both fundamental molecular biology and its application in diagnosis and treatment of diseases such as cancer, autoimmune and inflammatory disorders, metabolic or neurodegenerative disorders. Over the two-year programme, students are prepared for a scientific career within a specific domain of Molecular Life Sciences, particularly in fields of Cell Biology, Molecular Genetics, Molecular Medicine, and Translational research. The link between fundamental science, technology and disease is also looked into through technology platforms at the forefront of European research, such as genomics, proteomics, bioinformatics, cellular therapy, tissue engineering and molecular imaging.

Each year of the two-year MMD Master's programme is worth 60 European Credits (EC), where 1 EC is 28 hours of study. The following table shows the distribution of the EC points over the two-year course:

Table 1: Courses included in the MMD Master's programme including study load. 1 European Credit (EC) equals 28 hours of study.

Code	Course	Year 1 (EC)	Year 2 (EC)
8IC01	Introduction course	1.5	
8C01	Excellence in Communication	1.5	
8SE01	Science & Society	1.5	
8T01	Infection, Immunity and Tissue Repair	5.5	
8T02	Metabolism, Transport and Motion	5.5	
8T03	Cell Growth and Differentiation	5.5	
8MC02	Masterclass theme 2	1.5	
8MC03	Masterclass theme 3	1.5	
8P01	Research Training Period & write up year 1	34	
	Electives year 1	2	
8MC01	Masterclass theme 1		1.5
8ST01	Statistics		4
8P02	Research Training Period & write up year 2		45
	Electives year 2		9.5
	Total	**60**	**60**

More information about the Master's programme can be found on http://www.ru.nl/master/NCMLS-MMD/

1.4 Introduction MMD Research Training Periods

Objectives

The student will gain knowledge on how to apply the latest technology, and how to define and solve current research problems in designing and executing his/her own research project. The student will be supported by her/his supervisor in forming a critical analysis and applying an integrated approach to

problem solving, thus also improving learning skills. Research project management will also be further developed during this period.

Supervision and guidance

Practical research will be guided closely by the research training period supervisor or daily supervisor (definitions below) during the first two weeks of each practical research project. After these two weeks, the student will be expected to conduct his/her research experiments in an independent fashion. Consultation will be possible at least once every two days (for 30 minutes) with the daily supervisor on day-to-day progress. Weekly meetings with the supervising principal investigator (PI) are scheduled to discuss results and problems. Additionally, consultation with the mentor (based at NCMLS) is possible all through the project should problems arise. Suggestions will be given by the daily supervisor and research training period supervisor to further progress of the research project if requested. The student will however be encouraged to use own initiative based on acquired knowledge to proceed.

Assessment

The research training period is assessed on the following points:

- Professional attitude and activities during the training period (1/2)
- Oral presentation and written report (1/2)

An assessment form for the research training periods is available in the **Appendix M**.

Subject Training periods

The first research training period is performed in an NCMLS workgroup. The NCMLS research training period classifies into one of the NCMLS research themes:

Theme 1	Infection, Immunity and Tissue Repair
Theme 2	Metabolism, Transport and Motion
Theme 3	Cell Growth and Differentiation

The second research training period is performed abroad (obligatory for Dutch students and international students who did their BSc in Nijmegen, optional for international students who did their BSc outside Nijmegen), at the NCMLS (optional for international students who did their BSc outside Nijmegen) or at another Dutch university or institute (optional for international students who did their BSc outside Nijmegen). When students start their second research training period, they should have concluded their first research training period already. The research training periods are arranged by the students themselves. The choice of institute and subject of the training period can be discussed with the mentor and an NCMLS PI who is in the applicable field of research. The grading of the second training period is done by the NCMLS External Assessor (see below) together with the Research training period Supervisor.

Administration

When a research training period subject and PI are chosen, the student writes the workplan and completes the form "workplan research training period", in consultation with the putative supervisor. The workplan is signed by the applicable PI (international supervisors should confirm by email to the student) and student and is submitted to the Board of Examiners.

Research training period supervisors

The following people are involved in supervision and assessment of the research training periods:

- **Research training period supervisor:** The Research training period supervisor is a Principal Investigator (scientist with own workgroup, valid for all types are RUNMC research-oriented PIs). He/she provides the means, both material and intellectual, to enable the student to carry out his/her research project. In particular, regular meetings are arranged with the research training period supervisor to discuss progress. Also the research training period supervisor

will support the student, by giving feedback and asking the student to reflect, on their progress in achieving the end/final qualifications that are to be expressed in the thesis. Students are responsible for finding research training period supervisors.

- **Daily supervisor**: The daily supervision of a research training period may be done by the daily supervisor (if different from research training period supervisor). The daily supervisor may be a postdoc or PhD student. Daily supervision should not be done by a technician.
- **External assessor**: Each research training period report or Master's thesis is assessed by an external assessor from the NCMLS. He/she is a PI from (a different department of) the NCMLS, who is sufficiently knowledgeable to assess the research training period. Students will find the external assessor in collaboration with the research training period supervisor.

1.5 Research Training Period 1 (34 EC)

The first research training period covers 26 weeks, including 2 weeks of elective courses and the writing of a report (~2 weeks). The first research training period will take place in the NCMLS. To spread the workload and benefits, only one MMD student can do his/her (first) training period in an NCMLS workgroup (which is led by one PI/junior PI/other type of PI). There are no limitations to the number of students in an NCMLS department, as long as they belong to different workgroups.

Students have the option to extend the training period up to four weeks (6 EC). The Board of Examiners must approve this extension of the research training period.

The research training period is performed from half January to July. The deadline for the research training period mark is 1 October (normal length) or 1 November (with 4 week extension). The almost-final version of the report should be submitted one month earlier. Students should arrange with the Research training period Supervisor and the External Assessor when the report will be assessed.

Guidelines Report Research training period 1

The first research research training period must be concluded with a full report describing all the studies that were performed in the training period. The structure of the report for the second research training period is similar to the structure of an article, for which some guidelines are found below. In both cases the student will be the only author of the report.

Full report

There are several ways to lay out the information in a report; we prefer the most common one. The text may be around 30 pages (up to 50 pages) with a spacing of 1 and letter size 12 Times New Roman.

- Full title page (title, author, supervisor(s), department, training period, duration of the training period, date of the report)
- Abstract: This is a short but full description of all important aspects of the research training period (250 words maximum). It should contain: aim, research question, methods, results and conclusion
- Index with numbered pages (this is not normally done in a draft article, but may be useful in the assessment of the report).
- Chapter 1: Introduction. The introduction describes the reason for conducting the research. Furthermore, a brief introduction of the literature in the field concerned. The introduction concludes with stating the research question(s). This chapter also contains the definitions of various notions.
- Chapter 2: Methods. This chapter describes how the research was conducted. The following points will be addressed:
    - Research design (i.e. how was the study set up and why was this setup chosen to answer the research question; if this is already described in the introduction, this does not need to be addressed)
    - Materials

    - Techniques and instruments
    - Methods of analysis
- Chapter 3: Results. This chapter presents the results. The results should preferably be presented in figures, graphs and tables, as well as be described in the text. The figures should have a legend that is self-explanatory.
- Chapter 4: Discussion. In this chapter, the following points will be addressed:
    - Results versus research question
    - Possible restrictions due to methods or execution
    - Consideration of the results relative to the present literature
    - Possible adjustments and future experiments
- References: The following design is advised:
    - Books: Surnames of authors with initials and if possible name suffixes (year, edition). Title, Place: editor.
    - Articles: Surnames of authors with initials and if possible name suffixes. Title. Name of the journal (year); year of publication, volume, first and last page.
- Appendices: for example: research instrument, letters, tables and figures, glossary, etc.; supplementary material

In some cases, the research performed during the training period results in a publication that contains more results than obtained by the student alone. To ensure that the student's contribution is sufficient, these concept articles written by many authors can be accepted, only if the student is first or second author. In other cases, the article-like report is written completely by the student and may be used at a basis for a future publication.

Research training period supervisors may be asked to check the report or thesis for plagiarism using a dedicated computer programme.

For the student administration, two printed copies are necessary. The research training period supervisor indicates how many printed copies are needed for the host Department (minimum of two). For students that make use of funding from the RUNMC study fund, three copies are requested that should be given to the study coordinator. The host department pays the printing costs of the reports.

1.6 Research Training Period 2 (45 EC)

The second research training period covers 31 weeks, including the description of the results (~2 weeks) in the form of an article (see below). The second year practical research period will amount to 45 EC and takes place in an institute abroad (obligatory for Dutch students, optional for international students) or in the NCMLS/other Dutch research institutes (International students). A good life balance in the student's working hours should be considered. Two weeks are scheduled for preparation (literature reading) that can be done before going to the institute of the research training period, i.e. before Christmas. The dates of the practical research period will be flexible to allow for the different elective choices of the student.

The research training period is performed from January to July. The deadline for the research training period mark is 15 August (graduation date: 31 August). Students should arrange with the Research training period Supervisor and the External Assessor when the thesis will be assessed.

Each research training period is assessed based on scientific skills, oral presentation and a written report (training period 1) or a Master's thesis (training period 2). Guidelines for these are found below. The assessment form for the training periods is found in the **Appendix M**.

Guidelines Master's Thesis Research Training Period 2

Article-like report

Appendix N

The second research training period includes the writing of a Master's thesis in the form of an article that, provided the results are interesting enough, could be submitted to a peer-reviewed journal. The article may describe a selection of the research performed during the training period.

The results of the second research training period should be written in the form of an article, even if the results obtained are not conclusive enough to allow submission. In such situations the student can describe in the discussion section which other experiments would be required to obtain a more definitive answer to the research question, and/or why the chosen approach was insufficient, and/or increase the review aspects of the manuscript in introduction and discussion. In contrast to a full report, an article focuses on one particular, most interesting part of the results obtained during the research training period, rather than describing everything that was done. It is written in concise wording and makes a clear point about a research question. For standard experimental procedures references to the relevant literature are sufficient. In case more than one subject was studied during the research training period the student is free to choose which one to use for the article. Together with the advisor a suitable journal is chosen and the author instructions of this journal are followed, including the approximate number of words, figures etc. Depending on the chosen journal, it is possible to include supplementary data as an appendix. When more than one subject was studied during the research training period, or when not all the results could be described in the article, the other subjects and results can be described separately in a report to ensure continuity of the research, in line with the requirements of the supervisor and the hosting lab.

In many cases, a full article will contain more results than obtained by the student alone. To ensure that the student's contribution is sufficient, these concept articles written by many authors can be accepted, only if the student is first or second author. In other cases, the article-like report is written completely by the student and may be used at a basis for a future publication.

Research training period supervisors may be asked to check the report or thesis for plagiarism using a dedicated computer programme.

1.7 Dutch grading system

Dutch universities mark according to a system from 1 - 10 (1 = abysmal, 10 = absolutely outstanding). Besides full grades, half grades are given by adding 0.5 to the grade. The grade 5.5, however, is not awarded.

Students in the Netherlands must gain 6 or more to pass. The frequency of the grades is indicated in Table 3. The following provides some insight into the meaning of Dutch marks:

Table 2: Short description of the Dutch grading system.

Grade	Description
10	Exceptional
9	Excellent
8	(Very) good
7	Fair/Average
6	Sufficient
5	Doubtful
4	Insufficient
3	Bad
2	Very bad
1	No show

Table 3 . Comparison of the Dutch grading system with US and UK systems, including frequencies of Dutch marks. The grade A++ does not exist in US/Canada or UK, but it is an indication of the

acquired level. As half grades are not always allowed, frequencies are only given for round marks. Source: "Cijfers ontcijferd", Nuffic afdeling Diplomawaardering en certificering, 2006.

Netherlands	Frequency	US/Canada	UK (marks)	UK (grades)
10	0.6%	No equivalent (A++)	96%-100%	No equivalent (A++)
9.5		No equivalent (A++)	90%-95%	No equivalent (A++)
9	6%	A+	80%-89%	A+
8.5		A+	70%-79%	A+
8	28%	A/A-	60%-69%	A/A-
7.5		A/A-	54%-59%	B+/B
7	34%	A-/B+	50%-53%	B/B-
6.5		B+/B	45%-49%	C+
6	31%	B/B-/C	40%-44%	C/D
5.5 not allowed		D	35%-39%	Pass
5	0.5%	F	30%-34%	F
4		F	25%-29%	F
3		F	20%-24%	F
2		F	10%-19%	F
1		F	0%-9%	F

The explanation of the grades as it accounts for research training periods are described in Table 4.

Table 4: Explanation of the Dutch grades for research training periods

Dutch grade	Explanation
10	exceptional ability, indicative of outstanding grasp of the subject, originality and independence
9	excellent, demonstrating confidence and insight in handling the subject, showing excellence and own ideas
8	good performance, good overall ability and grasp of subject
7	fair/average; reasonable level of performance, unexceptional with average grasp of the subject
6	sufficient performance, with scope for improvement

Appendix O

Appendix O: Brief CVs of major contributors to the programme and top publications of NCMLS key players

Brief CV's from personnel important to the MMD programme. CV's are included of course coordinators, members of the MMD Educational Management Team, NCMLS Director and Theme Leaders, and chairpeople of the MMD Programme Committee and Board of Examiners. Most of these also have major roles in theoretical courses and guidance on research internships. **In bold we depicted their MSc MMD contributions.**

Name	**Gosse Adema**
Birth date/ Country	November 13 1962, Gorinchem
Department	Department of Tumor Immunology
Scientific Qualifications	• PhD (1991) • Full professor in Molecular Immunology
Teaching Qualifications	• Theoretical teaching: Basic Qualification • Supervision research training: Advanced Qualification
Research positions held	• Post-doc at the Division of Immunology of the Netherlands Cancer Institute, Amsterdam, The Netherlands. **(**1991-1994) • Staff member of the Department of Tumor Immunology at the University Hospital Nijmegen St Radboud (Prof. dr C.G. Figdor) , The Netherlands. **(**1994-1996) • Visiting Scientist, DNAX Research Institute, Palo Alto, USA, dr. J. de Vries, director of human Immunology, drs. G. Zurawski and L. Lanier, directors of Molecular Biology and Immunology. **(**07-1995 - 10-1995 and 06-1996 - 03-1997) • Assistant Professor, head of the tumor immunology group, Department of Tumor Immunology at the Radboud University Medical Center, the Netherlands. **(**1996 – 2000) • Associate Professor in Molecular Immunology, head of the Tumor Immunology group, and deputy head of the department of Tumor Immunology at the Radboud University Medical Center, the Netherlands. (2000 – 2003) • Full Professor in Molecular Immunology, Nijmegen center for Molecular Life Sciences, deputy head of the department of Tumor Immunology at the Radboud University Medical Center, the Netherlands. Theme leader of NCMLS theme 1: Infection, Immunity and Tissue repair (150 scientists). **(**07-2003 – present)
Educational duties / committees	<u>Radboud University Nijmegen Medical Centre:</u> • Several courses in Immunology and Gene- & Immunotherapy (KMP-1 Course, Institute of Cellular Signaling, Masterclass Internal Medicine, Utopism and Medicine). • Education of Medical, Biology and Chemistry students at the department of Tumor Immunology. • AIO-mentor at the NCMLS • **Coordinator MSc MMD Theme 1 Core Fundamental Course and Masterclass** • **Member MSc MMD selection committee (2005 – 2008)** <u>National Ph.D. courses in:</u> • Immunology. • Antigen presentation by Dendritic Cells, e.g. ALIFI Masterclass on 'Dendritic Cells' • Immunotherapy of Cancer, e.g. "Detection, treatment and biology of minimal residual disease in human solid tumors" VU, Amsterdam, The Netherlands. • Immunology and Infectious Diseases, e.g. University of Utrecht, The Netherlands <u>HLO, Nijmegen:</u> • Lectureship on Gene- and Immunotherapy
Awards & Prizes	• NWO Vici award
Memberships of local, (inter)national committees	• Advisorship Monsanto/Pharmacia • Member of the scientific meeting committee of the Dutch Society of Immunology • Member of the board of the KWF/NKB Tumor Immunology working party • Member of the CLKF Immunomonitoring committee. Chairman of the CLKF • HLO, Nijmegen: lectureship on Gene and Immunotherapy • Member of the NCMLS research council • NCMLS Theme 1 leader: Infection, Immunity and Tissue repair (150 Scientists) • Section-editor MAI-journal • Lecturer in several national master-classes

Appendix O

Brief research interests	• My research is centred on the molecular and functional analysis of DC in mouse and man. Applying different molecular approaches at the genomic and proteomic level a set of novel DC-antigens have been identified. Knowledge regarding DC-immuno-biology is essential for the development and design of DC-based vaccines in mouse models as well as in clinical studies in cancer patients.
Five key publications in last 5 years	1. Meyer-Wentrup F, Benitez-Ribas D, Tacken PJ, Punt CJ, Figdor CG, de Vries IJ, **Adema GJ**. Targeting DCIR on human plasmacytoid dendritic cells results in antigen presentation and inhibits IFN-alpha production. *Blood* **111**:4245-53, 2008. **IF 10.4** 2. Sutmuller RP, Morgan ME, Netea MG, Grauer O, **Adema GJ**. Toll-like receptors on regulatory T cells: expanding immune regulation. *Trends Immunol.* **27**:387-93, 2006. **IF 10.2** 3. Benitez-Ribas D, **Adema GJ**, Winkels G, Klasen IS, Punt CJ, Figdor CG, de Vries IJ. Plasmacytoid dendritic cells of melanoma patients present exogenous proteins to CD4+ T cells after Fc gamma RII-mediated uptake. *J Exp Med.* **203**:1629-35, 2006. **IF 14.5** 4. Sutmuller RP, den Brok MH, Kramer M, Bennink EJ, Toonen LW, Kullberg BJ, Joosten LA, Akira S, Netea MG, **Adema GJ**. Toll-like receptor 2 controls expansion and function of regulatory T cells, *J Clin Invest.* **116**:485-94, 2006. **IF 15.8** 5. de Vries IJ, Bernsen MR, Lesterhuis WJ, Scharenborg NM, Strijk SP, Gerritsen MJ, Ruiter DJ, Figdor CG, Punt CJ, **Adema GJ**. Immunomonitoring tumor-specific T cells in delayed-type hypersensitivity skin biopsies after dendritic cell vaccination correlates with clinical outcome. *J Clin Oncol*. **23**:5779-87, 2005. **IF 13.6**

Appendix O

Name	**Wilbert Boelens**
Birth date/ Country	August 23 1956, The Netherlands
Department	Biomolecular Chemistry
Scientific Qualifications	• PhD (1992)
Research positions held	• PhD Scientist, Radboud University, Nijmegen (1988 – 1992) • Post-doctoral research scientist at EMBL Heidelberg (1992 – 1994) • Assistant professor, Radboud University, Nijmegen (1994- onwards)
Educational duties / committees	• Head practicum Molecular Sciences • NCMLS PhD committee • **Coordinator NCMLS PhD/MSc MMD Introduction Course (2007 – 2009)** • Board of Examiners Molecular Life Sciences • Cluster committee Molecular Sciences
Awards & Prizes	• KWF 2007: The role of the novel oncoprotein alphaB -crystallin in the aggressive behaviour of squamous cell carcinomas in relation with radiotherapy • Involved in CTMM 2009: Leiden-Alzheimer Research Nederland (LeARN) project • Involved in NPC 2009: The role of posttranslational modifications in the development of autoimmune diseases: a functional proteomics approach
Memberships of local, (inter)national committees	• NWO Protein Research
Brief research interests	• The role of small heat shock proteins and tissue transglutaminase in posttranslational modifications
Five key publications in last 5 years	1. Hagemann TL, **Boelens WC**, Wawrousek EF, Messing A. (2009) Suppression of GFAP toxicity by alphaB-crystallin in mouse models of Alexander disease. *Hum. Mol. Genet.* **18**:1190-9, 2009. **IF 7.8** 2. den Engelsman J, Gerrits D, de Jong WW, Robbins J, Kato K, and **Boelens WC**. Nuclear Import of alphaB-crystallin Is Phosphorylation-dependent and Hampered by Hyperphosphorylation of the Myopathy-related Mutant R120G. *J Biol Chem.* **280**: 37139-48, 2005. **IF 5.9** 3. Stamler R, Kappé G, **Boelens WC** and Slingsby C. Wrapping the alpha-crystallin domain fold in a chaperone assembly. *J Mol Biol.* **353**:68-79. **IF 5.2** 4. Boros S, Kamps B, Wunderink L, de Bruijn W, de Jong WW, **Boelens WC**. Transglutaminase catalyzes differential crosslinking of small heat shock proteins and amyloid-beta. *FEBS Lett.* **576**:57-62, 2004. **IF 3.8** 5. den Engelsman J, Bennink EJ, Doerwald L, Onnekink C, Wunderink L, Andley UP, Kato K, de Jong WW, **Boelens WC**. Mimicking phosphorylation of the small heat-shock protein alphaB-crystallin recruits the F-box protein FBX4 to nuclear SC35 speckles. *Eur J Biochem.* **1**:4195-203, 2004. **IF 3.3**

Appendix O

Name	**Hans van Bokhoven**
Birth date/ Country	09-05-1963/The Netherlands
Department	Human Genetics/Cognitive Neuroscience
Scientific Qualifications	• PhD • Unit Leader Neurogenetics and Molecular Neurobiology
Teaching Qualifications	• Theoretical teaching: Basic Qualification • Supervision research training: Basic Qualification
Research positions held	• Postdoc, Department of Human Genetics, UMCN (1992-1996). • Deputy Head of the Division of Molecular Genetics (1996-now) • Assistant professor Human Genetics (1998-2003) • Associate professor/Research co-ordinator, Human Genetics (2003-now) • Principal Investigator of the Nijmegen Center for Molecular Life Sciences (NCMLS).(2004-now) • Principal Investigator Donders Centre for Neuroscience (2008-now). • Principal Investigator UMC St Radboud (2008-now). • Unit Leader Neurogenetics and Molecular Neurobiology (2009-now)
Educational duties / committees	• Genetic and Immunological processes (Bachelor Medicine/Biomedical Sciences) • Biotechnology (Bachelor Medicine/Biomedical Sciences) • Molecular basis of disease (2nd year Molecular Life Sciences) • Genetic and Metabolic Diseases (Bachelor Medicine) • **Master's Molecular Mechanisms of Disease: Core Fundamental, Masterclasses.** • **Board of Examiners Master's Molecular Mechanisms of Disease.** • Member Faculty Board, Doctoral school of Medical Genetics, University of Siena (2004-now). • Supervision internships, PhD students and AGIKO's
Memberships of local, (inter)national committees	• EU FP6 review panel (Neurology, 2003) and EU FP7 (Genomics, 2007). • Scientific Committee. The second to fourth p63/p73 workshop. Rome, 2004, 2006, Toronto 2009. • Scientific Committee. 12th and 14th International Workshop on Fragile X and X-LinkedMental Retardation. Williamsburg Va, 2005; Sao Paulo, 2009. • VENI committee ZonMW (2004). • VIDI committee ZonMW (2005-2008); 2006-2008 vice-chairman. • Member Seminar Committee NCMLS (2005-now; chairman 2008-now). • Member Research Council NCMLS (2007). • **Theme leader of NCMLS theme "Cell Growth and Differentiation" (2007-present)**. • Member selection committee NCMLS Tenure track Research Fellowships (2007). • Organizing Committee. Epistem Conference Ghent, 27-29 February, 2008. • Member Horizon programme of the Netherlands Genomics Initiative. (2008-now). • Editorial Advisory Board of the " Encyclopedia of Life Sciences" (ELS; John Wiley & Sons). Section Genetics & Molecular Biology (2008-)
Brief research interests	• My ambition is to elucidate the genetic and molecular basis of (neuro)developmental disorders and to dissect the molecular networks and cellular processes that are affected by it, with the ultimate goal to rescue these defects in patients.
Five key publications in last 5 years	1. Iqbal Z, Cejudo-Martin P, de Brouwer A, van der Zwaag B, Ruiz-Lozano P, Scimia MC, Lindsey JD, Weinreb R, Albrecht B, Megarbane A, Alanay Y, Ben-Neriah Z, Amenduni M, Artuso R, Veltman JA, van Beusekom E, Oudakker A, Millán JL, Hennekam R, Hamel B, Courtneidge SA, **van Bokhoven H.** Disruption of the podosome adaptor protein TKS4 (SH3PXD2B) causes the skeletal dysplasia, eye, and cardiac abnormalities of Frank-Ter Haar syndrome. *Am J Hum Genet.* **86**:254-61, 2010. **IF 10.1** 2. Kornak U, Reynders E, Dimopoulou A, van Reeuwijk J, Fischer B, Rajab A, Budde B, Nürnberg P, Foulquier F; ARCL Debré-type Study Group, Lefeber D, Urban Z, Gruenewald S, Annaert W, Brunner HG, **van Bokhoven H**, Wevers R, Morava E, Matthijs G, Van Maldergem L, Mundlos S. Impaired glycosylation and cutis laxa caused by mutations in the vesicular H+-ATPase subunit ATP6V0A2. *Nat Genet.* **40**:32-4, 2008. 3. de Brouwer AP, Williams KL, Duley J, van Kuilenburg AB, Nabuurs S, Egmont-Petersen M, Lugtenberg D, Zoetekouw L, Banning MJ, Roeffen M, Hamel BC, Weaving L, Ouvrier RA, Donald JA, Wevers RA, Christodoulou J, **van Bokhoven H.** Arts syndrome is caused by loss-of-function mutations in PRPS1. *Am J Hum Genet.* **81**:507-18, 2007. 4. Kleefstra T, Brunner HG, Amiel J, Oudakker AR, Nillesen WM, Magee A, Genevieve D, Cormier-Daire V, van Esch H, Fryns JP, Hamel BC, Sistermans EA, de Vries BB, **van Bokhoven H.** Loss-of-Function Mutations in Euchromatin Histone Methyl Transferase 1 (EHMT1) Cause the 9q34 Subtelomeric Deletion Syndrome. *Am J Hum Genet.* **79**:370-7, 2006. 5. Rohmann E, Brunner HG, Kayserili H, Uyguner O, Nurnberg G, Lew ED, Dobbie A, Eswarakumar VP, Uzumcu A, Ulubil-Emeroglu M, Leroy JG, Li Y, Becker C, Lehnerdt K, Cremers CW, Yuksel-Apak M, Nurnberg P, Kubisch C, Schlessinger J, **van Bokhoven H**, Wollnik B. Mutations in different components of FGF signaling in LADD syndrome. *Nat Genet.* **38**:414-7, 2006.

Appendix O

Name	**Frans P.M. Cremers**
Birth date/ Country	March 17 1960, The Netherlands
Department	Human Genetics
Scientific Qualifications	• PhD (cum laude)(1991) • Full Professor in Ophthalmogenetics
Teaching Qualifications	• Principal Lecturer* (2009) • Theoretical teaching: Complete Qualification
Research experience / Posts	• Guest researcher at South-Western Medical Center, Dallas, USA (dr. M. Seabra, profs. Goldstein and Brown) (1992) • Head Division Molecular Genetics (40 staff) (1993 – present)
Educational experience / Posts	• Medicine and Biomedical Sciences module coordinator Genetic and Immunologic processes (B202) (1996 – 2002) • Lecturer BSc Molecular Life Sciences (2005 – present) • **Programme Director MSc Molecular Mechanisms of Disease (2005 – present)** • **Coordinator student selection committee (2005 – 2009)**
Awards & Prizes	• 'Student award' in the category 'predoctoral basic' at the 41st American Society of Human Genetics, 1990, Cincinnati, USA. • Retinitis Pigmentosa Award for the Prevention of Blindness 1990, February 1991, Essen, Germany. • European Vision Award 2007. Portoroz, European Vision Institute.
Memberships	• ARVO, Retina International
Research interests	• Molecular genetics of inherited retinal dystrophies & exudative vitreoretinopathies • Genetic therapies
Five key publications in last 5 years	1. Collin RWJ, Littink KW, Klevering BJ, van den Born LI, Koenekoop RK, Zonneveld MN, Blokland EAW, Strom TM, Hoyng CB, den Hollander AI, **Cremers FPM.** Identification of a 2 Mb human ortholog of *Drosophila eyes shut/spacemaker* that is mutated in patients with retinitis pigmentosa. *Am J Hum Genet* **83**:594-603, 2008. **IF 11.1** 2. den Hollander AI, Koenekoop RK, Mohamed MD, Arts HH, Boldt K, Towns KV, Sedmak T, de Beer M, Nagel-Wolfrum K, McKibbin,M, Dharmaraj S, Lopez I, Ivings L, Williams GA, Springell K, Woods CG, Jafri H, Rashid Y, Strom TM, van der Zwaag B, Gosens I, Kersten FF, Wijk, van Wijk E, Veltman JA, Zonneveld MN, van Beersum SE, Maumenee IH, Wolfrum, U, Cheetham ME, Ueffing M, ***Cremers FPM**, *Inglehearn CF, *Roepman R. Mutations in LCA5, encoding the ciliary protein lebercilin, cause Leber congenital amaurosis *Nature Genet* **39**:889-95, 2007. *Joint last authors. **IF 25.6** 3. van den Hurk JAJM, Meij IC, del Carmen SM, Kano H, Nikopoulos K, Hoefsloot LH, Sistermans EA, de Wijs I, Mukhopadhyay A, Plomp AS, de Jong PT, Kazazian HH, **Cremers FPM**. L1 retrotransposition can occur early in human embryonic development. *Hum Mol Genet* **16**:1587-92, 2007. **IF 7.8** 4. den Hollander AI, Koenekoop RK, Yzer S, Lopez I, Arends ML, Voesenek KEJ, Zonneveld MN, Strom TM, Meitinger T, Brunner HG, Hoyng CB, van den Born LI, Rohrschneider K & **Cremers FPM.** Mutations in the *CEP290* (*NPHP6*) gene are a frequent cause of Leber congenital amaurosis. *Am J Hum Genet* **79**:556-61, 2006. **IF 12.6** 5. Roepman R, Letteboer SJ, Arts HH, van Beersum SE, Lu X, Krieger E, Ferreira PA, **Cremers FPM**. Interaction of nephrocystin-4 and RPGRIP1 is disrupted by nephronophthisis or Leber congenital amaurosis (LCA)-associated mutations. *Proc Natl Acad Sci USA* **102**:18520-5, 2005. **IF 10.2**

Appendix O

Name	**Ton Feuth**
Birth date/ Country	August 01 1947, The Netherlands
Department	Epidemiology, Biostatistics, HTA
Scientific Qualifications	• MSc 1971
Teaching Qualifications	• Theoretical teaching: Basic Qualification
Research positions held	• Scientific teacher
Educational duties / committees	• MSc Biomedical Sciences: • Course coordinator E003: Multivariable Statistical Methods • Course coordinator AM07: Design and analysis of small scaled experiments • MSc Molecular Mechanisms of Disease • **Course coordinator MSc MMD Genomics and Statistics (2009 – present)** • Post academic (PAOG): • Course coordinator Post academic course in Biostatistics
Brief research interests	• Validation of statistical prediction models
Five key publications in last 5 years	1. Plantinga ThS, van der Velden WJFM, Ferwerda B, van Spriel AB, Adema G, **Feuth T**, Donnelly JP, Brown GD, Kullberg BJ, Blijlevens NMA, Netea MG. Early Stop Polymorphism in Human Dectin-1 is Associated with Increased Candida Colonisation in Hematopoietic Stem Cell Transplant Recipients. *Clinical Infectious Diseases* **49**:724-732, 2009. **IF 8.2** 2. Kooper AJA, Faas BHW, Kater-Baats E, **Feuth T**, Janssen JCJA, van der Burgt I, Lotgering FK, Geurts van Kessel AHM, Smits APT. Multiplex Ligation-dependent Probe Amplification (MLPA) as a stand-alone test for rapid aneuploidy detection in amniotic fluid cells. *Prenat Diagn* **28**:1004 -1010, 2008. **IF 1.6** 3. de Vries BB, Pfundt R, Leisink M, Koolen DA, Vissers LE, Janssen IM, Reijmersdal S, Nillesen WH, Huys EH, Leeuw N, Smeets D, Sistermans EA, **Feuth T**, van Ravenswaaij-Arts CM, Geurts van Kessel AHM, Schoenmakers EF, Brunner HG, Veltman JA. Diagnostic genome profiling in mental retardation. *Am J Hum Genet.* **77**:606-16, 2005. **IF 12.6** 4. de Kok JB, Roelofs RW, Giesendorf BA, Pennings JL, Waas ET, **Feuth T**, Swinkels DW, Span PN. Normalization of gene expression measurements in tumor tissues: comparison of 13 endogenous control genes. *Lab Invest*. **85**:154-9, 2005. **IF 3.8** 5. Vissers LELM, de Vries LBA, Osoegawa K, Janssen IM, **Feuth T**, Choy CO, Straatman H, van der Vliet WA, Huys EHLPG, van Rijk A, Smeets, van Ravenswaaij-Arts CMA, Knoers-van Slobbe VVAM, van der Burgt I, de Jong PJ, Brunner HG, Geurts van Kessel AHM, Schoenmakers EFPM, Veltman JA. Array-Based Comparative Genomic Hybridization for the Genomewide Detection of Submicroscopic Chromosomal Abnormalities. *Am. J. Hum. Genet.***73**:1261-1270, 2003 **IF 11.6**

Appendix O

Name	**Carl Figdor**
Birth date/ Country	June 26 1953, The Netherlands
Department	Department of Tumor Immunology
Scientific Qualifications	• PhD (1982) • Full professor in Tumor Immunology
Teaching Qualifications	• Theoretical teaching: Basic Qualification
Research positions held	• PhD student at the Netherlands Cancer Institute, Division of Immunology. (1979–1982) • Research fellow at the Netherlands Cancer Institute, Division of Immunology. (1982–1988) • Senior scientific staff member of the Netherlands Cancer Institute, Division of Immunology. (1988–1994) • Full professorship in Cell Biophysics at the University of Twente (1992–2009) • Full professorship in Experimental Immunology in particular Tumor Immunology and head of the department of Tumor Immunology at the Radboud University Nijmegen Medical Centre. (1994–present) • Co-director of the Nijmegen Centre for Molecular Life Sciences (NCMLS), Radboud University Nijmegen Medical Centre (2001–2003) • Scientific director of the Nijmegen Centre for Molecular Life Sciences (NCMLS), Radboud University Nijmegen Medical Centre. (2004 – present)
Educational duties / committees	• Courses in: immunology and cell biology, cell adhesion and migration, tissue engineering gene- and immunotherapy, Excellence in Communication, • Initiator of "Wetenschapsknoopunt Radboud Universiteit" (2009) • **Development of Molecular Mechanisms of Disease master's programme (2004)** • **Coordinator MSc MMD course Excellence in Communication (2005 – present)**
Awards & Prizes	• Van Loghum Award, Dutch society of Immunology (1999) • Eijkman Medal, Utrecht (2000) • Spinoza Award, Netherlands Organisation for Scientific research (NWO) (2006) • Koningin Wilhelmina research prize (2009)
Memberships of local, (inter)national committees	• Member of the Royal Dutch Academy of Sciences (KNAW). • Member of the Vici committee of the Dutch Science Organization • Member of the Subcommittee of Medical Sciences, Research Schools of the Royal Dutch Academy of Sciences (ECOS) • Member of the European Union Network, Executive committee of Excellence: Dendritic Cell Immunotherapy (DC-THERA) • Member of the board of Nijmegen Center for Molecular Life Sciences (NCMLS). • Coordinator of the Marie Curie Research Training Networks: Immunanomap • Editor for European Journal of Immunology. • Referee for various international journals including: Nature, Nature Cell Biology, Nature Immunology, Science, Cell, Immunity, Journ. Immunol., Journ. Cell Biol., Blood, Eur. Journ. Immunol., Int. Journ. Cancer, Melanoma.
Brief research interests	• Molecular cell biology and biophysics (high resolution microscopy of dendritic cells); Molecular Immunology, in particular cell adhesion-, and pathogen- receptors of immune cells; Translational research; Dendritic cell vaccination in cancer patients.
Five key publications in last 5 years	1. Cambi A, **Figdor CG**. Necrosis: C-type lectins sense cell death. *Curr Biol.* **19**: R375-8, 2009. **IF 10.8** 2. Tacken PJ, de Vries IJ, Torensma R, **Figdor CG**. Dendritic-cell immunotherapy: from ex vivo loading to in vivo targeting. *Nat Rev Immunol.* **7**:790-802, 2007. **IF 28.6** 3. Clark K, Langeslag M, **Figdor CG**, van Leeuwen FN. Myosin II and mechanotransduction: a balancing act. *Trends Cell Biol.* **17**:178-86, 2007. **IF 12.2** 4. Cambi A, Lidke DS, Arndt-Jovin DJ, **Figdor CG**, Jovin TM. Ligand-conjugated quantum dots monitor antigen uptake and processing by dendritic cells. *Nano Lett.* **7**: 970-7, 2007. **IF 9.96** 5. Zimmerman AW, Joosten B, Torensma R, Parnes JR, van Leeuwen FN, **Figdor CG**. Long-term engagement of CD6 and ALCAM is essential for T-cell proliferation induced by dendritic cells. *Blood* **107**:3212-20, 2006. **IF 12.4**

Appendix O

Name	**Ad Geurts van Kessel**
Birth date/ Country	February 03 1951, The Netherlands
Department	Head of the Cytogenetics division of the department of Human Genetics since 1989.
Scientific Qualifications	• PhD • Full professor in Tumor Cell Genetics
Teaching Qualifications	• Theoretical teaching: Basic Qualification • Supervision research training: Basic Qualification
Research positions held	• Research Associate, Department of Cell Biology and Genetics, Erasmus University, Rotterdam, the Netherlands. (1976-1983) • Assistant Professor, Department of Cell Biology and Genetics, Erasmus University, Rotterdam, the Netherlands. (1983-1989) • Associate Professor, Department of Human Genetics, Radboud University Nijmegen Medical Centre, the Netherlands. (1989-1993) • Full professor in Tumor Cell Genetics and vice-chairman of the Department of Human Genetics, Radboud University Nijmegen Medical Centre, the Netherlands. (1993-present)
Educational duties / committees	• **MSc MMD Programme Committee (2008-present)** • **MSc MMD course coordinator Translational Research (2005-present)**
Awards & Prizes	• Prof. dr. van Nieuwenhoven Prize for Biology, Radboud University Nijmegen, the Netherlands • Research Award for Genetics, Human Genetics Society, the Netherlands • Research Award for Human Genetics, Simons Fund, the Netherlands • Elected member of the Human Genome Organization (HUGO) • NKB/KWF professorship in Tumor Cell Genetics • Honorary Professor at the General Hospital of Beijing Military Region, Beijing, China.
Memberships of local, (inter)national committees	• Senior editor of the international 'Human Genome Project' (HGP) • Member of the international 'Human Genome Organization' (HUGO) • Associate editor of 'Cytogenetic and Genome Research' • Editorial board member of 'Cancer Genetics and Cytogenetics' • Editorial board member of the 'Atlas of Genetics and Cytogenetics in Oncology and Haematology' • Member of the NWO-ZonMW VICI program committee • Member of the NWO-ZonMW program committee Gen-Omgevingsinteracties • Member of the NWO-ZonMW Horizon committee • Member of the COGEM committee epigenetics and the COGEM committee miRNAs • Reviewer for NWO-ZonMW-ALW-STW-VENI-VIDI, NKB-KWF • KNAW Association for International Cancer Research (AICR), Medical Research Council UK, Cancer Research UK, French National Institute of Health INSERM, Italian Association for Cancer Research (IACR), IWT-Flanders, Scientific Research Fund Flanders (FCRF), Vlaams Instituut voor Biotechnologie (VIB), Portuguese Foundation for Science and Technology (FST), Academy of Finland (FA), Hong Kong Research Grants Council (RGC), Biomedical Research Council Singapore (BMRC) • Co-chair of the Portuguese Foundation for Science and Technology (FST) • Scientific chair and organizer of the 12th European Workshop on Cytogenetics and Molecular Genetics of Solid Tumors, 3-6 June 2010, Nijmegen, The Netherlands
Brief research interests	• To unravel the role of genomic aberrations in the development of familial (hereditary) and non-familial forms of cancer, including the development and implement novel technologies such as microarray-based genomic profiling and next generation sequencing.
Five key publications in last 5 years	1. Ligtenberg MJ, Kuiper RP, Chan TL, Goossenes M, Hebeda KM, Voorendt M, Lee TYH, Bodmer D, Hoenselaar E, Brunner HG, **Geurts van Kessel A**, Yuen ST, van Krieken JHJM, Leung SY, Hoogerbrugge N. Heritable somatic methylation and inactivation of MSH2 in families with Lynch syndrome due to deletion of the 3' exons of TACSTD1. *Nature Genet.* **41**:112-117, 2009. **IF 25.8** 2. Langemeijer SMC, Kuiper RP, Berends M, Knops R, Aslanyan MG, Massop M, Stevens-Linders E, van Hoogen P, **Geurts van Kessel A**, Raymakers RAP, Kamping EJ, Verburgh E, Hagemeijer A, Vandenberghe P, de Witte TM, van der Reijden BA, Jansen JH. Acquired mutations in TET2 are common in myelodysplastic syndromes. *Nature Genet.* **41**:838-842, 2009. **IF 25.8** 3. Vrijenhoek T, Buizer-Voskamp JE, Van der Stelt I, Strengman E, Genetic Risk and Outcome in Psychosis (GROUP) Consortium, Sabatti C, **Geurts van Kessel A**, Brunner HG, Ophoff RA, Veltman JA. Recurrent CNVs disrupt 3 novel candidate genes in schizophrenia patients. *Am. J. Hum. Genet.* **83**: 504-510, 2008. **IF 11.1** 4. Koolen D, Vissers L, Pfundt R, de Leeuw N, Knight S, Regan R, Kooy F, Reyniers E, Romano C,

Appendix O

	Fichera M, Schinzel A, Baumer A, Anderlid B, Schoumans J, Knoers N, **Geurts van Kessel A**, Sistermans E, Veltman J, Brunner H, de Vries B. A new chromosome 17q21.31 microdeletion syndrome associated with a common inversion polymorphism. *Nature Genet.* **38**:999-1001, 2006. **IF 25.6** 5. Vissers LELM, van Ravenswaaij CMA, Admiraal R, Hurst JA, de Vries BBA, Janssen IM, van der Vliet WA, Huys EHLPG, de Jong PJ, Hamel BCJ, Schoenmakers EFPM, Brunner HG, Veltman JA, **Geurts van Kessel A**. Mutations in a new member of the chromodomain gene family cause CHARGE syndrome. *Nature Genet.* **36**:955-95, 2004. **IF 25.6**

Appendix O

Name	**Wiljan J.A.J. Hendriks**
Birth date/ Country	October 7 1959, The Netherlands
Department	Cell Biology, UMC St Radboud
Scientific Qualifications	• PhD (1989) • Assistant Professor in Molecular Cell Biology (1991) • Associate professor in Molecular Cell Biology (1995 - present)
Teaching Qualifications	• Theoretical teaching: Advanced Qualification • Supervision research training: Advanced Qualification
Research positions held	• Postdoc Biochemistry, Radboud University Nijmegen, The Netherlands (1988-1989) • Postdoc Molecular Biology, University of Zurich, Switzerland (1989-1991) • UD/UHD Cell Biology, Radboud University Nijmegen Medical Centre (1991-present)
Educational duties / committees	• **MSc MMD Board of Examiners (2005 - 2009)** • **MSc MMD Education Management Team (2009 - present)** • Course coordinator of Bachelor's course in Medicine (2009 - present) • **Coordinator of MSc MMD core fundamental course (2009 - present)**
Awards & Prizes	• EMBO Long Term Fellowship (1989)
Memberships of local, (inter)national committees	• NCMLS Graduate school – Education Committee (1995 - 1998) • Member RUNMC Medical Library Advisory Committee (2000 - present) • (vice) Coordinator of EU Research Training Networks under Framework Programs FP4, FP5 and FP6 (1997 – present)
Brief research interests	• Role of mammalian protein tyrosine phosphatases in development and disease
Five key publications in last 5 years	1. Hoover AC, Strand GL, Nowicki PN, Anderson ME, Vermeer PD, Klingelhutz AJ, Bossler AD, Pottala JV, **Hendriks WJ**, Lee JH. Impaired PTPN13 phosphatase activity in spontaneous or HPV-induced squamous cell carcinomas potentiates oncogene signaling through the MAP kinase pathway. *Oncogene* **28**:3960-3970, 2009. **IF 7.2** 2. Uetani N, Bertozzi K, Chagnon MJ, **Hendriks WJ**, Tremblay ML, Bouchard M. Maturation of ureter-bladder connection by LAR receptor protein-tyrosine phosphatases. *J Clin Invest* **119**:924-935, 2009. **IF 16.6** 3. Noordman YE, Augustus ED, Schepens JT, Chirivi RG, Ríos P, Pulido R, **Hendriks WJ**. Multimerisation of receptor-type protein tyrosine phosphatases PTPBR7 and PTP-SL attenuates enzymatic activity. *Biochim Biophys Acta* **1783**:275-286, 2008 **IF 2.7** 4. van den Berk LC, Landi E, Walma T, Vuister GW, Dente L, **Hendriks WJ**. An allosteric intramolecular PDZ-PDZ interaction modulates PTP-BL PDZ2 binding specificity. *Biochemistry* **46**:13629-13637, 2007. **IF 3.4** 5. Chirivi RG, Noordman YE, Van der Zee CE, **Hendriks WJ**. Altered MAP kinase phosphorylation and impaired motor coordination in PTPRR deficient mice. *J Neurochem* **101**:829-840, 2007. **IF 2.9**

Appendix O

Name	**Joost Hoenderop**
Birth date/ Country	November 17 1969
Department	Physiology
Scientific Qualifications	• PhD (2000, cum laude) • Associate Professor of Physiology (2006-present)
Teaching Qualifications	• Theoretical teaching: Basic Qualification • Supervision research training: Advanced Qualification
Research positions held	• PhD student (1996-1999) • Post.doc long-term EMBO fellow (2000-2001) • Assistant Professor of Physiology, VIDI fellow (2001-2006) • Associate Professor of Physiology, EURYI fellow (2006-present)
Educational duties / committees	• Scientific board jury member Radboud University Nijmegen Medical Centre (2009) • Review board member Pflugers Archives – European Journal of Physiology (2008) • Review member of European Science Foundation (2008) • Member International Young Nephrology Committee to improve kidney research (2007) • NWO-ALW review committee member (2007) • **MSc MMD lecturer in theme 2 core fundamental course (2005 - present)** • **MSc MMD masterclass coordinator (twice)** • **Member MSc MMD selection committee (2009 – present)** • Teacher in course "Water and salt homeostasis for Medical students". (2005) • Teaching in course "Research methodology for students at Biomedical Health Sciences". (2002) • Participant of the newly established theme "Kidney diseases" that is part of the RUNMC Program "Membrane, transport and motion". (2000) • Organization of student laboratory practice. (1999)
Awards & Prizes	• Elected your member of the Royal Dutch Academy of Sciences (KNAW) (2009) • European Young Investigators award (EURYI) 2006, €1.250.000. (2006) • Annual award of the Dutch Society of Nephrology for best presentation. (2004) • Travel grant award by the EKRA to attend the World Congress for Nephrology Berlin. (2003) • NEU Excellent Young Researchers for most successful international collaboration between Universities of different several European countries. (2002) • Travel grant award by the Physiological Society to attend Leeds meeting. (2002) • Award of the Dutch Society of Nephrology for best Thesis of 2000. (2000) • Award of the Graduate school "Institute of Cellular Signaling" for best Thesis of 2000. (2000) • Annual award of the Graduate School "Institute of Cellular Signaling" for the best oral presentation. (1999) • Young Physiologist award of the Dutch Society of Physiology for the best oral presentation. (1999) • Annual award of the Graduate School "Institute of Cellular Signaling" for the best oral presentation. (1998) • NATO Science Fellowship for Summer Workshop, Greece. (1998) • Young Physiologist award of the Dutch Society of Physiology for the best oral presentation. (1998) • Annual award of the Graduate School "Institute of Cellular Signaling" for the best poster presentation. (1998) • Young Physiologist award of the Dutch Society of Physiology for the best oral presentation. (1997)
Memberships of local, (inter)national committees	• Member of Physiological Society • Member of Nephrology Society • European Kidney Research Association (EKRA) • Member of Young Royal Netherlands Academy of Arts and Sciences
Brief research interests	• Research interests include the regulation of calcium and magnesium transport in renal epithelia with a specific focus on the molecular regulation of epithelial calcium and magnesium channels (TRPV5&6 and TRPM6&7), members of the transient receptor potential (TRP) channels.
Five key publications in last 5 years	1. Alexander RT, Woudenberg-Vrenken TE, Buurman J, Dijkman H, van der Eerden BC, van Leeuwen JP, Bindels RJ, **Hoenderop JG**. Klotho prevents renal calcium loss. *J Am Soc Nephrol.* **20**: 2371-9, 2009. **IF 7.8** 2. Glaudemans B, van der Wijst J, Scola RH, Lorenzoni PJ, Heister A, van der Kemp AW, Knoers NV, **Hoenderop JG**, Bindels RJ. A missense mutation in the Kv1.1 voltage-gated potassium channel-encoding gene KCNA1 is linked to human autosomal dominant hypomagnesemia. *J Clin Invest.* **119**:936-42, 2009. **IF 15.9** 3. Cao G, Thebault S, van der Wijst J, van der Kemp A, Lasonder E, Bindels RJ, **Hoenderop JG**. RACK1

	inhibits TRPM6 activity via phosphorylation of the fused alpha-kinase domain. *Curr Biol.* **18**: 168-76, 2008. **IF 11.0** 4. Chang Q, Hoefs S, van der Kemp AW, Topala CN, Bindels RJ, **Hoenderop JG**. The beta-glucuronidase klotho hydrolyzes and activates the TRPV5 channel. *Science*. **310**:490-3, 2005. **IF 30.0** 5. **Hoenderop JG**, Nilius B, Bindels RJ. Calcium absorption across epithelia. *Physiol Rev.* **85**:373-422, 2005. **IF 29.6**

Appendix O

Name	**Martijn A. Huynen**
Birth date/ Country	April 11 1964, The Netherlands
Department	CMBI
Scientific Qualifications	• PhD (1993) • Professor (2002)
Teaching Qualifications	• Theoretical teaching: Complete Qualification • Supervision research training: Start Qualification
Research positions held	• Head Comparative Genomics group
Educational duties / committees	• **MSc MMD Education Management Team; coordinator of Translational Research course Theme 2** • **Member MSc MMD selection committee (2005 – present)** • NCMLS VENI/VIDI/VICI Committee
Memberships of local, (inter)national committees	• Peer reviewer for International Journals: Science, Trends Genet., Genome Research, PLoS Biology, Nucleic Acids Research, Genome Biology, BMC Bioinformatics, BMC genomics, Molecular Biology and Evolution, • Editorial board of Biology Direct • Reviewer grant proposals NWO VIDI, VENI, Horizon, International Grants • Reviewer board for the VIB Ghent
Brief research interests	• Exploiting genomics data to unravel the workings or proteins and pathways, both in terms of the development of methods and in terms of making specific predictions about proteins/pathways for experimental corroboration
Five key publications in last 5 years	1. Oti M, **Huynen MA**, Brunner HG. The biological coherence of human phenome databases. *Am J Hum Genet.* **85**:801-8, 2009. **IF 10.1** 2. Bych K, Kerscher S, Netz DJ, Pierik AJ, Zwicker K, **Huynen MA**, Lill R, Brandt U, Balk J. The iron-sulphur protein Ind1 is required for effective complex I assembly. *EMBO J.* **27**:1736-46, 2008. **IF 8.7** 3. Kensche PR, Oti M, Dutilh BE, **Huynen MA**. Conservation of divergent transcription in fungi. *Trends Genet.* **24**:207-11, 2008. **IF 9.7** 4. Gabaldón T, Rainey D, **Huynen MA.** Tracing the evolution of a large protein complex in the eukaryotes, NADH:ubiquinone oxidoreductase (Complex I). *J Mol Biol.* **348**:857-70, 2005. **IF 5.2** 5. Boxma B, de Graaf RM, van der Staay GW, van Alen TA, Ricard G, Gabaldon T, van Hoek AH, Moon-van der Staay SY, Koopman WJ, van Hellemond JJ, Tielens AG, Friedrich T, Veenhuis M, **Huynen MA**, Hackstein JH. An anaerobic mitochondrion that produces hydrogen. *Nature.* **434**:74-9, 2005. **IF 29.3**

Appendix O

Name	**Frank J. van Kuppeveld**
Birth date/ Country	August 25 1965, The Netherlands
Department	Medical Microbiology
Scientific Qualifications	• PhD (1997) • Assistant Professor (2001) • Associate Professor (pending; 2010)
Teaching Qualifications	• Theoretical teaching: Complete Qualification • Supervision research training: Advanced Qualification
Research positions held	• Head Molecular Virology research unit
Educational duties / committees	• **MSc MMD Educational Management Team** • **Course coordinator MMD theme Infection Immunity and Tissue Repair** • **Member MSc MMD selection committee (2005 – present)**
Awards & Prizes	• Beijerink Premie 2004 (50 kEuro, funded by the Royal Dutch Academy of Sciences) for excellent Virological research (2004) • NWO-VIDI grant 'Evasion of antiviral host cell responses: Tricks and treats by RNA viruses' (2003). • JDRF grant 2008 (with Prof. G Adema, B Roep). Enterovirus, dendritic cells, and pancreatic islets; a dangerous triangle in type 1 diabetes? • Convenant RUNMC - Katholieke Universiteit Leuven grant together with Prof. J. Neyts. Novel strategies to inhibit enterovirus replication.
Memberships of local, (inter)national committees	• Member of the NCMLS Seminar Committee (2004-2008) • Peer reviewer for International Journals: J Virol, J Biol Chem EMBO J, PLoS Pathogen, Cell Microbiol, Trends Microbiol. and others (-ongoing) • Editorial board of Journal of General Virology (2006) • Member of the American Society for Microbiology • Member of the Society for General Microbiology • Reviewer grant proposals NWO VIDI, VENI, Rubicon
Brief research interests	• The molecular, cellular and immunological aspects of picornavirus replication and pathogenesis.
Five key publications in last 5 years	1. Hsu N, Ilnytska O, Belov G, Santiana M, Chen Y, Pau C, Takvorian P, van der Schaar H, Kaushik-Basu N, Balla T, Cameron C, Ehrenfeld E, **van Kuppeveld FJ**, Altan-Bonnet N. Viruses reorganize secretory pathway to form organelles with specific lipid microenvironment for RNA replication. *Cell,* in press. **IF 31.2** 2. Zoll J, Erkens Hulshof S, Lanke K, Verduyn Lunel F, Melchers WJ, Schoondermark-van de Ven E, Roivainen M, Galama JM, **van Kuppeveld FJ**. Saffold virus, a human Theiler's-like cardiovirus, is ubiquitous and causes infection early in life. *PLoS Pathog*. **5**:e1000416, 2009. **IF 9.1** 3. Verheije MH, Raaben M, Mari M, Te Lintelo EG, Reggiori F, **van Kuppeveld FJ**, Rottier PJ, de Haan CA. Mouse hepatitis coronavirus RNA replication depends on GBF1-mediated ARF1 activation. *PLoS Pathog*. **4**:e1000088, 2008. **IF 9.1** 4. Gubser C, Bergamaschi D, Hollinshead M, Lu X, **van Kuppeveld FJ**, Smith GL. A new inhibitor of apoptosis from vaccinia virus and eukaryotes. *PLoS Pathog*. **3**:e17, 2007. **IF 9.1** 5. Wessels E, Duijsings D, Niu T, Neumann S, Oorschot V, de Lange F, Lanke K, Klumperman J, Henke A, Jackson C, Melchers W, **van Kuppeveld FJ**. A viral protein that blocks Arf1-mediated COP-I assembly by inhibiting the guanine nucleotide exchange factor GBF1. *Dev Cell* 11:191-201, 2006 **IF 13.5**

Appendix O

Name	**Colin Logie**
Birth date/ Country	June 26 1969, Belgium
Department	Molecular Biology
Scientific Qualifications	• PhD (1996) • Assistant professor in Molecular Biology (1999)
Research positions held	• Head of the Chromatin Motors research group (2001-present)
Educational duties / committees	• NCMLS PhD committee (2004-present) • **Member MSc MMD examination board (2006-2009)** • **Member MSc MMD selection committee (2005 – 2009)** • Member FNWI Examination board biology (2001-2008) • Member FNWI Examination board MLW (2004-2008) • Member FNWI Examination board Natuurwetenschappen (2008-present)
Awards & Prizes	• KWF Grant (2007-2010)
Memberships of local, (inter)national committees	• Member of Bestuurlijk Overleg Subfaculteit Biologie (2001-2003) • Member NWO Nucleic Acids study section (2001-present) • Chairman EuroDYNA scientific committee (2005-present)
Brief research interests	• Chromatin structure and transcription, DNA replication, recombination and repair, as well as chromatid condensation, cohesion and segregation. • Histone modifications, on the SNF2-type ATPase bearing chromatin motors, on SMC-type ATPase bearing protein complexes and histone modifications
Five key publications in last 5 years	1. van Vugt JJ, de Jager M, Murawska M, Brehm A, van Noort J, **Logie C**. Multiple aspects of ATP-dependent nucleosome translocation by RSC and Mi-2 are directed by the underlying DNA sequence. *PLoS One.* **4**:e6345, 2009. **IF NA** 2. Burgio G, La Rocca G, Sala A, Arancio W, Di Gesù D, Collesano M, Sperling AS, Armstrong JA, van Heeringen SJ, **Logie C**, Tamkun JW, Corona DF. Genetic identification of a network of factors that functionally interact with the nucleosome remodeling ATPase ISWI. *PLoS Genet.***4**:e1000089, 2008 **IF 8.7** 3. Campsteijn C, Wijnands-Collin AM, **Logie C**.Reverse genetic analysis of the yeast RSC chromatin remodeler reveals a role for RSC3 and SNF5 homolog 1 in ploidy maintenance. *PLoS Genet.* **3**:e92, 2007. **IF 8.7** 4. Ozdemir A, Masumoto H, Fitzjohn P, Verreault A, **Logie C**. Histone H3 lysine 56 acetylation: a new twist in the chromosome cycle. *Cell Cycle.* **5**:2602-8, 2006. **IF 3.2** 5. Ozdemir A, Spicuglia S, Lasonder E, Vermeulen M, Campsteijn C, Stunnenberg HG, **Logie C**. Characterization of lysine 56 of histone H3 as an acetylation site in Saccharomyces cerevisiae. *J Biol Chem.* **280**:25949-52, 2005. **IF 5.9**

Appendix O

Name	**Roos Masereeuw**
Birth date/ Country	May 03 1967, The Netherlands
Department	Pharmacology & Toxicology
Scientific Qualifications	• PhD (1997) • Assistant professor in pharmacology (1998) • Associate professor in pharmacology (2002)
Teaching Qualifications	• Theoretical teaching: Advanced Qualification • Supervision research training: Advanced Qualification
Research positions held	• Mount Desert Island Biological Laboratory (MDIBL), Maine, USA (1997-1998)
Educational duties / committees	• **MSc MMD Board of Examiners (chair)(2007 – present)** • PhD-student Committee of the NCMLS 2005 – present • Board of the major Toxicology for Biomedical Health Sciences (vice-chair), 2003 – present • Lecturer for Postgraduate Education in Toxicology (national programme)
Awards & Prizes	• NWO ASPASIA (2002)
Memberships of local, (inter)national committees	• Member of the Editorial Advisory Board of the *Journal of Pharmacology and Experimental Therapeutics* (2006-) • Advisory Board of "Effect of administration route on biodistribution and shedding of viral vectors used in gene therapy" for the National Institute for Public Health and the Environment (RIVM), 2007 – 2008 • Dutch Society of Pharmacology, Dutch Society of Nephrology, Dutch Society of Toxicology, American Society of Physiology and American Association of Pharmaceutical Sciences. Within the Dutch Society of Pharmacology member of the Congress Committee, 2002-2007
Brief research interests	• Regulation of drug transport under physiological and pathological conditions. • The role of drug transporters in renal regeneration, with an emphasis on the role of stem cells in kidney tissue repair • Proteomics-based analysis of differentially expressed proteins in human urine associated with drug toxicity
Five key publications in last 5 years	1. Heemskerk S, **Masereeuw R**, Moesker O, Bouw MP, van der Hoeven JG, Peters WH, Russel FG, Pickkers P; On behalf of the APSEP Study Group. Alkaline phosphatase treatment improves renal function in severe sepsis or septic shock patients. *Crit Care Med.* **37**:417-23, 2009. **IF 6.3** 2. Huls M, Brown CD, Windass AS, Sayer R, van den Heuvel JJ, Heemskerk S, Russel FG, **Masereeuw R**. The breast cancer resistance protein transporter ABCG2 is expressed in the human kidney proximal tubule apical membrane. *Kidney Int.* **73**:220-5, 2008. **IF 4.9** 3. Huls M, Kramers C, Levtchenko EN, Wilmer MJ, Dijkman HB, Kluijtmans LA, van der Hoorn JW, Russel FG, **Masereeuw R**. P-glycoprotein-deficient mice have proximal tubule dysfunction but are protected against ischemic renal injury. *Kidney Int.***72**:1233-41, 2007. **IF 4.9** 4. Huls M, van den Heuvel JJ, Dijkman HB, Russel FG, **Masereeuw R**. ABC transporter expression profiling after ischemic reperfusion injury in Mouse kidney. *Kidney Int.* **69**:2186-93, 2006. **IF 4.8** 5. **Masereeuw R**, Notenboom S, Smeets PHE, Wouterse AC and Russel FGM. Impaired renal secretion of Mrp2-substrates in mutant transport deficient (TR-) rats. *J. Am. Soc. Nephrol.***14**:2741-49, 2003. **IF 7.5**

Appendix O

Name	**Annemiek Nelis**
Birth date/ Country	April 23 1970, The Netherlands
Department	Faculty of Science (FNWI); Institute for Science, innovation and Society (ISIS); Centre for Society and Genomics (CSG).
Scientific Qualifications	• MA Health Science (University of Maastricht) • PhD sociology of technology (University of Twente)
Research positions held	• PhD student University Twente, the Netherlands (1993–1997) • post-doc Science and Technology Studies Unit (SATSU), APU, Cambridge (UK) (1997–1999) • Assistant professor Amsterdam Vrije Universiteit, the Netherlands (1999–2001) • Assistant professor University of Amsterdam, The Netherlands (2001-2004) • General director Centre for Society and Genomics (2007 - present)
Educational duties / committees	• Initiator of "Wetenschapsknoopunt Radboud Universiteit" (together with prof. Carl Figdor). (2009-present) • Coordinator national PhD network research school Science, Technology and Modern Culture (WTMC) (1999–2005) • **Coordinator MSc MMD course Science & Society** • Courses - Our Genetic Identity. Cursus Honours Program, Radboud Universiteit Nijmegen. (2008) - Course coordinator Science and Society, MSc Molecular Mechanisms of Disease, Radboud Universiteit Nijmegen. (2008) - Summer School ELSA Genomics. Together with Centre for Economic and Social Aspects of Genomcis (UK) & Universiteit van Amsterdam. (2006) - Onze Genetische Identiteit. Bachelor studenten. On behalf of Institute for Interdisciplinary Studies (IIS), Universiteit van Amsterdam (UvA), Amsterdam (2005)
Memberships of local, (inter)national committees	• Member scientific Advisory Board ESRC Genomics Centre EGENIS, Exeter, UK. (2009–present) • Associated Fellow. Science & Technology Studies Unit (SATSU) University of York, York, UK. (0-aanstelling). (1999–present)
Brief research interests	• Research interest focuses on the relationship between genomics and society. Her current work focuses in particular on biobanks, genetic data and the role of genomics in corporate science.
Five key publications in last 5 years	1. Penders B, Verbakel JMA, **Nelis A** (accepted for publication). The social study of corporate science: A research manifesto. *Bulletin of Science, Technology and society*. 2. Bijker W, Brom F, Hoppe R, Schipaanbord A, Terpstra E, **Nelis A**. The Societal aspect of the life sciences in 2020. In: *Laane & Besteman (editors)* Partners in the Polder, a visioen of the life sciences in the Netherlands and the role of public-private partnerships, Den Haag. 2009 3. Koops BJ, Lüthy C, **Nelis A**, Sieburgh C. De Maakbare Mens. Tussen Fictie en Fascinatie*. Uitgeverij Prometheus/Bert Bakker.* 4. Radstake M, van den Heuvel-Vromans E, Jeucken N, Dortmans K, **Nelis A** Societal dialogue needs more than public engagement. *EMBO reports* **10**:313–17, 2009. **IF7.1** 5. **Nelis A**, De Vries G, Hagendijk R. Patients as public in ethics debates: interpreting the role of patient's organisations in democracy In: Atkinson, Paul. Glasner, Peter & Helen Greenslade, *New Genetics, New Identities*. London: Routledge, p.28-43, 2007

Appendix O

Name	**Joost Schalkwijk**
Birth date/ Country	February 20 1954
Department	Dermatology
Scientific Qualifications	• MSc in Biology and Chemistry (B4), Nijmegen and Leiden • PhD Experimental Rheumatology, faculty of Medicine (1986) • Professor of Experimental Dermatology (2003-now)
Teaching Qualifications	• Theoretical teaching: Advanced Qualification • Supervision research training: Advanced Qualification
Research positions held	• Post-doc, department of Rheumatology • Post-doc, department of Dermatology • Associate professor and head of laboratory, department of Dermatology
Educational duties / committees	• **Lectures and courses** in the Medicine curriculum and **master's programme in MMD**. • Lectures in master's programme in Molecular Life Sciences (Science faculty) • **Chairman of the MMD Programme Committee (2008 – present)**
Awards & Prizes	• NWO-genomics grant • Wyeth award for psoriasis research
Memberships of local, (inter)national committees	• Past member of the science committee at the RUNMC (WECO) • Subtheme leader of the NCMLS and past member of the NCMLS research council • Chairman of the annual Science day of N4i • Member of the NWO VIDI committee • Elected Member of the board of the Dutch Society for Experimental Dermatology • Past chairman of the Dutch society for connective tissue research • Member of the European skin barrier network; co-organizer of the annual meeting • Reviewer for international research councils (UK, Israel, France, Belgium) • Reviewer for various international journals including the J Clin Invest, J Biol Chem, Am J Pathol, Hum Mol Genet, J Invest Dermatol
Brief research interests	• Genetics and cell biology of skin inflammation and infection • Keratinocyte biology • Proteases and protease inhibitors
Five key publications in last 5 years	1. Jansen PA, Rodijk-Olthuis D, Hollox EJ, kamsteeg M, Tjabringa GS, de Jongh GJ, van Vlijmen-Willems IM, Bergboer JG, van Rossum MM, de Jong EM, den HM, Evers AW, Bergers M, Armour JA, Zeeuwen PL, **Schalkwijk J.** Beta-defensin-2 protein is a serum biomarker for disease activity in psoriasis and reaches biologically relevant concentrations in lesional skin. *PLoS ONE* **4**: e4725, 2009. **IF NA** 2. de CidR, Riveira-Munoz E, Zeeuwen PL, Robarge J, Liao W, Dannhauser EN, Giardina E, Stuart PE, Nair R, Helms C, Escaramis G, Ballana E, Martin-Ezquerra G, den HM, Kamsteeg M, Joosten I, Eichler EE, Lazaro C, Pujol RM, Armengol L, Abecasis G, Elder JT, Novelli G, Armour JA, Kwok PY, Bowcock A, **Schalkwijk J**, Estivill X. Deletion of the late cornified envelope LCE3B and LCE3C genes as a susceptibility factor for psoriasis. *Nat Genet* **41**:211-5, 2009. **IF 25.6** 3. Hollox EJ, Huffmeier U, Zeeuwen PL, Palla R, Lascorz J, Rodijk-Olthuis D, van de Kerkhof PC, Traupe H, de Jongh G, den Heijer M, Reis A, Armour JA, **Schalkwijk J**. Psoriasis is associated with increased beta-defensin genomic copy number. *Nat Genet* **40**:23-5, 2008. **IF 25.6** 4. Cheng T, Hitomi K, van Vlijmen-Willems IM, de Jongh GJ, Yamamoto K, Nishi K, Watts C, Reinheckel T, **Schalkwijk J**, Zeeuwen PL. Cystatin M/E is a high affinity inhibitor of cathepsin V and cathepsin L by a reactive site that is distinct from the legumain-binding site. A novel clue for the role of cystatin M/E in epidermal cornification. *J Biol Chem* **281**:15893-9, 2006. **IF 5.9** 5. de Jongh GJ, Zeeuwen PL, Kucharekova M, Pfundt R, van der Valk, Blokx W, Dogan A, Hiemstra PS, van de Kerkhof PC, **Schalkwijk J** (2005). High expression levels of keratinocyte antimicrobial proteins in psoriasis compared with atopic dermatitis. *J Invest Dermatol* **125**:1163-73, 2005. **IF 5.3**

Appendix O

Name	**Joris Veltman**
Birth date/ Country	August 28 1971, The Netherlands
Department	Department of Human Genetics
Scientific Qualifications	• PhD (1999) • Associate Professor in Genomic Disorders (2008-present)
Teaching Qualifications	• Theoretical teaching: Basic Qualification • Supervision research training: Basic Qualification
Research positions held	• Postdoctoral fellow, dept. Cancer Genetics, UCSF Comprehensive Cancer Centre, San Francisco, USA. (1999-2000) • Postdoctoral fellow, dept. Human Genetics, Radboud University Nijmegen Medical Centre, Nijmegen, NL. (2001-2004) • Assistant professor and Head Microarray Facility Nijmegen, dept. Human Genetics, Radboud University Nijmegen Medical Centre, Nijmegen, NL. (2005-2008)
Educational duties / committees	• **Coordinator MSc MMD course Genomics and Statistics (together with dr. Ton Feuth).** • Lecturer in various Local and National courses on Genomics Technologies and genomic disorders.
Awards & Prizes	• "Isabella Oberlé Award", European Human Genetics Conference, Birmingham, United Kingdom (2003).
Memberships of local, (inter)national committees	• Member Scientific Steering Committee Institute of Genetic and Metabolic Disease, one of the six Research Institutes of the Radboud University Nijmegen Medical Centre (2008-now). • Member Scientific Steering Committee gEUVADIS, a European Initiative for Medical Genome Sequencing (2008-now).
Brief research interests	• My work focuses on disease gene identification, structural genomic variation and improving genetic diagnosis in general using state-of-the-art technologies and approaches such as microarrays, bioinformatics and whole genome sequencing.
Five key publications in last 5 years	1. Webber C, Hehir-Kwa JY, Nguyen DQ, de Vries BBA, **Veltman J.A.***, Ponting CP*. Forging links between human mental retardation-associated CNVs and mouse gene knockout models. *PLoS Genetics* **5**:e1000531, 2009 **IF 8.9** *Joint senior authors. 2. Friedman J, Vrijenhoek T, Markx S, Janssen IM, van der Vliet WA, Faas BHW, Knoers NV, Cahn W, Kahn RS, Edelmann L, Davis KL, Silverman JM, Brunner HG, Geurts van Kessel A, Wijmenga C, Ophoff RA, **Veltman J.A**. CNTNAP2 gene dosage variation is associated with schizophrenia and epilepsy. *Mol Psych* **13**:261-266, 2008. **IF 12.5** 3. Vrijenhoek T, Buizer-Voskamp JE, van der Stelt I, Strengman E; Genetic Risk and Outcome in Psychosis (GROUP) Consortium, Sabatti C, Geurts van Kessel A, Brunner HG, Ophoff RA, **Veltman J.A**. Recurrent CNVs disrupt three candidate genes in schizophrenia patients. *Am J Hum Genet.* **83**:504-10, 2008. **IF 10.2** 4. de Vries BB, Pfundt R, Leisink M, Koolen DA, Vissers LE, Janssen IM, Reijmersdal S, Nillesen WM, Huys EH, Leeuw N, Smeets D, Sistermans EA, Feuth T, van Ravenswaaij-Arts CM, Geurts van Kessel A, Schoenmakers EF, Brunner HG, **Veltman JA**. Diagnostic genome profiling in mental retardation. *Am J Hum Genet*, **77**:606-16, 2005. **IF 10.2** 5. Vissers LE, van Ravenswaaij CMA, Admiraal R, Hurst JA, de Vries BBA, Janssen IM, van der Vliet WA, Huys EH, de Jong PJ, Hamel BC, Schoenmakers EF, Brunner HG, **Veltman JA**, Geurts van Kessel A. Mutations in a novel member of the chromodomain gene family cause CHARGE syndrome. *Nature Genet*, **36**:955-7, 2004. **IF 30.2**

Appendix O

Name	**Bé Wieringa**
Birth date/ Country	July 10 1951, The Netherlands
Department	Cell Biology
Scientific Qualifications	• Ph.D. (Summa Cum Laude) (1980) • Full Professor and in Cell Biology
Teaching Qualifications	• Theoretical teaching: Advanced Qualification • Supervision research training: Advanced Qualification
Research positions held	• Post-doctoral period/Senior Scientist at the Institut für Molekularbiologie I, ETH University Zürich, Switzerland CH (EMBL-long term fellowship/kanton Zürich). • Senior Scientist (tenured), Netherlands Institute for Public Health and Environmental Hygiene, Bilthoven NL (poliovirus biology - vaccine development). • Associate Professor, Head Recombinant DNA research Group, Dept. Human Genetics, Medical Faculty, Radboud University Nijmegen. • Professor and Head of Dept. Cell Biology, Medical Faculty University Nijmegen (now: Radboud University Nijmegen Medical Centre). • Chairman Board of Directors NCMLS, Radboud University Nijmegen Medical Centre.
Educational duties / committees	• Co-Initiator - and Member of the Board - of the Institute for Cellular Signaling (ICS) Nijmegen (1994-2002). • Chairman ICS-Ph.D. Program-Committee ICS (1995 - 1998). • Chairman FMW-KUN Ph.D. Committee (1995/1997). • Teacher in a number of BSc and MSc Courses. • **Co-Initiator of MSc Molecular Mechanisms of Disease (2004)** • **Coordinator MSc MMD Core Fundamental Theme 2 (2005-present)**
Awards & Prizes	• Chemistry Student Award (RUG, Faculty of Chemistry) 1969. • EMBL Long Term Fellowship (Post-doc), 1980-1982 • Award of the Dutch Society for Biochemistry and Molecular Biology, 1983 • Personal Travel Awards (MDA, AFM, NWO), 1988-present
Memberships of local, (inter)national committees	• Member ZonMW INV committee • Member Research Council NCMLS • Chairman RU GGO Advisory Committee • Chairman and Member of various Appointment Committees RUNMC • Member Editorial Board FEBS Letters
Brief research interests	• Metabolic Compartmentalization: Energy (ATP) and Redox (NAD(P)(H) metabolism • Metabolic control of actomyosin-based cell dynamics.
Five key publications in last 5 years	1. Mulders SAM, van den Broek WJAA, Wheeler TM, Croes HJE, van Kuik-Romein P, de Kimpe SJ, Furling D, Platenburg GJ, Gourdon G, Thornton CA, **Wieringa B**, Wansink DG Triplet-repeat oligonucleotide-mediated reversal of RNA toxicity in myotonic dystrophy. *Proc Natl Acad Sci USA* **106**:13915-20, 2009. **IF 9.6.** 2. van Horssen R, Janssen E, Peters W, van de Pasch L, Lindert MM, van Dommelen MM, Linssen PC, Hagen TL, Fransen JA, **Wieringa B**. Modulation of Cell Motility by Spatial Repositioning of Enzymatic ATP/ADP Exchange Capacity. *J Biol Chem.* **284**:1620-7, 2009. **IF 5.6** 3. Chang EJ, Ha J, Oerlemans F, Lee YJ, Lee SW, Ryu J, Kim HJ, Lee Y, Kim HM, Choi JY, Kim JY, Shin CS, Pak YK, Tanaka S, **Wieringa B**, Lee ZH, Kim HH. Brain-type creatine kinase has a crucial role in osteoclast-mediated bone resorption. *Nat Med.* **14**:966-72, 2008. **IF 26.3** 4. Kuiper JW, Pluk H, Oerlemans F, van Leeuwen FN, de Lange F, Fransen J, **Wieringa B**. Creatine kinase-mediated ATP supply fuels actin-based events in phagocytosis. *PLoS Biol.***6**:e51, 2008. **IF 13.5** 5. Willemse M, Janssen E, de Lange F, **Wieringa B**, Fransen F. ATP and FRET, a cautionary note. *Nature Biotech.* **25**:170-2, 2007. **IF 22.3**

Appendix O

Top 5 publications from the NCMLS Principal Investigators that are not mentioned above.

Theme 1a

Wim van der Berg

1. Geurts J, Joosten LA, Takahashi N, Arntz OJ, Glück A, Bennink MB, **van den Berg WB**, van de Loo FA. Computational design and application of endogenous promoters for transcriptionally targeted gene therapy for rheumatoid arthritis. *Mol Ther.* **17**:1877-87, 2009. **IF 6.8**
2. Abdollahi-Roodsaz S, Joosten LA, Koenders MI, Devesa I, Roelofs MF, Radstake TR, Heuvelmans M, Akira S, Nicklin MJ, Ribeiro-Dias F, **van den Berg WB**. Stimulation of TLR2 and TLR4 differentially skews the balance of T cells in a mouse model of arthritis. *J Clin Invest.* 118: 205-16, 2008. **IF 15.8**
3. Zwerina J, Redlich K, Polzer K, Joosten L, Kronke G, Distler J, Hess A, Pundt N, Pap T, Hoffmann O, Gasser J, Scheinecker C, Smolen JS, **van den Berg WB**, Schett G. TNF induced structural joint damage is mediated by IL-1. *PNAS* **104**:11742-7, 2007. **IF 9.6**
4. Joosten LAB, Netea MG, Kim SH, Oppers Walgreen B, Radstake TRD, Barrera P, van de Loo FAJ, Dinarello CA, **van den Berg WB**. IL-32, a new proinflammatory cytokine in RA. *PNAS* **103**: 3298-303, 2006 **IF 9.6**
5. Netea MG, Joosten LAB, Lewis E, Jensen DR, Voshol PJ, Fantuzzi G, Kullberg BJ, Tack CJ, van Krieken H, Kim SH, Stalenhoef AF, van de Loo FAJ, Verschueren I, Pulawa L, Akira S, Eckel RH, Dinarello CA, **van den Berg WB**, van der Meer JWM. Deficiency of IL-18 in mice leads to hyperphagia, obesity and insulin resistance. *Nature Med*. **12**: 650-56, 2006. **IF 28.6**

Theme 1b

Roland Brock

1. Ruttekolk IR, Duchardt F, Fischer R, Wiesmüller KH, Rademann J, **Brock R**. HPMA as a scaffold for the modular assembly of functional peptide polymers by native chemical ligation. *Bioconjug Chem.* **19**:2081-7, 2008. **IF 4.4**
2. Köhler K, Ganser A, André T, Roth G, Grosse-Hovest L, Jung G, **Brock R**. Stimulus dependence of the action of small-molecule inhibitors in the CD3/CD28 signalling network. *Chem Med Chem.* **3**:1404-11, 2008. **IF 3.4**
3. Duchardt F, Fotin-Mleczek M, Schwarz H, Fischer R, **Brock R**. A comprehensive model for the cellular uptake of cationic cell-penetrating peptides. *Traffic*. **8**:848-66, 2007. **IF 6.5**
4. Stoevesandt O, Köhler K, Wolf S, André T, Hummel W, **Brock R**. A network analysis of changes in molecular interactions in cellular signaling. *Mol Cell Proteomics*. **6**:503-13, 2007. **IF 9.4**
5. Stoevesandt O, Köhler K, Fischer R, Johnston IC, **Brock R**. One-step analysis of protein complexes in microliters of cell lysate. *Nat Methods.* **2**:833-5, 2005. **IF 15.5**

Jolanda de Vries

1. Meyer-Wentrup F, Benitez-Ribas D, Tacken PJ, Punt CJ, Figdor CG, **de Vries IJ**, Adema GJ. Targeting DCIR on human plasmacytoid dendritic cells results in antigen presentation and inhibits IFN-alpha production. *Blood* 111:4245-53, 2008. **IF 10.4**
2. Tacken PJ, **de Vries IJ**, Torensma R, Figdor CG. Dendritic-cell immunotherapy: from ex vivo loading to in vivo targeting. *Nature reviews* **7**:790-802, 2007. **IF 28.7**
3. Benitez-Ribas D, Adema G J, Winkels G, Klasen IS, Punt CJ, Figdor CG, **de Vries IJ**. Plasmacytoid dendritic cells of melanoma patients present exogenous proteins to CD4+ T cells after Fc gamma RII-mediated uptake. *J Exp Med* **203**:1629-35, 2006. **IF 14.6**
4. **de Vries IJ**, Lesterhuis WJ, Barentsz JO, Verdijk P, van Krieken JH, Boerman OC, Oyen WJ, Bonenkamp JJ, Boezeman JB, Adema GJ, et al. Magnetic resonance tracking of dendritic cells in melanoma patients for monitoring of cellular therapy. *Nat Biotechnol* **23**:1407-13, 2005. **IF 22.4**
5. **de Vries IJ**, Bernsen MR, Lesterhuis WJ, Scharenborg NM, Strijk SP, Gerritsen MJ, Ruiter DJ, Figdor CG, Punt CJ, Adema GJ. Immunomonitoring tumor-specific T cells in delayed-type hypersensitivity skin biopsies after dendritic cell vaccination correlates with clinical outcome. *J Clin Oncol* **23**:5779-87, 2005. **IF 10.2**

Theme 1c

Toin van Kuppevelt

1. Gotte M, Spillmann D, Yip GW, Versteeg E, Echtermeyer FG, **Van Kuppevelt TH**, Kiesel L. Changes in heparan sulfate are associated with delayed wound repair, altered migration, adhesion and contractility in the galactosyltransferase I (beta4GalT-7) deficient form of Ehlers-Danlos syndrome. *Hum. Mol. Genet.* **17**:996-1009, 2008. **IF 8.1**

2. Dinglasan RR, Alaganan A, Ghosh AK, Saito A, **Van Kuppevelt TH**, Jacob-Lorena M. Plasmodium flaciperum ookinetes require mosquito midgut chondroitin sulfate proteoglycans for cell invasion. *Proc. Natl. Acad. Sci USA*, **104**:15882-7, 2007. **IF 9.6**
3. Daamen WF, Geutjes PJ, Van Moerkerk HTB, Nillesen STM, Wismans RG, Hafmans T, Van den Heuvel LP, Pistorius AMA, Veerkamp JH, Van Hest JCM, **Van Kuppevelt TH**. Lyophilisomes: a new type of (bio)capsules. *Adv. Mater*. **19**: 673-7, 2007. **IF 7.9**
4. Lensen JFM, Rops ALWMM, Wijnhoven TJM, Hafmans T, Feitz WFJ, Oosterwijk E, Banas B, Bindels RJM, van den Heuvel LPWJ, van der Vlag J, Berden JHM, **Van Kuppevelt TH**. Localization and functional characterization of glycosaminoglycan domains in the normal human kidney as revealed by phage display-derived single chain antibodies. *J. Am. Soc. Nephrol*. **16**:1279-88, 2005. **IF 7.4**
5. Jenniskens GJ, Koopman WJ, Willems PHGM, Pecker I, Veerkamp JH, **Van Kuppevelt TH**. Phenotypic knock out of heparan sulfates in myotubes impairs excitation-induced calcium spiking. *FASEB J*. **17**:878-80, 2003. **IF 6.7**

John Jansen

1. Nikolidakis D, Meijer GJ, Oortgiesen DA, Walboomers XF, **Jansen JA**. The effect of a low dose of transforming growth factor beta1 (TGF-beta1) on the early bone-healing around oral implants inserted in trabecular bone. *Biomaterials*. **30**:94-9, 2009. **IF 6.3**
2. Habraken WJ, Zhang Z, Wolke JG, Grijpma DW, Mikos AG, Feijen J, **Jansen JA**. Introduction of enzymatically degradable poly(trimethylene carbonate) microspheres into an injectable calcium phosphate cement. *Biomaterials*. **29**:2464-76, 2008. **IF 6.3**
3. Link DP, van den Dolder J, van den Beucken JJ, Wolke JG, Mikos AG, **Jansen JA**. Bone response and mechanical strength of rabbit femoral defects filled with injectable CaP cements containing TGF-beta 1 loaded gelatin microparticles. *Biomaterials*. **29**:675-82, 2008. **IF 6.3**
4. Zhang W, Walboomers XF, van Kuppevelt TH, Daamen WF, Bian Z, **Jansen JA**. The performance of human dental pulp stem cells on different three-dimensional scaffold materials. *Biomaterials*. **27**:5658-68, 2006. **IF 6.3**
5. Link DP, van den Dolder J, Jurgens WJ, Wolke JG, **Jansen JA**. Mechanical evaluation of implanted calcium phosphate cement incorporated with PLGA microparticles. *Biomaterials*. **27**:4941-7, 2006. **IF 6.3**

Theme 2a

Jan Smeitink

1. Hoefs SJ, Dieteren CE, Distelmaier F, Janssen RJ, Epplen A, Swarts HG, Forkink M, Rodenburg RJ, Nijtmans LG, Willems PH, **Smeitink JA**, van den Heuvel LP. NDUFA2 complex I mutation leads to Leigh disease. *Am J Hum Genet.* **82**:1306-15, 2008. **IF 11.1**
2. Dieteren CE, Willems PH, Vogel RO, Swarts HG, Fransen J, Roepman R, Crienen G, **Smeitink JA**, Nijtmans LG, Koopman WJ. Subunits of mitochondrial complex I exist as part of matrix- and membrane-associated subcomplexes in living cells. *J Biol Chem*. **283**:34753-61, 2008. **IF 5.6**
3. Hoefs SJ, Dieteren CE, Distelmaier F, Janssen RJ, Epplen A, Swarts HG, Forkink M, Rodenburg RJ, Nijtmans LG, Willems PH, **Smeitink JA**, van den Heuvel LP. NDUFA2 complex I mutation leads to Leigh disease. *Am J Hum Genet*. **82**:1306-15, 2008. **IF 11.1**
4. Smits P, **Smeitink JA**, van den Heuvel LP, Huynen MA, Ettema TJ. Reconstructing the evolution of the mitochondrial ribosomal proteome. *Nucleic Acids Res*. **35**:4686-703. **IF 7.0**
5. Vogel RO, Janssen RJ, van den Brand MA, Dieteren CE, Verkaart S, Koopman WJ, Willems PH, Pluk W, van den Heuvel LP, **Smeitink JA**, Nijtmans LG. Cytosolic signaling protein Ecsit also localizes to mitochondria where it interacts with chaperone NDUFAF1 and functions in complex I assembly. *Genes Dev.* **21**:615-24, 2007. **IF 14.8**

Theme 2b

Rene Bindels

1. Cao G, Thébault S, van der Wijst J, van der Kemp A, Lasonder E, **Bindels RJ**, Hoenderop JG. RACK1 a new auxiliary protein inhibiting TRPM6 activity via phosphorylation of the fused α-kinase domain. *Current Biology* **18**:168-76, 2008. **IF 10.6**
2. Nijenhuis T, van der Eerden BC, Hoenderop JG, Weinans H, van Leeuwen JP, **Bindels RJ**. The Bone Resorption Inhibitor Alendronate Normalizes the Reduced Bone Thickness of $TRPV5^{-/-}$ Mice. *J Bone Miner Res* **23**:1815-24, 2008. **IF 6.0**
3. Tiel Groenestege W, Thébault S, van der Wijst J, van den Berg D, Janssen R, Tejpar S, van den Heuvel L, van Cutsem E, Hoenderop JG, Knoers N and **Bindels RJ**. Impaired basolateral sorting of pro-EGF causes related recessive renal hypomagnesemia. *J Clin Invest* **117**:2260-7, 2007. **IF 16.9**
4. Lambers TT, Mahieu F, Oancea E, Hoofd L, de Lange F, Mensenkamp AR, Voets T, Nilius B, Clapham DE, Hoenderop JG, **Bindels RJ**. Calbindin-D_{28K} dynamically controls TRPV5-mediated Ca^{2+} transport. *Embo J* **25**:2978-88, 2006. **IF 8.7**

5. Chang Q, S Hoefs, A van der Kemp, C Topala, **RJ Bindels**, JG Hoenderop. TRPV5 channel activation on the cell surface depends on extracellular glycan hydrolysis by the β-glucuronidase klotho. *Science* **310**:490-93, 2005. **IF 26.4**

Peter Friedl

1. **Friedl P**, Wolf K. Tube travel: protease functions in individual and collective cancer invasion. *Cancer Res.* **68**:7247-9, 2008. **IF 7.7**
2. **Friedl P**, Weigelin B. Interstitial leukocyte trafficking and immune function. *Nat. Immunol.* **9**:839-48, 2008. **IF 26.2**
3. Wolf K, Wu YI, Liu Y, Tam E, Geiger J, Overall C, Stack MS, **Friedl P**. Multi-step pericellular proteolysis controls the transition from individual to collective cancer cell invasion. *Nat. Cell Biol.* **9**:893-904, 2007. **IF 18.5**
4. **Friedl P**. Cell fusion: new mechanisms for plasticity in cancer? *Lancet Oncol*. **4**:916-918, 2005. **IF 10.1**
5. **Friedl P**, den Boer AT, Gunzer M. Tuning immune responses: diversity and adaptation of the immunological synapse. *Nat. Rev. Immunol*. **5**:532-45, 2005. **IF 28.7**

Peter Deen

1. Robben JH, Kortenoeven ML, Sze M, Yae C, Milligan G, Oorschot VM, Klumperman J, Knoers NV, **Deen PMT.** Intracellular activation of vasopressin V2 receptor mutants in nephrogenic diabetes insipidus by nonpeptide agonists. *Proc Natl Acad Sci U S A.* **106**:12195-200, 2009. **IF 9.6**
2. Robben JH, Sze M, Knoers NVAM, Eggert P, **Deen PMT**, Müller D. Relief of nocturnal enuresis by desmopressin is kidney and Vasopressin type-2 receptor independent. *J Am Soc Nephrol*. **18**:1534-9, 2007. **IF 7.4**
3. Kamsteeg E-J, Duffield AS, Konings IBM, Spencer J, Pagel P, **Deen PMT**, Caplan MJ. MAL Decreases the internalization of the Aquaporin-2 Water Channel. *Proc Natl Acad Sci U S A.* **104**:16696-701, 2007. **IF 9.6**
4. Kamsteeg E-J, Hendriks G, Konings IBM, Oorschot V, van der Sluijs P, Klumperman J, **Deen PMT**. Lys63-linked short-chain ubiquitination regulates aquaporin-2 endocytosis from the apical membrane. *Proc. Natl Acad. Sci. USA* **103**:18344-9, 2006. **IF 9.6**
5. Fabra M, Raldúa D, Power DM, **Deen PMT**, Cerdà J. Marine fish egg hydration is aquaporin mediated. *Science* **307**:545, 2005. **IF 30.0**

Frans Russel

1. Huls M, **Russel FG**, Masereeuw R. The role of ATP binding cassette transporters in tissue defense and organ regeneration. *J Pharmacol Exp Ther.* **328**:3-9, 2009. **IF 4.0**
2. Wagener FA, Toonen EJ, Wigman L, Fransen J, Creemers MC, Radstake TR, Coenen MJ, Barrera P, van Riel PL, **Russel FG**. HMOX1 promoter polymorphism modulates the relationship between disease activity and joint damage in rheumatoid arthritis.*Arthritis Rheum*. **58**:3388-93, 2008. **IF 7.7**
3. El-Sheikh AA, van den Heuvel JJ, Koenderink JB, **Russel FG**. Effect of hypouricaemic and hyperuricaemic drugs on the renal urate efflux transporter, multidrug resistance protein 4.*Br J Pharmacol.* **155**:1066-75, 2008. **IF 3.8**
4. Vegt E, van Eerd JE, Eek A, Oyen WJ, Wetzels JF, de Jong M, **Russel FG**, Masereeuw R, Gotthardt M, Boerman OC. Reducing renal uptake of radiolabeled peptides using albumin fragments. *J Nucl Med.* **49**:1506-11, 2008. **IF 5.9**
5. El-Sheikh AA, van den Heuvel JJ, Krieger E, **Russel FG**, Koenderink JB. Functional role of arginine 375 in transmembrane helix 6 of multidrug resistance protein 4 (MRP4/ABCC4). *Mol Pharmacol*. **74**:964-71, 2008. **IF 3.6**

Theme 3a

Hannie Kremer

1. van Wijk E, Kersten FF, Kartono A, Mans DA, Brandwijk K, Letteboer SJ, Peters TA, Märker T, Yan X, Cremers CW, Cremers FP, Wolfrum U, Roepman R, **Kremer H**. Usher syndrome and Leber congenital amaurosis are molecularly linked via a novel isoform of the centrosomal ninein-like protein. *Hum Mol Genet* **18**:51-64, 2009. **IF 7.8**
2. Collin RW, Kalay E, Tariq M, Peters T, van der Zwaag B, Venselaar H, Oostrik J, Lee K, Ahmed ZM, Caylan R, Li Y, Spierenburg HA, Eyupoglu E, Heister A, Riazuddin S, Bahat E, Ansar M, Arslan S, Wollnik B, Brunner HG, Cremers CW, Karaguzel A, Ahmad W, Cremers FP, Vriend G, Friedman TB, Riazuddin S, Leal SM, **Kremer H.** Mutations of ESRRB encoding estrogen-related receptor beta cause autosomal-recessive nonsyndromic hearing impairment DFNB35. *Am J Hum Genet* **82**,125-38, 2008. **IF 11.1**
3. Ahmed ZM, Masmoudi S, Kalay E, Belyantseva IA, Mosrati MA, Collin RW, Riazuddin S, Hmani-Aifa M, Venselaar H, Kawar MN, Tlili A, van der Zwaag B, Khan SY, Ayadi L, Riazuddin SA, Morell RJ, Griffith AJ, Charfedine I, Caylan R, Oostrik J, Karaguzel A, Ghorbel A, Riazuddin S, Friedman TB, Ayadi H, **Kremer H**. Mutations of LRTOMT, a fusion gene with alternative reading frames, cause nonsyndromic deafness in human. *Nat Genet* **40**:1335-40, 2008. **IF 25.6**
4. Collin RW, Chellappa R, Pauw RJ, Vriend G, Oostrik J, van Drunen W, Huygen PL, Admiraal R, Hoefsloot LH, Cremers FP, Xiang M, Cremers CW, **Kremer H.** Missense mutations in POU4F3 cause autosomal dominant hearing impairment DFNA15 and affect subcellular localization and DNA binding. *Hum Mutat* **29**:545-54, 2008. **IF 6.3**
5. van Wijk E, van der Zwaag B, Peters T, Zimmermann U, te Brinke H, Kersten FF, Märker T, Aller E, Hoefsloot LH, Cremers CW, Cremers FP, Wolfrum U, Knipper M, Roepman R, **Kremer H**. The DFNB31 gene product whirlin

connects to the Usher protein network in the cochlea and retina by direct association with USH2A and VLGR1. *Hum. Mol. Genet.* **15**:751-65, 2006. **IF 7.8**

Han van Krieken

1. Tol J, Koopman M, Cats A, Rodenburg CJ, Creemers GJ, Schrama JG, Erdkamp FL, Vos AH, van Groeningen CJ, Sinnige HA, Richel DJ, Voest EE, Dijkstra JR, Vink-Börger ME, Antonini NF, Mol L, **van Krieken JH**, Dalesio O, Punt CJ. Chemotherapy, bevacizumab, and cetuximab in metastatic colorectal cancer. *N Engl J Med*. **360**:563-72, 2009. **IF 52.5**
2. Koopman M, Kortman GA, Mekenkamp L, Ligtenberg MJ, Hoogerbrugge N, Antonini NF, Punt CJ, **van Krieken JH.** Deficient mismatch repair system in patients with sporadic advanced colorectal cancer. *Br J Cancer.* **100**:266-73, 2009. **IF 4.6**
3. Ligtenberg MJ, Kuiper RP, Chan TL, Goossens M, Hebeda KM, Voorendt M, Lee TY, Bodmer D, Hoenselaar E, Hendriks-Cornelissen SJ, Tsui WY, Kong CK, Brunner HG, van Kessel AG, Yuen ST, **van Krieken JH**, Leung SY, Hoogerbrugge N. Heritable somatic methylation and inactivation of MSH2 in families with Lynch syndrome due to deletion of the 3' exons of TACSTD1. *Nat Genet.* 41:112-7, 2009. **IF 25.6**
4. van Herpen CM, van der Voort R, van der Laak JA, Klasen IS, de Graaf AO, van Kempen LC, de Vries IJ, Boer TD, Dolstra H, Torensma R, **van Krieken JH**, Adema GJ, De Mulder PH. Intratumoral rhIL-12 administration in head and neck squamous cell carcinoma patients induces B cell activation. *Int J Cancer.* **123**:2354-61, 2008. **IF 4.6**
5. Overes IM, de Rijke B, van Horssen-Zoetbrood A, Fredrix H, de Graaf AO, Jansen JH, **van Krieken JH**, Raymakers RA, van der Voort R, de Witte TM, Dolstra H. Expression of P2X5 in lymphoid malignancies results in LRH-1-specific cytotoxic T-cell-mediated lysis. *Br J Haematol*.**141**:799-807, 2008. **IF 4.5**

Jack Schalken

1. Salagierski M, Verhaegh GW, Jannink SA, Smit FP, Hessels D, **Schalken JA.** Differential expression of PCA3 and its overlapping PRUNE2 transcript in prostate cancer. *Prostate.* **70**:70-8, 2010. **IF 3.7**
2. Hessels D, Smit FP, Verhaegh GW, Witjes JA, Cornel EB, **Schalken JA**. Detection of TMPRSS2-ERG fusion transcripts and prostate cancer antigen 3 in urinary sediments may improve diagnosis of prostate cancer. *Clin Cancer Res* **13**:5103-8, 2007. **IF 6.2**
3. Moonen PM, Peelen P, Kiemeney LA, Boon ME, **Schalken JA**, Witjes JA. Quantitative cytology on bladder wash versus voided urine: a comparison of results. *Eur Urol* 49:1044-9, 2006. **IF 5.6**
4. van Gils MP, Hessels D, van HO, Jannink SA, Peelen WP, Hanssen SL, **Schalken JA**. The time-resolved fluorescence-based PCA3 test on urinary sediments after digital rectal examination; a Dutch multicenter validation of the diagnostic performance. *Clin Cancer Res* **13**:939-43, 2007. **IF 6.2**
5. Schrier BP, Vriesema JL, Witjes JA, Kiemeney LA, **Schalken JA**. The predictive value of p53, p27(kip1), and alpha-catenin for progression in superficial bladder carcinoma. *Eur Urol* **50**:76-82, 2006. **IF 5.6**

Annette Schenck

1. Zweier C, de Jong EK, Zweier M, Orrico A, Ousager LB, Collins AL, Bijlsma EK, Oortveld MA, Ekici AB, Reis A, **Schenck A**, Rauch A. CNTNAP2 and NRXN1 are mutated in autosomal-recessive Pitt-Hopkins-like mental retardation and determine the level of a common synaptic protein in Drosophila. *Am J Hum Genet.* **85**:655-66, 2009. **IF 10.2**
2. **Schenck** A, Goto-Silva L, Collinet C, Rhinn M, Giner A, Habermann B, Brand M, Zerial M. The endosomal protein APPL1 mediates Akt substrate specificity and cell survival in vertebrate development. *Cell*, **133**:486-497, 2008. **IF 29.2**
3. Qurashi A, Sahin HB, Carrera P, Gautreau A, **Schenck A**, Giangrande A. HSPC300 and its role in neuronal connectivity. *Neural Develop*. **2**:18, 2007. **IF NA**
4. Kim Y, Sung JY, Ceglia I, Lee KW, Ahn J, Halford JM, Kim A, Kwak SP, Park JB, Ryu SH, **Schenck A**, Bardoni B, Scott JD, Nairn AC, Greengard P. Phosphorylation of WAVE1 regulates actin polymerization and dendritic spine morphology. *Nature*, **442**: 814-7, 2006. **IF 28.8**
5. **Schenck, A**., Bardoni, B., Langmann, C., Harden, N., Mandel, J.L. Giangrande, A. CYFIP/Sra-1 regulates neuronal connectivity in Drosophila and links the Rac1 small GTPase pathway to the Fragile X protein. *Neuron* **38**:887-98, 2003. **IF 13.9**

Henk Stunnenberg

1. Salcedo-Amaya AM, van Driel MA, Alako BT, Trelle MB, van den Elzen AM, Cohen AM, Janssen-Megens EM, van de Vegte-Bolmer M, Selzer RR, Iniguez AL, Green RD, Sauerwein RW, Jensen ON, **Stunnenberg HG**. Dynamic histone H3 epigenome marking during the intraerythrocytic cycle of Plasmodium falciparum. *Proc Natl Acad Sci U S A*. **106**:9655-60, 2009. **IF 9.6**
2. Nielsen R, Pedersen TA, Hagenbeek D, Moulos P, Siersbaek R, Megens E, Denissov S, Børgesen M, Francoijs KJ, Mandrup S, **Stunnenberg HG**. Genome-wide profiling of PPARgamma:RXR and RNA polymerase II occupancy reveals temporal activation of distinct metabolic pathways and changes in RXR dimer composition during adipogenesis. *Genes Dev.* **22**:2953-67, 2008. **IF 14.8**
3. Lasonder E, Janse CJ, van Gemert GJ, Mair GR, Vermunt AM, Douradinha BG, van Noort V, Huynen MA, Luty AJ, Kroeze H, Khan SM, Sauerwein RW, Waters AP, Mann M, **Stunnenberg HG**. Proteomic profiling of Plasmodium

sporozoite maturation identifies new proteins essential for parasite development and infectivity. *PLoS Pathog*. 4:e1000195, 2008. **IF 9.3**

4. Outchkourov NS, Roeffen W, Kaan A, Jansen J, Luty A, Schuiffel D, van Gemert GJ, van de Vegte-Bolmer M, Sauerwein RW, **Stunnenberg HG**. Correctly folded Pfs48/45 protein of Plasmodium falciparum elicits malaria transmission-blocking immunity in mice. *Proc Natl Acad Sci U S A* **105**:4301-5, 2008. **IF 9.6**
5. Hatzis P, van der Flier LG, van Driel MA, Guryev V, Nielsen F, Denissov S, Nijman IJ, Koster J, Santo EE, Welboren W, Versteeg R, Cuppen E, van de Wetering M, Clevers H, **Stunnenberg HG**. Genome-wide pattern of TCF7L2/TCF4 chromatin occupancy in colorectal cancer cells. *Mol Cell Biol*. **28**:2732-44, 2008. **IF 6.4**

Appendix P: Overview of European subsidies and large-scale collaborative projects

coordinator projects are indicated shaded

	project accronym/name	type	framework	department	researcher	start date	end date
1	RETNET: European Retinal Research Training Network	Marie Curie RTN	FP6	Human Genetics	F. Cremers	1-1-2004	30-4-2009
2	Dc-Vacc	Collaboration	FP6	Tumor Immunology	C.G. Figdor	1-1-2004	1-4-2009
3	Biomalpar	Network of Excellence		Medical Microbiology	R.W. Sauerwein	1-4-2004	30-9-2009
4	EUMITOCOMBAT	Collaboration	FP6	Paediatrics (coordinator)	J.A.M. Smeitink	1-7-2004	31-1-2009
5	EUROPEAN MCL NETWORK: European Mantle Cell Lymphoma Network	Collaboration	FP6	Pathology	J.H.J.M. van Krieken	1-7-2004	30-12-2008
6	PRIMA: PRostate cancer Integral Management Approach	Collaboration	FP6	Urology (coordinator)	J.A. Schalken	1-7-2004	1-7-2009
7	P-Mark	Collaboration	FP6	Urology (coordinator)	J.A. Schalken	1-11-2004	30-6-2009
8	EuroHEAR: Advances In Hearing Science: From Functional Genomics To Therapies	Collaboration	FP6	Ear Nose Throat	J.M.J. Kremer	1-12-2004	1-1-2010
9	Dc Thera	Network of Excellence	FP6	Tumor Immunology	C.G. Figdor	1-1-2005	1-1-2010
10	Functional Genomics Of The Retina In Health And Disease	Collaboration	FP6	Human Genetics	R. Roepman	1-4-2005	31-12-2009
11	Nanobiocom	Collaboration	FP6	Paradontology & Biomaterials	J.A. Jansen	1-4-2005	1-1-2009
12	MALINV	Collaboration	FP6	Medical Microbiology	R.W. Sauerwein	1-6-2005	30-12-2008
13	Mitocircle	Collaboration	FP6	Paediatrics (coordinator)	L.P.W.J. van den Heuvel	1-7-2005	30-6-2009
14	HEROIC	Collaboration	FP6	Molecular Biology (coordinator)	H. Stunnenberg	1-11-2005	1-11-2010
15	EPISTEM	Collaboration	FP6	Human Genetics	J.H.L.M. van Bokhoven	1-1-2006	31-12-2009
16	Autocure	Collaboration	FP6	Rheumatology Lab	W.B. van den Berg	1-1-2006	1-1-2011
17	Cancerimmunotherapy	Collaboration	FP6	Tumor Immunology	C.G. Figdor	1-3-2006	1-3-2010
18	Role Of P63 And Related Pathways In Epithelial Stem Cell Proliferation Ad Differentiation And...			CMBI	M.A. Huijnen	1-7-2006	1-7-2010
19	Embrace	Network of Excellence	FP6	CMBI	M.A. Huijnen	1-9-2006	31-10-2010
20		Collaboration	FP6	Paediatrics	P.W.M. Hermans	1-9-2006	31-8-2009
21	CANCURE	Marie Curie EST	FP6	Urology (coordinator)	J.A. Schalken	1-9-2006	31-12-2010
22	ExAct ResoMat	Collaboration	FP6	Orthopaedics (coordinator)	N.J.J. Verdonschot	1-10-2006	31-12-2010
23	Aneuploidy: Understanding The Importance Of Genen Dosage Imbalance In Human Health.	Collaboration	FP6	Human Genetics	J.A. Veltman	1-11-2006	31-10-2010
24	AQUA(GLYCERO)PORINS	Marie Curie RTN	FP6	Physiology	P.M.T. Deen	1-11-2006	30-12-2010
25	Immunanomap	Marie Curie RTN	FP6	Tumor Immunology (coordinator)	C.G. Figdor	1-11-2006	1-3-2011
26	European Malaria Vaccine Development Association	Collaboration	FP6	Medical Microbiology	R.W. Sauerwein	1-1-2007	1-1-2010
27	Eurostec	Collaboration	FP6	Urology (coordinator)	W.F.J. Feitz	1-1-2007	31-12-2011
28	EU FAST	Marie Curie RTN	FP6	Radiology	A. Heerschap	1-3-2007	1-3-2011
29	BIOLIGHTTOUCH			Tumor Immunology	C.G. Figdor	1-3-2007	1-3-2010
30	Dyscerme - A European Network Of Centres Of Reference For Dysmorphology.			Human Genetics	H.G. Brunner	1-4-2007	31-3-2010
31	PTPNET	Marie Curie RTN	FP6	Cell Biology	W. Hendriks	1-5-2007	1-5-2010
32	BETA IMAGE	Collaboration	FP7	Nuclear Medicine (coordinator)	Martin Gotthardt	01.10.2008	
33	Techgene	Collaboration	FP7	Human Genetics (coordinator)	Hans Scheffer	01.02.2009	
34	ENCITE	Collaboration	FP7	Tumor Immunology / Cell Biology	Carl Figdor / Peter Friedl	01.06.2008	
35	EUNEFRON	Collaboration	FP7	Cell Physiology & Human Genetics	Peter Deen & Nine Knoers	01.05.2008	
36	Elixir		FP7	CMBI	Gert Vriend	01.01.2007	
37	STOPPAM	Collaboration	FP7	Parasitology	Adrian Luty	01.02.2008	
38	PNEUMOPATH	Collaboration	FP7	Paediatrics (coordinator)	Peter Hermans	2009	
39	PluriSys	Collaboration	FP7	CMBI	Martijn Huynen	2009	
40	Malsig	Collaboration	FP7	CMBI	Edwin Lasonder	2009	
41	MALVECBLOK	Collaboration	FP7	Parasitology	Robert Sauerwein	2009	
42	OPTIMALVAC		FP7	Parasitology	Adrian Luty	2009	
43	Craniotech		FP7	Human Genetics	Hans Scheffer	2009	
44	INFRAVEC		FP7	Parasitology	Robert Sauerwein	2009	
45	HGG-IMMUNO		FP7	Tumor Immunology	Jolanda de vries	2009	
46	Multiterm	Initial Training Network	FP7	Urology (coordinator)	Egbert Oosterwijk	01.10.2009	
47	T3NET	Initial Training Network	FP7	Cell Biology	Peter Friedl		
48	Pro-Nest	Initial Training Network	FP7	Urology (coordinator)	Jack Schalken	01.11.2009	
49	Remedi	Collaboration	FP7	Tumor Immunology	Alessandra Cambi		
50	FinSysb	Initial Training Network	FP7	Medical Microbiology	Mihai Netea	2009	
51	Adipoa		FP7	Rheumatology Lab	Wim van den Berg	2009	
52	evimalar	Network of Excellence	FP7	Parasitology	Robert Sauerwein	01.10.2009	
53	syscilia		FP7	Human Genetics (coordinator)	Ronald Roepman	2010	
54	gencodys		FP7	Human Genetics (coordinator)	Hans van Bokhoven	2010	
55	redmal		FP7	Parasitology (coordinator)	Rovert Sauerwein	2010	
56	nanodiaria		FP7	Rheumatology Lab	Wim van den Berg	2010	

Nota

Docentprofessionalisering UMC St Radboud Nijmegen

Versie: 2 november 2006

INHOUD

Het onderwerp docentprofessionalisering staat al lang op de agenda van de Radboud Universiteit en het UMC St Radboud. Het College van Bestuur (CvB) heeft in oktober 2002 de universitaire uitgangspunten vastgelegd. In het UMC St Radboud is eerder binnen het cluster tandheelkunde een proefproject uitgevoerd. De resultaten daarvan zijn weergegeven in de nota 'Onderwijskwalificaties en docentcompetenties' waarvan in december 2001 een bijgestelde versie is uitgebracht. De Raad van Bestuur (RvB) heeft vervolgens de directeur onderwijsinstituut gevraagd 'een aanvang te maken met de invoering van de nota en daartoe zonodig concrete aanbevelingen te doen of voorstellen te ontwikkelen'. In augustus 2003 heeft de directeur onderwijsinstituut een gedétailleerd implementatieplan vastgesteld.
Ten behoeve van de medezeggenschapsorganen en de besluitvorming door de RvB wordt het deels eerder vastgestelde en deels nieuw voorgestelde beleid in deze notitie samengevat. In de tekst worden de onderdelen waar nieuwe besluitvorming nodig is duidelijk aangegeven.

1. Inleiding

Docentprofessionalisering is het geheel van activiteiten dat gericht is op een optimale personeelsbezetting voor uitvoering van de onderwijstaak, zowel kwantitatief als kwalitatief. In essentie betreft het personeelsbeleid gericht op docenttaken voor het wetenschappelijk personeel.
Verschillende ontwikkelingen onderstrepen het belang van docentprofessionalisering juist nu. Het aantal studenten is de afgelopen jaren fors gegroeid. Tussen 1995 en 2003 is de numerus fixus voor de opleiding geneeskunde met 83% toegenomen tot 330, voor de opleiding biomedische wetenschappen met 25% tot 100 en voor de opleiding tandheelkunde met 37% tot 82. Uiteraard leidt een dergelijke groei van de aantallen onderwijsvragende studenten tot een groter beroep op docenten. Parallel daaraan zijn vanaf 1995 nieuwe curricula ingevoerd die gekenmerkt worden door kleinschaliger en daardoor docentintensievere werkvormen. Bovendien wordt de docent nu als coach bij het leerproces van studenten in een andere rol aangesproken. Dit vergt daarop toegesneden vaardigheden.

2. Universitaire uitgangspunten toegepast in het UMC St Radboud

Het CvB stelt dat academische loopbanen moeten bestaan uit een combinatie van onderwijs en onderzoek. Binnen het UMC St Radboud moet rekening worden gehouden met drie kerntaken: naast onderwijs en onderzoek ook patiëntenzorg. Analoog aan het universitaire uitgangspunt geldt binnen het UMC St Radboud dat loopbanen voor wetenschappelijk personeel bestaan uit een combinatie van ten minste twee van de drie kerntaken: kennisoverdracht (onderwijs/opleiding), kennisontwikkeling (onderzoek) en kennistoepassing binnen de patiëntenzorg. Voor individuele personen kan het accent liggen op die kerntaak(a)k(en) waarin de medewerker excelleert.
Het UMC St Radboud onderschrijft met het CvB het belang van opleidings- en begeleidingstrajecten ten behoeve van docenten in verschillende fasen van hun onderwijsloopbaan. Binnen het UMC St Radboud is onderwijskundige scholing verplicht onderdeel van het professionaliseringstraject van docenten. Onderlinge uitwisseling van ervaringen door intervisie wordt gestimuleerd. Daarnaast worden individuele begeleidingstrajecten voor docenten aangeboden.
In overeenkomst met de universitaire aanbevelingen en het proefproject bij het cluster tandheelkunde richt het UMC St Radboud een onderwijskwalificatiestructuur in met 4 niveaus:

startkwalificatie, basiskwalificatie, uitgebreide kwalificatie en volledige kwalificatie. Per kwalificatieniveau worden evalueerbare competenties vastgelegd. De kwalificaties worden gerelateerd aan binnen het UMC St Radboud voorkomende docentexpertiseniveaus.
Het jaargesprek met de eigen leidinggevende is het centrale instrument bij de loopbaanontwikkeling. In het jaargesprek wordt vastgesteld welke ambities de medewerker op het gebied van onderwijs heeft en welke eisen de organisatie in dit opzicht aan de medewerker stelt. Mede aan de hand van het portfolio wordt vastgesteld welke (onderwijs)competenties reeds aanwezig zijn en hoe verdere competenties verworven zullen worden.
Beoordeling van aanwezige (onderwijs-)competenties geschiedt door de leidinggevende tijdens een beoordelingsgesprek op basis van een portfolio waarin ook informatie vanuit de onderwijsorganisatie is opgenomen.

Behalve het wetenschappelijk personeel zijn bij bepaalde onderwijstaken NWP betrokken. De hier geschetste ontwikkelingen hebben voor deze groep medewerkers ook mogelijke consequenties. Dit dient in samenhang met ontwikkelingen voor het WP te worden opgepakt en zal derhalve in de loop van het implementatietraject verder worden uitgewerkt.

3. Onderwijsrollen en kwalificatiestructuur

Centrale begrippen bij het docentprofessionaliseringsbeleid zijn de te onderscheiden onderwijsrollen en kwalificatieniveaus.
Binnen de taak van individuele docenten worden drie onderwijsrollen onderscheiden. Het betreft uitvoering, ontwikkeling en organisatie van onderwijs. Binnen iedere rol zijn verschillende taken gedefinieerd.
De vier kwalificatieniveaus worden als volgt aangeduid: startkwalificatie (SK), basiskwalificatie (BK), uitgebreide kwalificatie (UK) en volledige kwalificatie (VK).
Onderwijsgevenden met een startkwalificatie hebben vooral taken binnen de rol ‘uitvoering’. Door het opdoen van ervaring in die rol, door aanvullende scholing én coaching kunnen zij bij het bereiken van de basiskwalificatie zelfstandig voor alle uitvoerende taken worden ingezet. Op het niveau van de basiskwalificatie levert de medewerker ook een bijdrage binnen de rollen ‘ontwikkeling’ en ‘organisatie’. Bij het bereiken van de uitgebreide kwalificatie is de medewerker in staat alle taken binnen de drie rollen zelfstandig uit te voeren, met uitzondering van de taken op curriculumniveau binnen de rollen onderwijsontwikkeling en organisatie.
Medewerkers die de uitgebreide kwalificatie bezitten kunnen zich verder ontwikkelen richting volledige kwalificatie. Bij het bereiken daarvan worden taken op het niveau van grotere segmenten binnen het curriculum, het curriculum als geheel of curriculumoverstijgend binnen het onderwijsinstituut zelfstandig vervuld. Het accent kan daarbij liggen op onderwijsontwikkeling of organisatie van onderwijs.

Nieuw besluit (1)
Voor alle zelfstandige onderwijsgevenden in het UMC St Radboud is het beschikken over een basiskwalificatie onderwijs verplicht. Voor zittende medewerkers wordt een overgangsregeling getroffen. Of een medewerker streeft naar een hogere kwalificatie hangt af van zijn individuele ambities en de plaats die de onderwijstaak in de loopbaanplanning inneemt. Het streven naar een hogere kwalificatie wordt gestimuleerd door daaraan mogelijkheden voor een hogere inschaling of toelagen te koppelen en door bij topstaf benoemingen op dit punt eisen te stellen.

4. Docentfuncties in het UMC St Radboud

Binnen het cluster tandheelkunde zijn tijdens het proefproject 5 docentfuncties beschreven: juniordocent, docent, seniordocent, hoofddocent en seniorhoofddocent. Dit stelsel van docentfuncties voldoet voor het curriculum tandheelkunde. Voor de curricula geneeskunde en biomedische wetenschappen bestaat behoefte aan voor de betrokken docenten beter herkenbare indeling in niveaus. Daarom zijn docentexpertiseniveaus onderscheiden binnen de lijnen theoretisch blokonderwijs, onderzoekstages en het praktisch klinisch onderwijs inclusief de co-assistentschappen. Daarnaast worden centrale onderwijstaken onderscheiden .

Overzicht van docentexpertiseniveaus (geneeskunde en biomedische wetenschappen)

Drie lijnen		
Theoretisch blokonderwijs	**Onderzoekstages**	**Praktisch klinisch onderwijs Co-assistentschappen**
juniordocent	**juniorbegeleider**	**juniorbegeleider**
docent	**begeleider**	**begeleider**
seniordocent	**coördinator**	**tutor** **opleider**
blokcoördinator		**stagecoördinator**
Centrale onderwijstaken		

Nieuw besluit (2)
Voor de opleidingen geneeskunde en biomedische wetenschappen worden maximaal 4 docentexpertiseniveaus onderscheiden. Deze zijn ondergebracht in 3 lijnen: theoretisch blokonderwijs, onderzoekstages en praktisch klinisch onderwijs inclusief co-assistentschappen. Daarnaast worden centrale onderwijstaken gedefinieerd.
Voor de opleiding tandheelkunde worden de eerder binnen het proefproject ontwikkelde functies gehandhaafd.

Voor de docentexpertiseniveaus in iedere lijn worden, zoals dat eerder ook gedaan is voor de functies binnen de opleiding tandheelkunde, competentieprofielen opgesteld. Daarin wordt aangegeven welk kwalificatieniveau voor het docentexpertiseniveau vereist is en welke competenties worden verwacht in de gebieden inhoudelijke deskundigheid, professionele ontwikkeling, onderwijsuitvoering, onderwijsontwikkeling en onderwijsorganisatie. De competentieprofielen worden op voorstel van de betrokken curriculumcoördinatoren vastgesteld door de directeur onderwijsinstituut. In bijlage 1 zijn de conceptprofielen voor de docentexpertiseniveaus in de 3 lijnen opgenomen zoals die zijn geformuleerd in samenspraak met een klankbordgroep van docenten uit het UMC St Radboud.

Nieuw besluit (3)
De directeur onderwijsinstituut stelt in overleg met de decaan en op voorstel van de betrokken curriculumcoördinatoren competentieprofielen vast voor de onderscheiden docentexpertiseniveaus .

De centrale onderwijstaken zijn opgenomen in onderstaande tabel. In de tabel is per taak aangegeven welke benoemingseisen gelden. Binnen een aantal taken kan worden gewerkt aan het verkrijgen van een hogere kwalificatie. Voor sommige taken geldt dat alleen hoogleraren deze functie kunnen vervullen. Voor andere functies geldt dat zij bij voorkeur door een hoogleraar worden vervuld. Ook voor deze centrale taken geldt dat competentieprofielen worden vastgesteld. De nadruk ligt daarbij op de competentiegebieden onderwijsontwikkeling en onderwijsorganisatie. De profielen worden vastgesteld door de directeur onderwijsinstituut in overleg met de decaan en na advies van de curriculumcoördinatoren.

Overzicht centrale onderwijstaken

Functie	**kwalificatie**	
	'vereist'	***'werkt aan'***
Presidium Onderwijsinstituut		
Directeur onderwijsinstituut **	VK	nvt
Curriculumcoördinator geneeskunde *	UK	VK
Curriculumcoördinator biomedische wetenschappen *	UK	VK
Curriculumcoördinator tandheelkunde *	UK	VK
Programmacoördinator PAO *	UK	VK
Opleidingscommissies		
Voorzitter (GNK, BMW, THK) *	UK	VK
Docentlid (GNK, BMW, THK)	BK	UK
Examencommissies		
Voorzitter (GNK, BMW, THK) **	UK	nvt
Lid (GNK, BMW, THK)	UK	nvt
Onderwijsmanagement en -advies		
Docentlid OMT (GNK,BMW,THK)	UK	VK
Voorzitter stuurgroep keuze-onderwijs *	UK	VK
Docentlid stuurgroep keuze-onderwijs	BK	UK
Voorzitter commissie ICT in onderwijs	UK	VK
Docentlid commissie ICT in onderwijs	BK	UK
Coördinator ICT in onderwijs	BK	UK
Affiliatiecoördinator	UK	VK
Voorzitter keuzefase commissie BMW *	UK	VK
Studieleider BMW *	UK	VK

* *voor deze taken geldt dat zij bij voorkeur door een hoogleraar worden vervuld*
** *voor deze taken komen alleen hoogleraren in aanmerking*

Nieuw besluit (4)
De directeur onderwijsinstituut stelt in overleg met de decaan competentieprofielen vast voor de centrale onderwijstaken.

5. Verwerven van onderwijskundige competenties

Voor optimaal onderwijs is het essentieel dat onderwijsgevenden beschikken over vakinhoudelijke én onderwijskundige competenties. Voor het verwerven van vakinhoudelijke competenties staan verschillende wegen open. Het bespreken hiervan valt buiten het bestek van deze notitie. Om onderwijskundige competenties te verwerven is specifieke training én coaching nodig.

Onder training wordt verstaan het voor het verwerven van onderwijscompetenties relevante cursussen. Het UMC St Radboud biedt (aankomend) docenten reeds cursussen aan. Op onderdelen is uitbreiding van het cursusaanbod wenselijk. Dit geldt bijvoorbeeld voor de ontwikkeling van tutorvaardigheden en voor de begeleiding van onderzoekstages. Het cursusaanbod moet regelmatig worden geëvalueerd en waar nodig worden aangepast.
Binnen de onderscheiden lijnen wordt voor iedere docentexpertiseniveau vastgelegd welke cursussen verplicht moeten worden gevolgd en welke cursussen worden aanbevolen.

Nieuw besluit (5)
De directeur onderwijsinstituut draagt zorg voor een adequaat cursusaanbod voor de ontwikkeling van docentvaardigheden en stelt in overleg met de betrokken curriculumcoördinatoren vast welke cursus voor wie verplicht of aanbevolen is.

In bijlage 2 is een overzicht opgenomen van de nu bestaande en in ontwikkeling zijnde cursussen. Tevens is aangegeven welke cursussen verplicht zullen worden gesteld.

Onder coaching wordt verstaan begeleiding van individuele docenten of groepen van docenten die gebaseerd is op de eigen ervaringen van die docenten, op de feedback die anderen (studenten, collega-docenten) daarop geven en de eigen reflectie hierop. Als coach treedt in de regel een meer ervaren docent op. Ook kunnen onderwijskundigen bij de coaching worden betrokken. In het geval van groepen van docenten zal het in de regel om vormen van intervisie gaan. Afhankelijk van de situatie kan de coaching beperkt van omvang of intensiever zijn. Intensievere coaching is vooral dan aangewezen als binnen de loopbaanontwikkeling van de medewerker een duidelijk accent op de onderwijstaak ligt of als zich bij het functioneren in de onderwijstaak belangrijke knelpunten voordoen.

Nieuw besluit (6)
De directeur onderwijsinstituut draagt zorg voor een adequaat aanbod van mogelijkheden voor coaching van individuele docenten en van groepen docenten.

6. Beoordeling en registratie

Beoordeling van de onderwijsprestaties van medewerkers is een verantwoordelijkheid van het hoofd van de afdeling waar de medewerker werkzaam is. De beoordeling maakt deel uit van een cyclus: afspraken over loopbaanontwikkeling in de jaargesprekken, bijsturen tijdens de ontwikkeling (coaching, functioneringsgesprek) en vaststelling van de doorgemaakte ontwikkeling (beoordeling in een beoordelingsgesprek). In het beoordelingsgesprek wordt vastgesteld of de medewerker voldoet aan de eisen van de verlangde onderwijskwalificatie in de voor de medewerker relevante lijn(en).

De startkwalificatie kan worden verleend als voldaan is aan vakinhoudelijke criteria én de verplichte scholing voor het docentexpertiseniveau 'juniordocent/juniorbegeleider is gevolgd. Voor hogere kwalificatie gelden meer criteria:

- vakinhoudelijke eisen (voorbeelden: het volgen van een medische vervolgopleiding, het geregistreerd zijn als medisch specialist, huisarts of sociaal geneeskundige, een aantal jaren ervaring hebben in een bepaalde discipline, bezig zijn met het voorbereiden van een dissertatie, gepromoveerd zijn);
- het hebben voldaan aan de scholingsverplichtingen voor de functie die is verricht;
- het beschikbaar zijn van een 'portfolio' waarin minimaal zijn opgenomen: een overzicht van de eigen onderwijsactiviteiten met voorbeelden van eigen producten, een ingevuld zelf-evaluatie-instrument, een beoordeling door de 'onderwijsleidinggevende' en een eigen reflectie op al het materiaal in relatie tot het competentieprofiel.

Startpunt bij de beoordeling is de eigen reflectie van de onderwijsgevende op zijn functioneren. Daartoe wordt per docentexpertiseniveau op basis van het vastgestelde functieprofiel een 'zelf-evaluatie-instrument' (ZEI) ontworpen. Het ZEI wordt ingevuld door de medewerker. Uitkomsten van de ZEI worden door de medewerker besproken met de onderwijsleidinggevende. Zonodig stelt de medewerker de uitkomsten van de ZEI bij.

De onderwijsleidinggevenden zijn:

theoretisch blokonderwijs

- voor de (junior)docent: seniordocent
- voor de seniordocent: blokcoördinator
- voor de blokcoördinator: curriculumcoördinator

begeleiden wetenschappelijke stages

- voor de (junior)begeleider: coördinator
- voor de coördinator: afdelingshoofd

praktisch klinisch onderwijs

- voor de (junior)begeleider: opleider
- voor de opleider, tutor: stagecoördinator

specifiek tandheelkunde: nader te bepalen
centrale onderwijsfuncties: nader te bepalen

Nieuw besluit (7)
De directeur onderwijsinstituut draagt zorg voor een nadere uitwerking van de geschetste beoordelingscriteria en voor de ontwikkeling én implementatie van zelf-evaluatie-instrumenten per docentexpertiseniveau .

Als het afdelingshoofd concludeert dat de medewerker heeft voldaan aan de eisen van de verlangde kwalificatie, zal hij het clusterbestuur vragen de kwalificatie te verlenen. Het clusterbestuur beoordeelt het voorgelegde dossier, eventueel na consultatie van een eigen begeleidingscommissie docentprofessionalisering. Op grond van het voorliggend materiaal kan het clusterbestuur besluiten registratie bij het onderwijsinstituut te vragen. Het onderwijsinstituut beperkt zich tot een marginale toetsing van de gevolgde procedure en verleent het bij de verlangde kwalificatie behorende certificaat tenzij er zwaarwegende overwegingen zijn om negatief te besluiten.

Medewerkers die in het bezit zijn van de uitgebreide kwalificatie en in aanmerking wensen te komen voor de volledige kwalificatie, kunnen een verzoek richten aan de directeur onderwijsinstituut. De medewerker overlegt hierbij een relevant portfolio. Het portfolio wordt beoor-

deeld door een ad hoc in te stellen commissie die bestaat uit een lid van het presidium onderwijsinstituut, een lid aan te wijzen door het clusterbestuur van de cluster waarin betrokkene werkzaam is en een lid vanuit de topstafcommissie. Deze commissie voert ook een gesprek met de medewerker.

Het onderwijsinstituut houdt centraal een register van de verleende certificaten bij.

Nieuw besluit (8)
De directeur onderwijsinstituut draagt zorg voor de ontwikkeling, implementatie en onderhoud van een centraal register van onderwijskwalificaties, met inachtneming van het hierboven gestelde.

Certificaten hebben een beperkte geldigheidsduur van 5 jaar. In het vervolgtraject moeten de eisen worden beschreven waaraan moet worden voldaan voor verlenging van de certificering.

Nieuw besluit (9)
De directeur onderwijsinstituut draagt zorg voor de ontwikkeling van criteria voor herregistratie.

Medewerkers die de afgelopen jaren, sinds de curriculumherziening 1995, substantieel betrokken zijn geweest bij de uitvoering, ontwikkeling of organisatie van het onderwijs en ook nu nog onderwijstaken verrichten, kunnen op basis van hun eerdere ervaring worden geregistreerd. De criteria daarvoor worden vastgesteld door de directeur onderwijsinstituut. Een conceptversie is opgenomen in bijlage 3.

Nieuw besluit (10)
De directeur onderwijsinstituut stelt een overgangsregeling vast op basis waarvan onderwijskwalificaties van zittende medewerkers kunnen worden erkend.

7. Beloning van onderwijsprestaties

Een succesvol onderwijsloopbaanbeleid laat zien hoe onderwijsprestaties worden beloond. In dit verband zijn twee onderwerpen van speciale betekenis. Enerzijds gaat het om de criteria die worden gehanteerd bij benoemingen in academische posities en dan met name posities binnen de topstaf. Anderzijds, deels met het eerste onderwerp verbonden, gaat het om financiële beloningen in de salarissfeer.

Topstafbenoemingen
De waardering van de organisatie voor het uitvoeren van de onderwijstaak blijkt in het bijzonder op het moment dat besluiten vallen over topstafbenoemingen. Onder topstafbenoemingen worden hier verstaan benoemingen tot universitair hoofddocent en hoogleraar.
Bij de benoeming van een universitair hoofddocent gaat het om een medewerker die binnen zijn aanstelling zowel onderwijs- als onderzoektaken heeft. Daarbij moet sprake zijn van een aanmerkelijke omvang van beide taakgebieden maar kan wel een accent op één van beide liggen. De universitair hoofddocent heeft zowel onderwijs- als onderzoekkwalificaties. Voor het taakgebied onderwijs geldt als eis dat de medewerker beschikt over een uitgebreide kwalificatie. De vereiste kwalificaties op het gebied van onderzoek worden hier niet verder besproken.

Nieuw besluit (11)
Voor de benoeming van een universitair hoofddocent geldt in beginsel als eis dat betrokkene beschikt over de uitgebreide onderwijskwalificatie of vergelijkbare elders verworven competenties.

Indien besloten wordt tot benoeming van een universitair hoofddocent die bij de benoeming nog niet over de gewenste kwalificaties beschikt, worden met de medewerker individuele afspraken gemaakt over een nader docentprofessionaliseringstraject.
Bij de benoeming van hoogleraren geldt als belangrijkste eis dat betrokkene in belangrijke mate zelfstandig bijdraagt aan de verdere ontwikkeling van het eigen vakgebied. Deze bijdrage blijkt vaak uit de eerder geleverde onderzoeksprestaties maar kan ook blijken uit prestaties in onderwijs en patiëntenzorg.
Om een adequate beoordeling van de onderwijskundige competenties van kandidaten zoveel mogelijk te garanderen, zal steeds een vertegenwoordiger van het onderwijsinstituut lid zijn van de benoemingsadviescommissie. Indien besloten wordt tot benoeming van een hoogleraar die bij de benoeming nog niet over de gewenste kwalificaties beschikt, worden met de medewerker individuele afspraken gemaakt over een nader docentprofessionaliseringstraject.

Nieuw besluit (12)
Voor de benoeming van een hoogleraar geldt in beginsel als eis dat betrokkene beschikt over de uitgebreide onderwijskwalificatie of vergelijkbare elders verworven competenties.

Clusters geven in hun topstafplan aan welke topstafposities noodzakelijk zijn voor het uitvoeren van de drie primaire taken. Het topstafplan behoeft de goedkeuring van de RvB. Nieuwe topstafposities worden ingesteld door de RvB op basis van een beschrijving van de taken en de plaats in de organisatie.
Voor de benoeming van hoogleraren gelden de procedures zoals vastgesteld in het leerstoelenplan. Voor de bezetting van de overige posities stelt het betrokken clusterbestuur een benoemingsadviescommissie in waarin steeds ook een lid van de topstafcommissie participeert. De benoemingsadviescommissie betrekt in zijn advies alle voor de functie relevante aspecten. De hierboven weergegeven eisen ten aanzien van het bezit van onderwijskwalificaties bieden een houvast bij de beoordeling van dit taakgebied. Het bezit van de genoemde kwalificaties is echter op zichzelf onvoldoende om tot benoeming over te kunnen gaan. De eigen beoordeling door de benoemingsadviescommissie na een gesprek met de kandidaat blijft daarvoor doorslaggevend

Salarisschalen voor niet medisch specialisten
Het salaris wordt uitsluitend bepaald door toepassing van de in de CAO afgesproken functiewaarderingssystematiek. De in de nota onderscheiden docentexpertiseniveaus en de daaraan gekoppelde competentieniveaus zullen daarbij een rol gaan spelen. De precieze uitwerking daarvan wordt opgedragen aan de directeur staf P&O.

Nieuw besluit (13)
De directeur staf P&O geeft nadere uitwerking aan de rol van de in deze nota onderscheiden docentexpertiseniveaus en competentieniveaus bij de functiewaarderingssystematiek

Toelagen voor medisch specialisten
Voor medisch specialisten geldt dat de salarisschaal wordt bepaald door de kwalificatie en werkzaamheden als medisch specialist. Medisch specialisten worden maximaal 3 jaar ingeschaald als medisch specialist, zulks in verband met een vervolgopleiding, in het kader van een project of bij wijze van proef. De overige medisch specialisten (niet hoogleraren) worden ingeschaald als universitair medisch specialist (UMS).
In de honoreringsregeling voor medisch specialisten is vanaf juli 2006 voorzien in de mogelijkheid van een zogenaamde excellentietoelage. Criteria hiervoor zijn:

- is gepromoveerd;
- heeft belangrijke en extra verantwoordelijkheden en taken toegewezen gekregen door de raad van bestuur op het gebied van de organisatie van de patiëntenzorg en geeft ondermeer leiding aan een groep (academisch) medisch specialisten en arts-assistenten;
- voldoet aan minimaal één van de volgende drie criteria:
  - geniet zowel nationaal als internationaal aanzien op zijn of haar vakgebied;
  - initieert objectief aantoonbare ontwikkelingen in de patiëntenzorg en is een erkend actor bij het implementeren in de patiëntenzorg van op basis van wetenschappelijk onderzoek verkregen inzicht en kennis;
  - levert een wezenlijke en vernieuwende bijdrage aan de ontwikkeling van het hem toegewezen aandachtsgebied;
- voldoet aan minimaal twee van de volgende criteria:
  - is opleider van door MSRC en/of wetenschappelijke verenigingen erkende opleidingen en geeft supervisie aan andere (academisch) medisch specialisten:
  - is primair bedenker van onderzoeksprogramma's en treedt op als projectleider en heeft bewezen met onderzoeksvoorstellen extra financiële middelen te kunnen verwerven;
  - heeft meermalen als copromotor gefungeerd en publiceert regelmatig in gerenommeerde internationale en nationale tijdschriften op zijn vakgebied en wordt regelmatig geciteerd;
  - geeft inhoudelijk leiding aan onderwijsprogramma's op curriculum niveau;
  - ontwikkelt onderwijsmethoden en initieert vernieuwingen op het gebied van het medisch onderwijs op curriculumniveau.

8. Verantwoordelijkheden

Om een optimale personeelsbezetting voor uitvoering van de onderwijstaak te realiseren is samenwerking tussen verschillende organisatorische onderdelen van het UMC St Radboud noodzakelijk. De samenwerking moet gebaseerd zijn op een heldere verantwoordelijkheidsverdeling.

Raad van Bestuur
De RvB stelt de kaders voor het beleid ten aanzien van docenten vast. Tot die kaders behoren de in deze notitie opgenomen uitgangspunten en nadere besluiten.

Het onderwijsinstituut
Vormgeven aan en uitvoeren van docentprofessionaliseringsbeleid vergt specifieke expertise. Deze expertise zal vanuit het onderwijsinstituut aan clusters en afdelingen worden aangeboden. Hiertoe wordt binnen het onderwijsinstituut een functie docentprofessionalisering ingericht, bestaande uit een coördinator en secretariële ondersteuning, beide voor 0,5 fte. Taken van de coördinator zijn:

- ondersteuning van de directeur en het presidium onderwijsinstituut bij de implementatie van het docentprofessionaliseringsbeleid;
- ondersteuning van clusters bij het formuleren en uitvoeren van docentprofessionaliseringsplannen binnen de clusters;
- ondersteuning van afdelingshoofden bij het implementeren van het beleid binnen de afdeling;
- ontwikkeling van nieuwe cursussen en trajecten voor coaching van individuele docenten;
- het coördineren van de uitvoering van het scholingsaanbod;
- evaluatie van het scholingsaanbod en het doen van voorstellen voor aanpassing ervan;
- participeren in overlegsituaties binnen de KUN, met de andere UMCs respectievelijk medische faculteiten en binnen de Nederlandse Vereniging voor Medisch Onderwijs.

Nieuw besluit (14)
Binnen het onderwijsinstituut wordt een functie docentprofessionalisering ingericht.

Clusterbesturen
De clusterbesturen zijn verantwoordelijk voor het opstellen, uitvoeren én evalueren van een toekomstgericht personeelsplan dat het mogelijk maakt om te voldoen aan de door het onderwijsinstituut vastgestelde behoefte aan docenten uit de eigen cluster.
Het toekomstgerichte personeelsplan bevat afspraken over het voeren van 'onderwijsjaargesprekken' en over individuele trajecten inclusief coaching en intervisie. Onderdeel van het plan kan de instelling van een 'begeleidingsgroep docentprofessionalisering' zijn, die het clusterbestuur adviseert en regelmatig de voortgang van de uitvoering van het plan controleert.

Nieuw besluit (15)
Clusterbesturen stellen een toekomstgericht personeelsplan op, dat mede gericht is op de onderwijstaak van het cluster.

Hoofden van afdelingen
De hoofden van afdelingen zijn verantwoordelijk voor de uitvoering van het personeelsbeleid ten aanzien van het wetenschappelijk personeel binnen hun afdeling, waaronder de uitvoering van het door het clusterbestuur opgestelde, toekomstgerichte personeelsplan.
Ten aanzien van het wetenschappelijk personeel geldt dat het hoofd van de afdeling in het jaargesprek met de medewerkers bespreekt in welke mate de medewerker bijdraagt aan het realiseren van doelstellingen in de drie kerntaken van het UMC St Radboud: onderwijs én opleiding, onderzoek én (indien relevant) patiëntenzorg. In het jaargesprek worden de ambities van de medewerker én de behoefte vanuit de organisatie betrokken. Hierbij geldt als uitgangspunt dat iedere medewerker aan de realisatie van ten minste twee kerntaken bijdraagt.
Het hoofd van de afdeling is verantwoordelijk voor de beoordeling van het functioneren van de medewerkers binnen iedere kerntaak. Het hoofd van de afdeling neemt hierbij de ter zake geldende richtlijnen in acht.

Appendix R: Evaluation procedure for theoretical courses

Appendix R-1: Summary evaluation procedure MMD modules

- During the module, students keep in close contact with the course coordinator, giving feedback where needed.
- Two students are assigned (schedule_forum_discussions0910.doc, available in MMD Student community on Blackboard) to evaluate the course. “Student 1” keeps a record of the different components during the course, for which he/she may use the Evaluation Help (student’s evaluation help.doc) found on Blackboard.
- At the day of the preliminary examination or at the last day of the module, an invitation to complete the online evaluation (IOWO) is sent to the students. The students complete this evaluation within one week (5 work days). A reminder is sent after one week.
- After the end of the course (when the examinations have been graded): a forum discussion with the two assigned students, chaired by a member of the OMT, is held. The forum discussion follows the guidelines for a forum discussion (guidelines forum discussion.doc). The course coordinator should be present. The appointment for the forum discussions is made by one of the secretaries. One of the participants takes the minutes and sends them the students, the course coordinator and OMT. The suggestions for the next year are summarized during the meeting and in the report.
- The OMT discusses the evaluation report and summarises the discussion, which is sent to the course coordinator and the programme committee.
- The programme committee checks whether the evaluation has been performed properly. The programme committee should look more at the whole programme, rather than at the individual modules.

Master of Molecular Mechanisms of Disease

Course code: ABC
Course name: Course ABC
Cohort: 2009
Period: February 2010
General questions

Toelichting:
gemiddelde waarde en standaarddeviatie

Perception of the module

		1	2	3	4	5		open/n
1	My pre-existing knowledge was adequate for the level of this module.	highly disagree					highly agree	0 / 0
2	The current scientific topics in this field were adequately covered.	highly disagree					highly agree	0 / 0
3	The study load of the module was:	very low					very high	0 / 0
4	Overall I have participated actively in this module.	highly disagree					highly agree	0 / 0

		0	25	50	75	100	%	n	open/n
5	The estimated number of hours spent on this module is:	<30					0	0	0 / 0
		30-35					0	0	
		35-40					0	0	
		40-45					0	0	
		45-50					0	0	
		>50					0	0	
		n.a.					0	0	

		1	2	3	4	5		open/n
6	I feel I have learnt a lot during this module.	highly disagree					highly agree	0 / 0
7	The overall quality of the course programme was good.	highly disagree					highly agree	0 / 0

Organisation of the module

8	The layout and structure of the course manual are clear.	highly disagree					highly agree	0 / 0
9	It was clear what was expected from me during the course.	highly disagree					highly agree	0 / 0
10	The chosen educational formats (lectures, self study, group work, tutorials, practical trainings) were appropriate.	highly disagree					highly agree	0 / 0
11	This module was well organised.	highly disagree					highly agree	0 / 0
12	There was good opportunity for individual assessment in this course.	highly disagree					highly agree	0 / 0
13	The pace at which the material in the lectures was presented was:	very low					very high	0 / 0

Contents and examination module

14	I am satisfied with the contents of this module.	highly disagree					highly agree	0 / 0
15	This module is an important component of my study programme.	highly disagree					highly agree	0 / 0
16	The format of the assessment was consistent with the learning objectives.	highly disagree					highly agree	0 / 0
17	The content of the assessment was consistent with the learning objectives.	highly disagree					highly agree	0 / 0
18	My enthusiasm for the themes/subjects of this module has increased.	highly disagree					highly agree	0 / 0
19	The coherence between the lectures and the topics was good.	highly disagree					highly agree	0 / 0

		1	2	3	4	5	6	7	8	9	10	open/n
20	Overall I would grade this module on a scale from 1 (lowest) to 10 (highest) as:											0 / 0

Teachers in the module

		1	2	3	4	5		open/n
21	The teachers were enthusiastic.	highly disagree					highly agree	0 / 0
22	The teachers gave a good introduction to each new topic.	highly disagree					highly agree	0 / 0
23	The teachers gave me adequate feedback.	highly disagree					highly agree	0 / 0

Master of Molecular Mechanisms of Disease

Course code: ABC
Course name: Course ABC
Cohort: 2009
Period: February 2010
General questions

Toelichting:
gemiddelde waarde en standaarddeviatie

		1	2	3	4	5		open/n
24	There was good opportunity for interaction between students and lecturers in this course.	highly disagree					highly agree	0 / 0

MSc Molecular Mechanisms of Disease

Course Evaluation

code	
name	
cohort	2009
period	

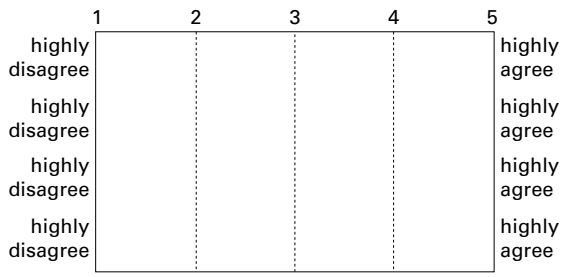
question	answer
a. Which section of the course was most educational and why?	
b. Which section of the course was least educational and why?	
c. How can the course be improved? Which sections / topics would you like to have covered?	
d. Other comments:	

Master of Molecular Mechanisms of Disease

Course code: ABC
Course name: Course ABC
Cohort: 2009
Period: February 2010
Dr. A.B.C. Test

Toelichting:
gemiddelde waarde en standaarddeviatie

Questions per teacher



Questions per teacher

		1	2	3	4	5	open/n		gem	sd
1	The content of the lecture/practical/work group by this teacher was good.	highly disagree	0 0%	0 0%	0 0%	0 0%	0 0%	0 / 0	highly agree	0.0	0.0
2	The presentation of the lecture/practical/work group by this teacher was good.	highly disagree	0 0%	0 0%	0 0%	0 0%	0 0%	0 / 0	highly agree	0.0	0.0
3	This teacher presented the material efficiently within the time available.	highly disagree	0 0%	0 0%	0 0%	0 0%	0 0%	0 / 0	highly agree	0.0	0.0
4	The level of the English language of this teacher was good.	highly disagree	0 0%	0 0%	0 0%	0 0%	0 0%	0 / 0	highly agree	0.0	0.0

Appendix R-5

GUIDELINES FOR THE MMD FORUM DISCUSSION

Module :
Academic Year : 2009-2010
Study : MMD
Date :
Time :
Location :

Participants panel discussion	
OMT-member	
Course coordinator	
Students	
Minutes taken by	

The meeting is meant to be an **open discussion**, with space for the students' questions, remarks and suggestions.
The students have the results of the **online-evaluation** before the meeting.
The students have prepared the **evaluation of the aims** before the meeting.

QUESTIONS

1. What are the most important positive comments?

2. What are the most important negative comments?

3. What are the conclusions after reinspection of the aims list?

4. Was the assessment done adequately? If applicable: were the questions in the written test clear and appropriate?

5. Do you have an explanation for the results of the online evaluation that might be less positive?

6. What are your most important suggestions to improve the module?

7. Other remarks

Conclusions and improvements for the next year

Appendix S: List of performed MMD research training periods

Schaded reports and theses are provided to the Accreditation Committee. These reports and theses were selected to represent a broad range of research themes and final grades.

Start year	*Initials*	*P01/ P02*	*Title*	*Theme*	*Grade*
2005	GB	P01	Expression and functional characterization of human URAT1 mutants in human embryonic kidney cells (HEK-293)	2b	7,5
2005	GB	P02	Modulation of macrophage apoptosis in artheroslerosis development and progression	2b	8
2005	KC	P01	Towards molecular understanding of DC. A quest for specific tools.	1b	9
2005	KC	P02	Functional and molecular genetic study of ciliopathies: Bardet-Biedl, Acrocollosal and Mechel-Gruber syndrome.	3a	9
2005	WH	P01	alfaB-crystallin; an oncoprotein involved in calpain activation	3a	8,5
2005	WH	P02	proj. 1: Candidate pathways regulating the aging and cander promoting senescence-associated secretory phenotype. Proj. 2. A mouse model to investigate and modulate senescence in vivo	3a	10
2006	MA	P01	Unraveling the mystery of MDS: a quest for the genes involved in myelodysplastic syndromes	1b	9
2006	MA	P02	Associations with USH2A and Nlp integrate the centrosomal protein SPAG5 in the Usher protein network	3a	8,5
2006	MJ	P01	Collagen VII as potential membrane marker for epidermal stem cells	1a	7
2006	MJ	P02	Mbd3 dependent gene repression in embryonic stem cells: the epigenetic tail	3a	8
2006	AK	P01	Identifying and characterizing protein interactors of ciliary proteins: RPGRIPIL and Lebercilin	3a	8,5
2006	AK	P02	Characterization of novel inverted repeat sequences from adrenovirus35	1a	8,5
2006	TL	P01	Gene expression profiling in dendritic cells and unrestricted somatic stem cells	1b	7
2006	TL	P02	The effects of immunosuppressive drugs on natural killer cell function in vitro	1b	7,5
2006	KN	P01	Verification of ubiquitination-related target genes of the p53-family	1b	8,5
2006	KN	P02	Validation and characterization of potential new target of the C/EBPd transcriptional factor	3a	9
2006	MS	P01	Behavior of Coxsackievirus B3 in different cell lines treated with IFN-alfa or poly IC.	1a	8
2006	MS	P02	Vav2 binds both PDGF alfa and beta-receptors and binds the beta-receptor at Tyr-771	3b	9
2006	SV	P01	Immune effector and regulatory functions of ex vivo-generated natural killer cells	1b	8,5
2006	SV	P02	Carbon nanotube-mediated siRNA therapy of TMPRSS2-ERG fusion in prostate cancer	3a	9
2006	RV	P01	Single chain variable fragments as a tool to study glycosaminoglycans	1c	7
2006	RV	P02	Characterization of JfF1 expression and signaling in the EbF2 null cerebellum	3a	9

2007	MA	P01	Interplay between histone H3 lysine 56 and serine 57 in DNA damage response in yeast Saccharomyces cerevisiae	3a	9
2007	MA	P02	Immunomodulatory effect of HCV core protein on human innate immune system	1b	8
2007	QF	P01	Recognition of Picornarviruses by Cytosolic RNA sensors and viral evasion strategies	1a	9
2007	QF	P02	Functional screen of human factors that supports HCV RNA replication in murine cells	1a	9,5
2007	AF	P01	Characterization of Kv1.1 N255D	2b	9
2007	AF	P02	TRPC6 and synaptopodin cooperate to regulate podocyte function	1b	9,5
2007	NK	P01	The interplay between DC-SCRIPT and nuclear receptors	1b	9
2007	NK	P02	TREML6 is an ITIM bearing member of the murine; TREM-receptor family that inhibits cell activation	1b	8,5
2007	DK	P01	Visualization of plasma membrane cytoplasmic leaflet upon triggering with different stimuli and endocytic processes	1a	9
2007	DK	P02	Usher Syndrome 1G Protein (SANS) interacts with PDE4DIP/Myomegalin and colocalizes in retinal photoreceptor cells	3a	9
2007	KP	P01	Heme oxygenase- and biliverdin reductase-mediated transcriptional regulation: a quest for novel target genes	1c	9
2007	KP	P02	The influence of experimental glaucoma on the circadian physiology	3a	8,5
2007	SP	P01	Imaging differential recruitment of phospagen kinases to the phacocytic cup	2a	9
2007	SP	P02	Misfolding and aggregation of PolyAlanine-repeat containing proteins	3a	9
2007	PR	P01	Identification of a gene experession profile in stromal cells associated with melanoma metastasis	1b	7,5
2007	PR	P02	Defining the immunological characteristics of HuMAPC	2b	9
2007	MS	P01	Characterisation of the histone modifications H4K16ac and H3K56ac and of the histone variants H2Bv and H3.3 of Plasmodium falciparum and cloning the sirtuin domain in E. coli	3a	7,5
2007	MS	P02	Transient p16INK4A expression leads to stable repression of telomerase and is associated with H3K27 methylation.	3a	8
2007	RS	P01	The role of PRAME in cancer; a substrate receptor for Cullin 2 complex mediated ubiquitination	3a	8,5
2007	RS	P02	Dynein light chain 1 interacts with the lysine specific dementhylase 1 involving residues lys 31 and lys 71	3a	9
2008	AA	P01	The direct role of TLRs on T-cell activation and differentiation	1a	
2008	AA	P02	The role of Runx3 in TGF-beta regulation in systemic sclerosis.	1b	
2008	KB	P01	Antibody-dependent uptake of coxsackievirus by human peripheral blood mononuclear cells: mechanisms and consequences	1a	
2008	KB	P02	Characterisation of norovirus replication complex formation.	1a	
2008	LB	P01	Pathway Signatures: which genes can predict the presence of a metabolic pathway	2a	9
2008	LB	P02	Protein-chemical networks	2a	
2008	AH	P01	The role of (local) NAD-levels during Glioma growth and migration	2a	9
2008	AH	P02	Role of the nuclear pore complex (NPC) protein RanBP2 kin chromosomal instability and cancer	1b	

Appendix S

2008	MK	P01	Interaction of cytoxic T cells attacking multicellular cancer cell spheroids: system development, interaction kinetics and function//Real time reconstruction of apoptotic and necrotic events using histone H2B-eGFP with 2--Photon Microscopy	2b	8,5
2008	MK	P02	Differential functions of cytohesin ARF-GEFs in LFA-1 mediated cell adhesion and signal transduction	1b	
2008	TN	P01	The effect of viral RNAi suppressor on the exogenous and endogenous RNAi pathway	3a	8
2008		P02	Function of TET2 in hematopoiesis.	3a	
2008	LP	P01	Functional Assay of Target Genes Dysregulated by p63 Mutations in EEC Syndrome	3a	8
2008		P02	Genome-wide linkage analysis of an autosomal recessive congenetal cardiomyopahty.	3a	
2008	MP	P01	Endothelial activation in Malaria - direct or indirect role for P. falciparum?	1a	7
2008	MP	P02	The role of memory immunity in protection from Dengue virus secondary infections in mice	1a	
2008	SW	P01	Tools and targets to unravel the function of DC-stamp in Dendritic Cells	1a	8,5
2008	SW	P02	Dynamic imaging of neutrophils during tumor development	2b	
2008	VY	P01	Homozygosity mapping and CNV detection in retinal dystrophies	3a	7,5
2008	VY	P02	Characterization and Function of Epstein-Barr Virus (EBV) Thymidine Kinase (TK) in Classical Hodgkin Lymphoma (cHL)	1a	
2008	MZ	P01	Regulation of DC-script protein expression	1b	8,5
2008	MZ	P02	Understanding the role of transcription factors in T cell differentiation in response to pathogen infection	1a	

Appendix T: High impact publications based on MMD research training periods

(In alphabetic order of first authors)

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Appendix T

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