Maastricht University

Maastricht UMC+

MHeNs School for Mental Health & Neuroscience

Annual Report 2015

Maastricht University
Faculty of Health, Medicine and Life Sciences
&
Health Institutes:
Maastricht University Medical Centre+
RIAGG Maastricht
PMS Vijverdal
Mondriaan Zorggroep Heerlen

Content

Preface

Prof.dr. Harry W.M. Steinbusch
Scientific Director

Dear colleagues,

As past director I would like to look back with you to MHeNs with our Annual Research Report 2015. As already in the previous years it presents a full overview of the scientific achievements and provides information concerning the School for Mental Health and Neuroscience (MHeNs) in the fields of research output, earning power, staff members and postdoctoral teaching activities in 2015. MHeNs has continued to grow not only regarding the number of publications as requested by the Faculty of Health, Medicine and Life Sciences (FHML) but more importantly also in the quality of the papers as indicated by an increase in the average impact factors. We were encouraged to increase the number of papers in particular in the top 10% and in general in the top 25% of the impact fields in which we are working. The increase in non-tenured staff members has resulted in a sharp increase in the number of PhD theses to 47 in 2015. This is mainly achieved by going much more international and including external PhD theses from e.g. India and China. This number will further increase due to the strength and sustainability of the international programs with Japan, China, Korea and of course with our Euron partners. MHeNs currently hosts about 178 PhD students. The guidance of these students is a significant challenge that requires an enormous and coordinated effort of all our staff members, keeping in mind that at least two supervisors guide each PhD student. In accordance with the performance contract with FHML we have focused on increasing the funding from NWO/ZonMW (Dutch Medical Research Council) and FP7- Horizon 2020 - EU grants, which has resulted in depending less on grants obtained from other peer-reviewed agencies. Grants obtained from industrial contract research now represent a very limited component of our funding.

Research in MHeNs is guided by the insight that the brain mediates behavioural adaptation to the environment, and that higher order mental, motor and sensory processes converge to guide adaptive behaviour in complex ways. Individual differences in mentation and behaviour are related to (epi)genetic variation and early environmental influences with enduring developmental impact. Research in MHeNs attempts to trace the origin of cognitive, motor, sensory and behavioural dysfunction to interacting genetic and environmental influences, and to elucidate the biological and mental mechanisms between aetiology and symptoms. We focus on common biological pathways such as epigenetics, neuroplasticity, neuronal excitability, neurodegeneration, neuroinflammation,

and cerebrovascular regulation. Thereby, we are working toward establishing how they subserve early imbalance in mentation and functional abilities of the central nervous system (cognition, emotion, incentive salience, movement and pain perception), finally resulting in early diagnosable mental and neurological syndromes requiring treatment.
Neuroscience research is becoming more focused on these major topics. Restructuring has resulted in one division focusing on Cognitive Neuropsychiatry and Clinical Neuroscience, one division on Mental Health and the third one Neuroscience. In line with this, educational activities of the Master's programs correspond to these three divisions. The prime strength of MHeNs is a strict translational approach, e.g., Division 1 concerns and combines neuro-epidemiology and brain imaging, Division 2 focuses on gene-environmental changes/interactions related to psychiatric disturbances such as psychoses, and Division 3 focusses on understanding biologic mechanisms mediating normal and aberrant functioning of the nervous system by performing high qulatity translational neuroscience research. These lines of research at MHeNs will continue to find much synergy within collaborative projects and research networks, in the areas of the cross-divisional task force Cross-species Research and Translational Neuropsychiatry, and studies related to the disturbances of the Brain vasculature, leading to Vascular dementia and dysfunctioning of the Blood Brain Barrier. MHeNs has also further developed in close relationship with Scannexus and the Faculty of Psychology and Neuroscience resulting in high-profile articles with authorships from the three MHeNs divisions. MHeNs is one of the heaviest users of the High Imaging Facility.

The implementation of the ***Neuro-Intervention Centre*** (NIC) has started, a Clinically-driven Research Unit, headed by Prof. J. van Os, MD PhD. NIC will start in 2017 and will deal with all aspects of mental health related issues related to research, patient care and education in the Academic Hospital Maastricht. NIC and MHeNs will jointly work together. As mentioned before this relationship has resulted in direct opportunities for translational research from bed to bench and vice-versa.

We would like to provide some additional thoughts with respect to ***EURON – European Graduate School of Neuroscience***. MHeNs is a fully integrated partner in EURON and moreover the coordinator. However, EURON comprises nine other universities in the Euregio as well. MHeNs has been taking the lead in all organizational aspects. Because it already provides an excellent opportunity for networking, further Euregional activities and the introduction of an international or European Master in Translational Neuroscience have great potential, which we hope to start 1-9-2018.

A further specific point deserving our attention is our partnership with the Faculty of Psychology and Neuroscience (FPN). Within EURON, there is already a collaboration with the Department of Neuropsychology and Psychopharmacology (NPPP), (FPN) headed by A. Blokland, PhD. In addition, there is a strong link with educational activities at the level of the Research Master Program Cognitive and Clinical Neuroscience in which the School is involved in two of the five tracks. Thus the FHML is the principal coordinator of two tracks of the Research Master. These partnerships are important for research and educational exchanges and should within the next period result in the ***Centre for Interactive Neuroscience*** (CIN).

Finally, the most important event for MHeNs was the report for the ***External Evaluation Committee*** who has visited January 2016. From this report we as School in total received a very good judgement which has indicated that all divisions are working very well with high standards. This is an excellent starting point for the next 6 years to come. I would like to thank all members of MHeNs for contributing their motivation, knowledge and expertise to the School and students in the past years.

Prof. Harry W.M. Steinbusch, PhD
Past Scientific Director
School for Mental Health and Neuroscience

1. Organizational structure

MHeNs is managed by the Board of MHeNs. The board is the body where strategies issues are discussed and effectuated. It consists of five members: the scientific director, the managing director and the three division leaders.

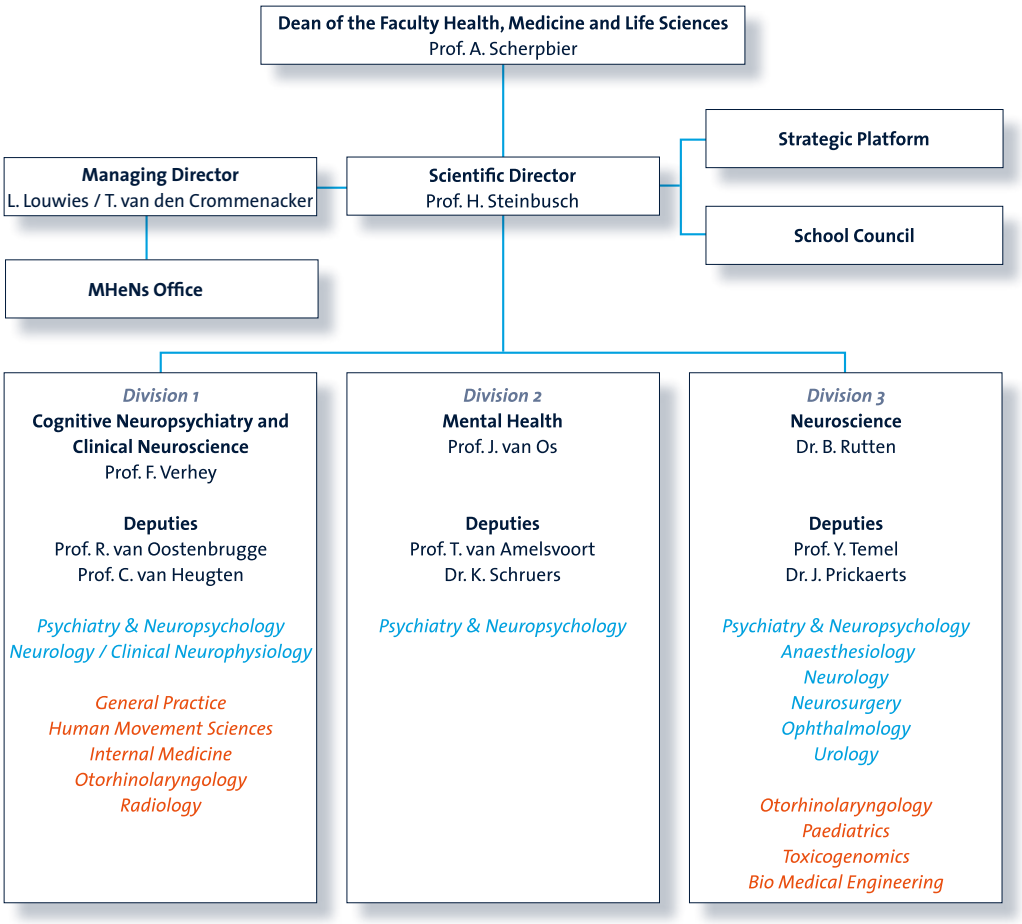


Figure 1.1 Organogram of MHeNs: the contribution of the different Departments of FHML to the current three Divisions of MHeNs.

Core Departments

Anaesthesiology - Prof. W. Buhre
Neurology / Clinical Neurophysiology - Prof. R. Van Oostenbrugge / Prof. W. Mess
Neurosurgery - Prof. J. Van Overbeeke
Ophthalmology - Prof. C. Webers
Psychiatry & Neuropsychology - Prof. J. Van Os
Urology - Prof. G. Van Koeveringe

Non Core Departments

Bio Medical Engineering – Prof. T. Delhaas
Human Movement Science – Prof. E. Blaak until September 2015
General Practice - Prof. J. Metsemakers
Internal Medicine - Prof. C. Stehouwer
Otorhinolaryngology - Prof. B. Kremer
Paediatrics - Prof. L. Zimmerman
Radiology - Prof. J. Wildberger
Toxicogenomics - Prof. J. Kleinjans since September 2015

Members of EURON

MHeNs is the coordinator of the European Graduate School of Neuroscience (EURON). EURON is a research and training network of 11 universities in four countries i.e. Belgium, Germany, France and the Netherlands.
Belgium

Belgium
Universiteit Hasselt
Katholieke Universiteit Leuven
Université de Liège
Université catholique de Louvain

Germany
RWTH Aachen University
University of Bonn
University of Cologne

France
Université Lille 1
Université Paris Descartes

The Netherlands
Maastricht University (MHeNs, FHML) and FPN

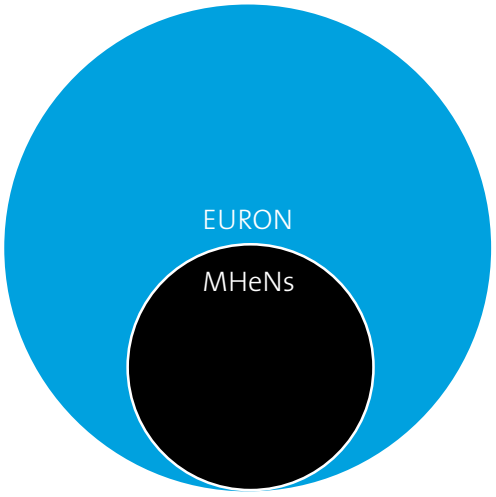


Figure 1.2 EURON in relation to MHeNs.

2. Divisions

2.1 Division I: Cognitive Neuropsychiatry & Clinical Neuroscience

Division Leader:
Prof. F. Verhey MD PhD

Deputies:
Prof. R. Van Oostenbrugge MD PhD
Prof. C. Van Heugten PhD

Staff:
P. Aalten PhD
J. Adam PhD
M. van den Akker PhD
R. Al-Momani PhD
Prof. B. Aldenkamp PhD
L. Anteunis PhD
Prof. W. Backes PhD
L. Berk, MSc
Y. Bol, PhD
L. Boots, PhD
M. van Boxtel MD PhD
S. Burgmans PhD
Prof. J.W. Cohen Tervaert MD PhD
J. Damoiseaux PhD
K. Deckers, MSc
J. Dijkstra PhD
E. Douven, MSc
A. Duits PhD
Prof. C. Faber MD PhD
E. George PhD
E. Gronenschild PhD
R. Hamel – de Bakker PhD
R. Handels PhD
J. Hendriksen PhD
Prof. P. Hofman MD PhD
D. Horstkötter MA PhD
Prof. R. Hupperts MD PhD
D. In de Braek PhD
J. Jansen PhD
W. Jansen PhD
H. Jacobs PhD
J. de Jong MSc
L. Kerpershoek, MSc
V. Kranen–Mastenbroek MDPhD
Prof. H. Kingma PhD
I. Klinkenberg PhD
R. van Knippenberg, MSc
S. Köhler MA PhD
Prof. B. Kremer MD PhD
Prof. A.A. Kroon, MD PhD
M. Kuijf MD, PhD
A. Leentjens PhD
Prof. P. de Leeuw MD PhD
B. Lenaert PhD
Prof. J. Lodder MD PhD
I. Merkies MD PhD
Prof. W. Mess MD PhD
Prof. J. Metsemakers MD PhD
J. Millenaar, PhD
A. Moonen PhD
L. Müller-Ehrenberg, MSc
Prof. R. Ponds PhD
I Ramakers PhD
J. Reijnders PhD
J.P.H. Reulen PhD
R. Rouhl MD PhD
Prof. J. Schols, MD PhD
Prof. R. Smeets MD PhD
P. Spauwen PhD
A. Stiekema PhD
Prof. R. Stokroos MD PhD
P.-J. Visser MD PhD
Prof. J. Vles MD PhD
M. Vlooswijk, MD PhD,
M. Voorend PhD
S. Vos PhD
M. de Vugt PhD
Prof. Dr. J. Wildberger MD PhD
I. Winkens PhD
C. Wolfs PhD
G. Wolters Gregorio, PhD

Goals & Results

Cognitive NeuroPsychiatry & Clinical Neurosciences (CNP-CNS)
The Division CNP&CNS performs fundamental and applied research on cognitive, neurological and otorinolaryngological disorders. CNP&CNS mission is to generate new insights into mechanisms of these conditions, which help to improve diagnosis and treatment, and quality of life of people with these disorders.

2.1.1 Research lines

1	Neurodegenerative disorders: mechanisms, early diagnosis and biomarkers
2	Neuroepidemiology
3	Psychosocial interventions and cognitive rehabilitation
4	Vascular Neurology i.e. the vascular contribution to neurodegeneration
5	Movement disorders
	5.1 Movement disorders in adults
	5.2 Pediatric movement disorders
6	Epilepsy
	6.1 Epilepsy in adults
	6.2 Epilepsy in children
7	Neuromuscular disorders
	7.1 Neuromuscular disorders in adults
	7.2 Neuromuscular disorders and/or neurocognition in children
8	The sense of hearing and balance: advanced diagnosis and substitution

1. Research line: Neurodegenerative disorders: mechanisms, early diagnosis and biomarkers	
PI:	Prof. F. Verhey MD PhD
Research Staff:	P. Aalten, MD PhD, M. Van Boxtel MD PhD, Prof. R. Van Oostenbrugge MD PhD, Prof. P. Hofman MD PhD, Prof. W. Backes PhD, J. Jansen MD PhD, H. Jacobs MD PhD, I. Ramakers MD PhD A. Leentjens MD PhD, A. Duits MD PhD, E. Gronenschild MD PhD, S. Köhler MD PhD, P-J. Visser MD PhD, Prof. F. Verhey MD PhD, Prof. C. Faber, J. Staals PhD
Postdocs:	S. Vos MSc PhD, R, Handels PhD
PhD-students:	H. van de Haar MSc, M. Huijts MSc, A. Moonen MSc, S. Schievink MSc,T. Van der Voort MSc, W. Janssen MSc, B. Reijs MSc ,E. Zhang MSc, A. Mertens MSc, W. Freeze MSc, L. Kerpershoek MSc, J Riphagen MSc, B. Gulpers MSc, L Müller-Ehrenberg MSc, N. Priovoulos MSc , I. Verheggen MSc, E. Douven, MSc
Co-investigators extern:	European Alzheimer'EEuropean Alzheime's Disease Consortium, Parelsnoer consortium
Focus of research:	Translational research into the early diagnosis of pathological ageing A large-scale national biobank, coordinated by MUMC and the VU-MC, formed the infrastructure for translational research into the early diagnosis of pathological ageing (Parelsnoer Neurodegeneratief), coordinated by Prof F. Verhey. Novel diagnostic technology for the early detection of Alzheimer's disease will be examined and evaluated in terms of Health Technology Assessment, i.e., with respect to its added value to existing diagnostic procedures (LeARN, CTMM).

This research line focuses on biomedical research on mechanisms of cognitive disorders, notably (prodromal and clinical stages of) Alzheimer's Disease, Stroke/ small vessel disease, and Motor Disorders (Parkinson's disease. Research activities are integrated with patient care facilities in several centres, i.e., Alzheimer Centre Limburg (PIs F. Verhey, M. de Vugt); Stroke centre (PI van Oostenbrugge) and Centre for Motor Disorders (PIs prof Temel, Dr Leentjens).

We continued in 2015 to participate in the National Parelsnoer Initiative (PIs: Pauline Aalten, Inez Ramakers), which is a collaboration of 8 Dutch UMC on several chronic diseases. Maastricht University/ Alzheimer Centre Limburg is national coordinator of the Pearl "Neurodegenerative diseases", which focuses on the early diagnosis and prognosis of Alzheimer's disease. In 2015 we performed the 5-year clinical follow-up assessments of non-demented participants for whom blood, MRI and CSF (optional) biomarker data were collected at baseline, adding to the PSI database..
The European multicentre BIOMARKAPD project, funded by JPND, was successfully finished in 2015 (PI involved is Pieter Jelle Visser). The aim of this study was to improve the clinical use of body fluid markers for the diagnosis and prognosis of Alzheimer's disease and Parkinson's disease. We set up a central and virtual biobank for body fluids and associated data from subjects with neurodegenerative diseases for the validation of novel biomarkers and assays for Alzheimer's disease and Parkinson's disease. This virtual biobank contains now information on over 8600 subjects from 21 local biobanks. Furthermore, we developed guidelines and studied the cost-effectiveness (R Handels) of the use of CSF biomarkers in diagnostic work up of Alzheimer's disease.
The European EMIF-AD project is an ongoing IMI project for which Maastricht is the academic lead (PI: Pieter Jelle Visser). The aim is to build an EU infra-structure for studies on neurodegeneration in order to discover and validate Alzheimer's disease markers for the facilitation of drug development and trial design in predementia stages of Alzheimer's disease. We currently have 12 larger AD cohorts available in the secure data environment to perform pooled analyses, while further development of the data storage infrastructure in collaboration with the EMIF-Platform is ongoing. We also developed an EMIF-AD catalogue to search for European Alzheimer's disease cohorts of interest to answer a particular research question, which will go public in 2016. Additionally, we have now collected existing samples and data from 1000 subjects in order to perform cross-modality analyses based on genomics, metabolomics, proteomics, and imaging data. Several high-impact publications with researchers form the Alzheimer Center Limburg, e.g. in JAMA and Brain, already resulted from this project.
We received two Kootstra Talented Fellowships in 2014 and 2015 from MUMC+/FHML for highly talented future postdocs (Stephanie Vos and Ron Handels). These ongoing projects focus on the biological mechanisms of atypical Alzheimer's disease in subjects with mild cognitive impairment and on cost-effectiveness of biomarker use in the diagnostic work-up of dementia and its early stages, respectively.
We are participating in the European VPH-DARE project (PI's involved are Pieter Jelle Visser and Stephanie Vos). This study aims to define novel memory disorder biomedical biomarkers, available for predictive multi-scale model-building and personalization, as well as for earlier differential diagnostics, to be made accessible through the data infrastructure. A resulting integrated clinical decision support platform will be validated by access to a dozen databases of international cross-sectional and longitudinal studies. We participate in this project with our European DESCRIPA study and examined the role of lifestyle and environmental factors in relation to biomarkers for diagnosis and prognosis of early stages of Alzheimer's disease. A manuscript is in preparation.

We are also involved in ongoing sponsor based trials, i.e. the Dutch Flutemetamol in young onset dementia study and a European multicentre double blind placebo controlled trial of Nilvadipine in mild to moderate Alzheimer's disease (PI: Frans Verhey). Additional info + status?

The SNAP-MCI project started the end of 2015 and is a personal grant from ZonMw Memorabel Deltaplan Dementie (PI: Stephanie Vos). The aim of this study is to investigate the underlying mechanisms of individuals with mild cognitive impairment and an atypical Alzheimer's disease biomarker profile, i.e. neuronal injury without amyloid pathology. Existing clinical data, CSF samples and MRI scans are now collected from 210 subjects with mild cognitive impairment and cognitively normal individuals. We plan to perform CSF proteomics and examine the MRI atrophy and vascular profiles of these subjects.

For the INPAD project (PI: Inez Ramakers) that just started, we aim to innovate and improve neuropsychological assessment in early dementia. The objectives are (1) to increase efficiency by the development of a web-based, computerized, cost-effective and user-friendly neuropsychological assessment analysis tool, and (2) to innovate patient communication by the development of a patient- and clinician-friendly visualization of cognitive test performances.

In 2016 the Takeda project will start (PI: Pauline Aalten). This is a longitudinal behavior-genomics study sponsored by Takeda. As part of this project cognition and (epi)genetics will be examined in our memory clinic patients with subjective cognitive decline and mild cognitive impairment. DNA and RNA will be collected and clinical follow-up assessments will be performed each 6 months up to 24 months after baseline.

Collaboration with the Departments of Neurology and Radiology was intensified, which has led to a new study on neurovascular mechanisms of cognitive disorders, and the interaction between vascular and neurodegenerative mechanisms. Drs S. Burgmans, H. Jacobs and profs W. Backes and F. Verhey continued their study on blood-brain barrier leakage in dementia (funded by an ISAO pilot award), hypothesing increased blood-brain barrier permeability in Alzheimer patients and developed a new dynamic contrast enhanced MRI scan. A new grant Toptalent (PhD I. Verheggen) of was obtained by these researchers to expand this research line.

A second BBBB project (funding NWO/Mozaïek; PhD I Verheggen) is ongoing to investigate the role of BBB leakage and microvascular impairment in patients with Vascular Cognitive Impairment and Lacunar Stroke (Prof. R. van Oostenbrugge, Prof. W. Backes). Further the research will be continued using advanced MRI techniques into the neuronal correlates of cognitive decrements in a diabetes population in collaboration with The Maastricht Study.

2. Research line: Neuroepidemiology	
PI's:	S. Köhler, PhD , M. van Boxtel, MD PhD
Research Staff:	Prof. F. Verhey, MD PhD, Prof. W. Backes, MD PhD, J. Jansen, PhD, Prof. R. Van Oostenbrugge, MD PhD
Postdocs / PhD-students:	F. van Dooren, MSc., P. Spauwen, MSc., W. van Zwam, MSc., F. van Bussel, K. Deckers, MSc., M. Wong MSc., L. Berk, MSc.
Focus of research:	Insight into the aetiology, prevention and treatment of cognitive dysfunction in the normal adult and elderly population

Research line staff members are active contributors to the Maastricht Study (DMS), a study to provide more insight into the prevention, aetiology and treatment of type 2 diabetes and other chronic diseases in relation to mental health. DMS is a good example of the integrative approach that we aim for, with multidisciplinary input from the departments of Psychiatry & Neuropsychology, Neurology, Neuroradiology, and Neuro-ophthalmology and Otolaryngology. Participation of this research line in DMS has resulted in 2015 in PhD theses of F. van Dooren (diabetes and depression, in collaboration with Tilburg University)) and P. Spauwen (cognition in diabetes). The project by J. Jansen (VENI grant) on multi-parametric imaging of cerebral biomarkers of cognitive deterioration using MRI in diabetes type-2 is now near completion. DMS encompasses a multi-disciplinary program in collaboration with the departments of Internal Medicine of the MUMC+.
The FP7 funded 3-year study into preventive strategies to ameliorate the individual dementia risk profile of middle-aged individuals (InMINDD; see www.inmindd.eu) has produced an evidence-based risk factor algorithm to estimate individual dementia risk: the Lifestyle for Brain Health (LIBRA) index. This product was implemented in an ongoing multicenter European intervention study in general practice aimed to reduce the dementia risk profile in middle-aged individuals. Preliminary results have shown that the product is feasible and offers opportunities to be implemented fur use in the general population. Funding was applied for to the Province of Limburg to undertake an implementation of InMINDD findings using e-Health technologies.
The results of the NWO/FES program 'Healthy Cognitive Ageing' aimed at the development of internet-based low-level intervention strategies to support the cognitive ageing process in middle-aged and older adults have been implemented as e-Health module ("Keep your brain fit!", www.houduwbreinvitaal.nl), which has been made available for the general public. Other products of this National collaboration with the universities of Amsterdam (VUmc, UvA) and Nijmegen (RUMC) are available at the consortium portal 'BreinWeb.nl'.
The Maastricht Ageing Study (MAAS) continuous to be a major source for new studies into determinants of cognitive ageing, including studies on positive affect, hypertension, obesity and cardiovascular disease. MAAS has been added to the "Cohort Studies of Memory in an International Consortium (COSMIC)" harmonisation project, allowing high-powered analyses of 24 population-based studies into cognitive ageing.
Other collaborations with international partners in dementia epidemiology and prevention have been intensified (e.g. Dr Launer, NIH; Prof. Brayne, U Cambridge, UK; Prof. Yaffe, USCF, USA), and new collaborations were started (Profs. Kivipelto/Solomon, Karolinska Institute, SWE; Prof. Steptoe, UCL, UK). New avenues are explored on the role of mindfulness in cognitive ageing and in the incidence of cognitive complaints, both in observational and in intervention studies.

The Weijerhorst foundation supported further research of the blood-brain-barrier (BBB) between the departments of Radiology and Neurology to develop MRI methods and apply these in patients with small vessel disease (SVD) to get more insight in the etiology of SVD and to link this with both pathological and normal ageing and cognitive decline. An NWO talentproject was started by Inge Verheggen on BBB integrity in normal ageing, within the framework of the Maastricht Ageing Study.

3. Research line: Psychosocial interventions and cognitive rehabilitation	
PI's:	Prof. C. van Heugten PhD, M. de Vugt PhD
Research Staff:	Prof. R. Ponds PhD, M. van Boxtel MD PhD , Prof. F. Verhey MD PhD
Postdocs / PhD-students:	I. Winkens PhD, C. Wolfs PhD, , I. Klinkenberg PhD, S. Smeets PhD, C. Bakker Msc., B. Dandachi-Fitzgerald MSc, L. Boots Msc, I. Brands MSc, J. Collet MD, M. van Eeden MSC, M. Fens MSc, R. van Knippenberg MSc, B. ter Mors MSc, V. Moulaert MSc, , N. Tielemans MSc, M. van Eeden MSc, A. Dam Msc, L. Kerpershoek Msc, J. Millenaar Msc, E. Tan MD, B. Appelhof Msc, A. Gerritsen MD, J. van Duin Msc.
Co-investigators extern:	International Interdem network, ZonMw consortium Restore4stroke, NWO HCMI consortium Cognitive Rehabilitation
Focus of research:	Psychosocial interventions, cognitive rehabilitation and health service evaluation research. Interventions in cognitive and acquired brain disorders such as acquired brain injury and dementia. In this research line a strong focus is put on evidence-based neuropsychological interventions, psychosocial interventions, caregiver interventions, cognitive rehabilitation and health service evaluation research. Both clinical and cost-effectiveness are investigated. In addition, research is focusing on the development and evaluation of new instruments to measure outcome of treatment and on investigating factors which influence outcome. Innovative treatment techniques are being evaluated in this programme, such as self-management techniques and e-health interventions.

The program on psychosocial aspects and interventions to support dementia patients and informal caregivers has received grants from Alzheimer Netherlands, Alzheimer Research Fund Limburg and the European Joint Program of Neurodegenerative Diseases (JPND)/ ZonMW..An important focus of the program is e-health interventions; with three PhD students (L. Boots, MSc / R. van Knippenberg, MSc/ A. Dam, MSc) that study the feasibility and effectiveness of newly developed e-health interventions. The program was expanded in 2014 with a JPND funded European study on the development of an e-learning tool specific for young onset dementia (J. Millenaar, MSc, Post doc Dr. Ch. Bakker), and an Erasmus funded project on the development of an online master program on positive aspects of dementia (Post doc Inge Klinkenberg). In addition, a JPND grant was received in 2014 to study access to timely formal care in dementia (Dr L. Kerpershoek, Post doc Dr. C. Wolfs). In collaboration with Alzheimer Center Nijmegen three external PhD students study aspects and interventions in young onset dementia (B. Appelhof, MSc, A. Gerritsen, MSc, J. van Duin, MSc).
In 2015, a n ITN H2020 Marie Curie grant called INDUCT (Interdisciplinary Network for Dementia Utilising Current Technology) was awarded to dr de Vugt and prof Verhey. Maastricht University participates as a training coordinator (I Klinkenberg training manager) in this network, and will appoint 2 Early Stage Researchers/ PhDs

In 2015 the development of the Expertise Center for Brain Injury was started. In this expertise centre, researchers of the UM of both FHML and FPN work closely together with psychologists from the MUMC and all hospitals in Limburg (Sittard, Heerlen, Roermond, Weert, Venlo). The expertise centre aims to improve the quality of life of brain injured patients and their caregivers by scientific research in combination with health care development and innovation.

In the program on neuropsychological interventions for patients with acquired brain injuries 3 internal and 2 external PhD students successfully finalized their research. At the UM I. Brands defended her thesis on a research project investigating the adaptation process following brain injury; N. Tielemans finalized her research project on the

effectiveness of a self-management programme for stroke patients and their partners; S. Smeets investigated deficits in self-awareness after brain injury as part of the ZonMw Restroe4stroke program. In collaboration with the Brain Center Utrecht H. Boosman successfully finished her research project on learning after brain injury as part of the NWO HCMI consortium on cognitive rehabilitation. Also in collaboration with Utrecht M. van Mierlo defended her thesis on the influence of personal factors on stroke outcome as part of the ZonMw Restore4stroke programme.

In the ZonMw/VSB fonds Restore4stroke programme 4 PhD students study the quality of life and participation of stroke patients and their partners until 2 years after stroke. This programme is a joint initiative of Maastricht, Utrecht and Nijmegen In which different methodologies are combined (i.e. prospective cohort study, record linkage study, burden of disease study, randomized clinical trials and economic evaluations). In 2015 2 of the 4 PhD students defended their thesis (see above).

The NWO/FES Brain & Cognition programme (0.9 Me) continued in 2015 studying the effectiveness of cognitive rehabilitation and factors influencing the success of cognitive rehabilitation. New interventions for executive dysfunction in Parkinson patients (Groningen), errorless learning augmented Goal Management Training (Nijmegen), problem solving therapy for stroke patients (Rotterdam) and the ABC method for severe behavioural problems after acquired brain injury (Maastricht) have been developed, and recruitment for efficacy studies has started. In addition, factors influencing rehabilitation outcome are being studied: self-awareness (Maastricht), learning style and learning potential (Utrecht/Maastricht). In 2015 2 PhD students defended their thesis (see above).

4. Research line: Vascular Neurology	
PI:	Prof. R. van Oostenbrugge, MD PhD
Research Staff:	Prof. W. Backes PhD, J. Jansen MD PhD, J. Staals MD, PhD
Postdocs:	S. Foulquier, PhD
PhD-students:	S. Schievink MSc, M. Wong MSc, E. Zhang, MD, R. Uiterwijk MSc, E. Douven, MSc.

The vascular Neurology group has a longstanding research tradition on cerebral small vessel disease (cSVD). Within division I the long term consequences of cSVD, specifically cognitive ones, are being studied. A project funded by NWO aims to determine the role of blood brain permeability in cognitive function in cSVD started. First results are being expected in 2016. End 2015, funding within the framework of HORIZON 2020 was obtained for a collaborative project with several European universities to study mechanisms of disease in cSVD. Furthermore, we participate in the JPND funded project 'Vascular Contribution to Neurodegeneration'. Main aim of this collaboration is establish a platform holding information about cohorts, relevant to vascular contribution to neurodegeneration (METACOHORTS). Translational research on cSVD is performed in collaboration with researchers from the School for Cardiovascular Diseases (CARIM). The focus is directed to the role of vascular inflammation and AT2R signalling in the development of cSVD.

5. Movement disorders	
5.1 Movement disorders in adults	
PI's:	Prof. Y. Temel, MD PhD, A. Leentjens, MD PhD, M. Kuijf MD, PhD, A. Duits PhD
Research staff:	M. Oosterloo MD
Co-investigators:	J. Janssen MD PhD, A. Moonen PhD
PhD's:	S. van de Weijer, A. Mulders, B. Isaacs, F. Gubben

Research in movement disorders in adults focuses on non-motor symptoms in Parkinson's disease and optimization of deep brain stimulation treatment (DBS). Important non-motor symptoms in Parkinson's disease include neuropsychiatric symptoms and cognitive impairment. Research of anxiety and depression has focused on characterizing and modelling risk factors for the presence of these symptoms in PD and evaluating treatment options including e-health applications and cognitive behavourial treatment. Currently, a multicenter clinical trial sponsored

by the Micheal J Fox Foundation has started on cognitve behavourial treatment and fMRI correlates in PD patients with anxiety. In addition, a multicenter clinical trial is coordinated from Maastricht in which an online training program for cognition in Parkinson's disease is evaluated in a large group of patients. Within this program that is sponsored by the industry (MyCognition), fMRI correlates of cognitive decline in Parkinson's disease will be investigated. Identification of anatomical and functional connectivity in deep brain structures used as a target for electrical stimulation (DBS) is investigated with high field 7T MRI imaging in co-operation with different research groups. The aim of this research line is to implement 7T MRI imaging for clinical use in pre-operative DBS targeting and optimizing treatment.

Besides the research line for Parkinson's disease, another line focuses on the hyperkinetic spectrum of movement disorders and Huntington's disease. In this research, phenotyping carriers of intermediate CAG lengths in Huntington genes and active participation in the European Huntington Registry study is ongoing.

5. Movement disorders	
5.2 Pediatric movement disorders	
PI's:	R.J. Vermeulen MD PhD, Prof J.S.H. Vles MD PhD
Research staff:	S. Koudijs MD
Co-investigators:	L. Speth MSc(rehabilitation), K. Meijer MSc(movement sciences)
PhD's:	L. Bonouvrie MSc

Early brain damage leads to movement disorders (spasticity, dystonia and ataxia), which interfere with motor development. We focus upon mobility (ie. walking) and head use. Therefore, the focus of this research line is upon interventions as treatment for motor disorders. The abnormalities of the brain are the primary cause of the motor disorder and therefore extensively studied in the study populations, using standard and advanced MR imaging. Currently, a randomized controlled trial with Intrathecal baclofen is conducted in pediatric and adolescent patients with dyskinetic cerebral palsy. (IDYS study, sponsored by the Phelps stichting, revalidatie fonds and Johanna kinderfonds)
Mobility is investigated with 3D over ground gait analysis (VICON) and treadmill gait analysis with virtual reality (CAREN). For the next years we aim at further development of (new) neurointerventions using functional electrical stimulation and deep brain stimulation.

6. Research line: Epilepsy	
6.1 Epilepsy in Adults	
PI's:	Prof. A. Aldenkamp, MD PhD, G. Hoogland MD PhD, MSc PhD,. R. Rouhl, MD PhD, M. Vlooswijk, MD PhD, Prof. W. Backes, MSc, PhD, P. Hofman MD PhD, J. Jansen, MSc PhD.
Post doc: / PhD students:	E. Barendse MSc, W. van Blarikom MSc Z. Bouwman MD PhD M. Buskermolen, MSc. N. Gosens, MSC. D. IJff, MSC. J. Peijnenborgh, MSc., J. van Tuyl, MD PhD, T. van Veenendaal, MSc., S. Schipper, MSc., M. Teunissen, MSc., L. Wagner, D MSc., C. van den Bosch, MSc. F. Schaper

In 2015, a central theme within the research topic of epilepsy was "Chronic Epilepsy", previously already funded by a substantial grant from the National Epilepsy Fund (NEF) for this program (led by Prof. A. Aldenkamp). One of the most severe consequences of chronic epilepsy is the impairment of cognitive functioning, including the general thinking, memory, language and problem-solving capabilities. The novel insight today is that epilepsy is more a network disease rather than a single focal abnormality or malfunction. Traditionally, epilepsy research utilizes different techniques and methods: measurement of brain waves (electro-encephalography, EEG), imaging (acquisition of anatomic and functional brain images with scanning devices) and neuropsychological assessment. Recent technological developments of MRI methods, in particular functional and diffusion MRI, provide possibilities to obtain new insights on the organization and integrity of cerebral networks which may lead to strategies that prevent chronic epilepsy and cognitive co-morbidity. Also, further efforts are taken to unravel the neuronal en physical substrates for Psychogenic Non-Epileptic Seizures.

Starting in 2014, as a consequence of a further integration of and novel opportunities within the Academic Centre for Epileptology (ACE) new focus points for research were explored and elaborated in 2015: special diagnostical methods (immunology, auto-antibodies) and genetics (whole exome sequencing)) as well as special therapeutical methods (deep brain stimulation). Cognition in relation to (interictal) epileptic discharges, especially in children, is another research focus point within ACE. To continue the translational and clinical epilepsy research, these new research lines have started or will be started in 2015.

6. Research line: Epilepsy	
6.2 Epilepsy in children	
PI's:	Prof. J.S.H. Vles MD PhD, Prof. A.P. Aldenkamp MD PhD
Research Staff:	S. Klinkenberg MD PhD, M. Debeij van Hall,. J.G.M. Hendriksen MD PhD, Prof. H.J.M. Majoie MD PhD, G. Hoogland MD PhD, J. Jansen MD, J. Nicolai MD PhD, S. Zinger MD
PhD:	E. Fonseca-Wald MSc , G. Drenthen MSc Van den Bosch/ Wagener-Schimmel MSc, S. Schipper MSc
Co-investigator:	Prof. H.J.M. Majoie MD PhD

Within the Academic Centre of Epilepsy (ACE) collaboration between Epilepsy Centre Kempenhaeghe and Departments of Neurology concerning diagnostic and treatment options augmented. In 2015 preparations were made for total package of diagnostic and treatment modalities for (refractory) epilepsy within ACE, leading among other things to scientific spin off in various directions: for example thesis S. Klinkenberg (VNS in children, a neuromodulating treatment alternative in refractory epilepsy).
Cognition in relation to (interictal) epileptic discharges and functional networks, especially during development in children, is another research focus in ACE. Preparation of the LEES study, a longitudinal follow-up study in children with absence epilepsy, was started. Benign childhood Epilepsy with centrotemporal spikes is another research theme, resulting in 'The Rolandic care program', a national recognized expertise centre. This program covers both diagnostic modalities (clinical, neurophysiological and neurocognitive) and expertise in counselling. Current study provides insight in subtypes and timing of treatment and consequences for later life. Next to this clinical research lines there is an established pre-clinical research program on cognition in relation to epilepsy and interictal epileptic discharges among other themes.

7. Research line: Neuromuscular disorders	
7.1 Neuromuscular disorders in adults, led by prof Faber, and children, led by prof Vles	
PI:	Prof. C. G. Faber MD PhD
Research staff:	J.G.J. Hoeijmakers MD PhD,. I.S.J. Merkies MD PhD
Postdoc:	R. Almomani MSc
PhD's:	B. de Greef MSc, M. Sopacua MSc, I. Eijkenboom MSc, R. Slangen, MSc B.A. Brouwer MSc, T. Draak MD, M. Pruppers MSc
Coinvestigators extern:	Prinses Beatrix Spierfonds, FP7 Healt Innovation, Grifols, Lamepro
Focus of research:	Painful (small Fibre) neuropathies (PhD students B. de Greef, M. Sopacua, I. Eijkenboom): the research on painful neuropathies focuses on the genetic mechanisms underlying neuropathic pain, identifying molecular targets which may reveal new druggable sites, and creating the possibility for personalized pain medicine in a collaborative project, 'Probing the role of sodium channels in painful neuropathies (PROPANE Study)', granted by the EU (Health.2013.2.2.1-5; Understanding and controlling pain. FP7-Health-2013-Innovation-1). Furthermore, studies for improving diagnostic techniques and development of new therapeutic strategies, including new trials, are being performed. Outcome measures for use in neuromuscular diseases (PhD students T. Draak, M. Pruppers) are essential for development of new trials in the upcoming therapeutic era, leading to several PhD theses (S. van Nes, E. Vanhoutte). M. Pruppers was awarded the Mazawey Fellowship, a 3-year Fellowship ($ 300.000) for the anti-MAG neuropathy study proposal. Myotonic dystrophy is another main research theme. The 'Maastricht Myotonic Dystrophy Register' dates from the early '80s of the previous century, containing data on more than 500 DM1 patients. A grant for development of the national registry for myotonic dystrophy was given to the Myotonic Dystrophy Centre the Netherlands (Maastricht UMC+ and Radboudumc).

7. Research line: Neuromuscular disorders	
7.2 Neuromuscular disorders and/or neurocognition in children	
PI's:	Prof. J.S.H. Vles MD PhD, J.G.M. Hendriksen MD PhD
Research staff:	S. Klinkenberg MD
PhD Student:	R.G.F. Hendriksen MSc (end date PhD 2017)

Learning problems, attention deficit disorders (ADHD) and autism spectrum disorders are more common among patients with dystrophinopathies (Duchenne muscular dystrophy and Becker muscular dystrophy) and myotonic dystrophy. Knowledge of this dyadic relationship between muscle and brain is important; with prolonged life expectancy these neurodevelopmental disorders may have growing impact and may be highly debilitating. The lack of dystrophin in the brain may be the explaining factor in this dyadic relationship. The possible role of dystrophin in neural excitability is the aim of the PhD study of R.G.F. Hendriksen and also focussed on the role of dystrophin deficiencies in epilepsy with both clinical and preclinical data being published. In collaboration with Leiden UMC a study on brain imaging (MRI and r-fMRI) and neurocognition was done in 30 DMD patients and 30 controls. Results have been published in Annals of Neurology and are currently under further investigation for longitudinal follow up. Furthermore, in collaboration with Leiden UMC,Radboud UMC, Kempenhaeghe centre of Neurological Learning and Developmental Disorders (CNL) and Maastricht UMC (department of child neurology) acquired a grant of 250.000 Euro for a longitudinal follow up and intervention study of neurodevelopmental disorders in Duchenne and Becker dystrophy and a grant of 100.000 Euro for a study of medical outcome measures and relationship between dystrophin and somatic functioning. Finally, MHeNS contributed a grant of 50.590 to the Neuromuscular research line
In patients with myotonic dystrophy a prospective follow up study on neurocognitive and neurobehavioral functioning in collaboration with prof. Dr. K. Faber is under progress.
Another focus of interest within the department of child neurology MUMC and Kempenhaeghe Centre of Neurological

Learning and developmental disabilities is Neurofibromatosis type 1 and cognition, (a NF1 neurocognition registry) this is in line with the national recognition by NFU as a centre of expertise. (Co-investigator: dr. C. Catsman, Erasmus MC)

8. Research line: The sense of hearing and balance: advanced diagnosis and substitution	
PI:	Prof. R.J. Stokroos, MD, PhD
Research Staff:	L. J. C Anteunis, AUD, PhD, J. Brokx, AUD, PhD, E. George, MSc, PhD, Prof. H. Kingma, MSc, PhD
PhD-students:	D. Smit, MD, G. Dees, MD, MSc, D. Henatsch, MD. MSc, J. Debruyne, AUD, R. Arts, MSc, J. Smit, MD, MSc, M. van Hoof, MD, S. Wagemakers, MD, J. Hof, MD, E. Devocht, AUD, S. Schaefer, MD, T. Calon, MD, R. v.d. Berg, MD, N. Guinand, MD, R. Jansen, MSc, L. Felipe, MSc, L. van Nierop, MSc, M. van Tilburg, MD
Co-investigators extern:	E. Formisano, PhD, Prof. Y. Temel, MD, PhD, K. Meijer, MSc, PhD, R. Peeters, MSc, PhD D. Jiang, PhD (UK), Prof. B. Kramer, MD, PhD (MUMC), D. Kunst, MD (KU Nijmegen), K. van Overbeeke, MD, PhD (MUMC), V. Demkin, MSc, PhD (Russia), J-P. Guyot, MD, PhD (Switzerland), D. Zee, MSc, PhD, (US, Johns Hopkins), S. Rauch, MSc, PhD (US, MIT)
Focus of research:	Translational research into the etiology of disorders of the senses of hearing and balance and the effect of neuromodulation with neuroprosthetic devices.

Hearing and balance problems are among the most prevalent health problems in our population.
Our research efforts are divided in three subcategories:

Tinnitus

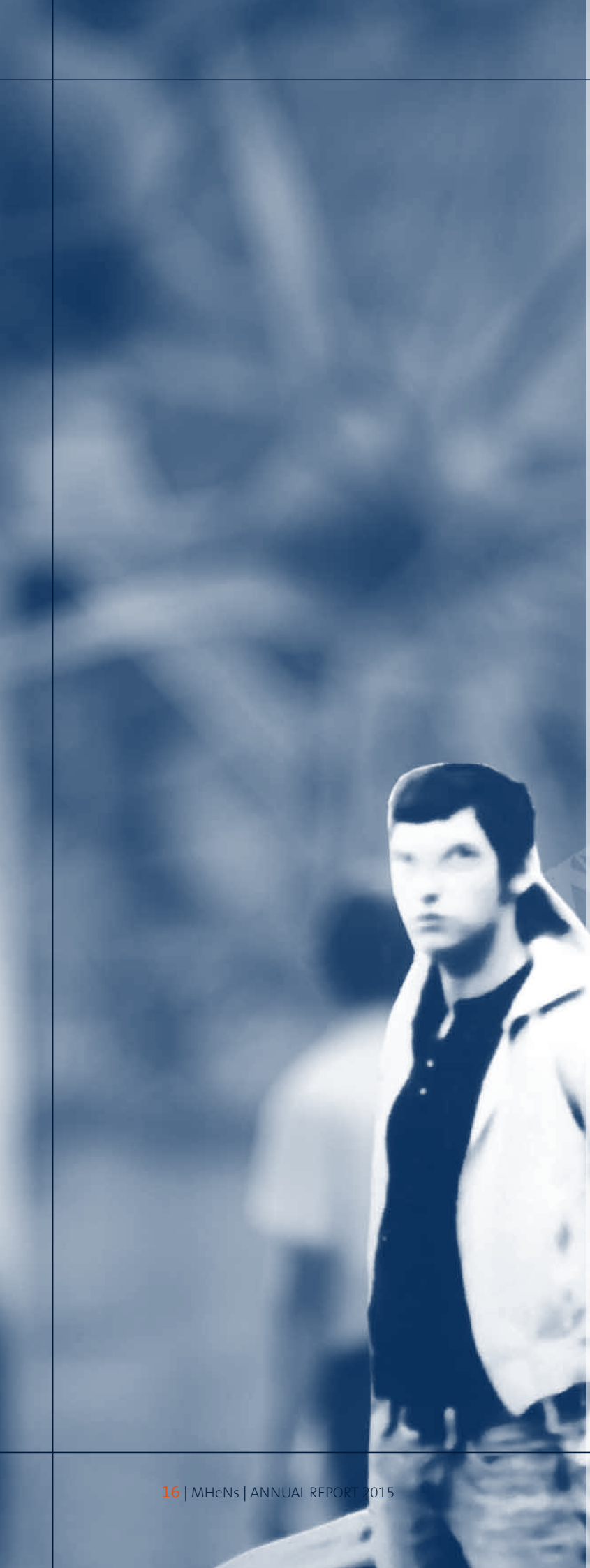
Basic research aims to unravel central nervous mechanisms causing tinnitus by using FMRI and animal models and the potential of neuromodulation using deep brain stimulation. This translates into clinical application wherein a specific neuromodulatory device, a tinnitus suppression implant has been applied. This has attracted a great number of patients for whom a care system was put in place which is systematically evaluated and improved further. Valorisation of this tinnitus care system is important since the new Dutch care standards are currently based on it. In the near future, the tinnitus implant will be furtjer refined.

Hearing

Optimizing the diagnostics of hearing loss at a very young age has been systematically studied, aimed at improving both measuring instruments and at early detection and intervention. Special attention has been addressed to basic mechanisms causing hearing damage in premature infants. Bilateral deafness treatment by cochlear implantation has been institutionalized at MUMC+. Research efforts are focused on optimizing coding strategies, on improving electrode placement using advanced fusion imaging, and on optimizing electrical and acoustic (bimodal) hearing. Single sided deafness is treated using bone conductive hearing. Research efforts are focused on optimizing abutment-skin interaction for bone anchored systems and at bimodal hearing, finding optimized strategies to combine hearing with cochlear implant and hearing aid. Hearing aid provision has been studied from a cost effectiveness point of view.

Balance

Advanced diagnosis and treatment possibilities of vestibular disorders have attracted many patients to our MUMC+. New medical and surgical treatment strategies became available for balance disorders, for example using the round window membrane as a pathway to the inner ear. However, for an important proportion of these patients, neuromodulatory devices remain the sole treatment option. A special balance belt has been developed with IDEE, supported by the Dutch Health Insurance Companies that increase the proprioceptive substitution for patients with severe balance disorders. In collaboration with Geneva and industrial partners a vestibular implant has been developed which substitutes a defect vestibular system and is currently evaluated and developed further.



2.2 Division II: Mental Health

Division Leader:
Prof. J. Van Os MD PhD MRCPsych

Deputies:
Prof. Th. van Amelsfoort MD MSc PhD
K. Schuers MD PhD

Staff:
M. Bak MD PhD
Prof. Ph. Delespaul SC PhD
R. van Diest PhD
P. Domen MD
M. Drukker PhD
L. Goossens PhD
E. Gronenschild PhD
P. Groot PhD
Prof. P. van Harten MD PhD
G. Kenis MSc PhD
G. Konings PhD
T. Lataster PhD
Ch. van der Leeuw MD PhD
C. Leue MD PhD
R. Lieverse MD PhD
R. Lousberg PhD
M. Marcelis MD PhD
Prof. I. Myin-Germeys, Msc, PhD
N. Nicolson PhD
Prof. F. Peeters MD PhD
U.Reininghaus PhD
B. Rutten (cross-divisional) MD PhD
J. Schieveld MD PhD
Prof J.-P. Selten MD PhD
R. Severijns PhD
C. Simons PhD
J. Strik MD PhD
M. Tijssen MD PhD
W. Viechtbauer PhD
M. Wichers PhD
R. van Winkel MD MSc PhD
C. van Zelst PhD

Description of the Division's organisation, composition and financing

Organisation and embedding of the Division

Embedding at the mental health services level

Division 2 basically comprises the Department of Psychiatry and Neuropsychology of Maastricht UMC, chaired by Prof. J. van Os, minus the neuroscience lab (part of Division 3) and the neurodegenerative disorders clinic (Division 1). Most of the staff in Division 2 has clinical attachments to our international mental health care services network of (figure2): (i) Maastricht UMC (Prof. van Os)1, (ii) Mondriaan (Prof. Delespaul, Dr. Schruers. Dr Rutten)2, (iii) Virenze-Riagg (Prof. Peeters)3, (iv) GGZE4 (Dr Marcelis and Dr Simons), (v) GGz Centraal (Prof. van Harten)5, (vi) Rivierduinen (Prof. Selten)6 and (vii) Louvain University Hospital (Prof. Myin-Germeys and Dr. van winkel)7. At each of these locations, Division 2 occupies strategic joint positions at the level of (Associate) Professor. In addition to the institutions named above, Division 2 is in the process of expanding/consolidating this network in dialogues with the Vincent van Gogh institute8. With the inclusion of Vincent van Gogh, the scope of Division 2 would be the entire province of Limburg in addition to Louvain, Belgium, which would further facilitate the clinical research component in terms of patient access, financial support and specialty areas.

Embedding within the MUMC Neurointervention Centre

The Neurointervention Centre (NIC) at MUMC, directed by Prof. J van Os, is the novel clinical facility that bundles the clinical and research capacities of a range of clinical departments that are associated with MHeNs. Within the matrix of disorders and associated interventions, an integrated approach is created that facilitates translational work linking clinical neuroscience and the neuroscience labs in MHeNs.

Internal organisation

Division 2 is organized in a network structure of methodological specialty areas, called 'expert groups', supervised by the Division 2 board (postdoc and higher) that meets on a monthly basis. Most members of staff are member of multiple expert groups (figure 2.1).
The methodological expert groups within the division focus on (1) Translational gene-environment interplay, (2) Momentary Assessment Technology, (3) Neuroimaging, (4) Clinical Epidemiology and Services Research, (5) Lived experience. Expert groups function as flexible fora for methodological expertise to guide research development, supervise methodological

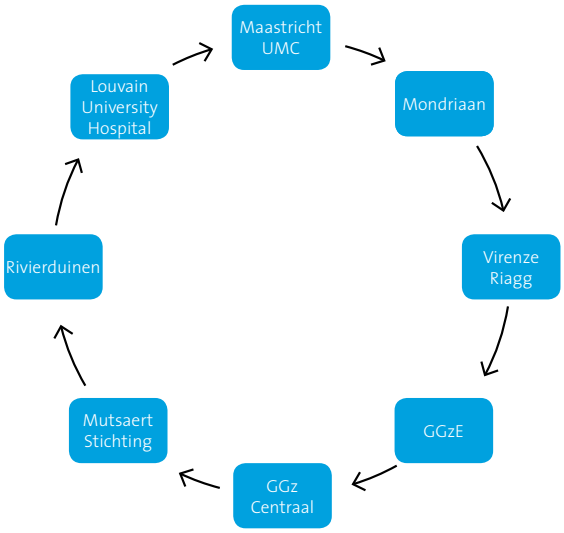


Figure 2: Division 2 Mental Health Institutions Circle

1 *Maastricht UMC: http://www.mumc.nl/*
2 *Mondriaan: http://www.mondriaan.eu/*
3 *Virenze-Riagg: https://www.virenze.nl/*
4 *GGZE: http://www.ggze.nl/*
5 *GGZ Centraal: http://www.ggzcentraal.nl/*
6 *Rivierduinen: http://www.rivierduinen.nl/*
7 *Louvain University Hospital: https://www.uzleuven.be/*
8 *Vincent van Gogh institute: http://www.vvgi.nl/*

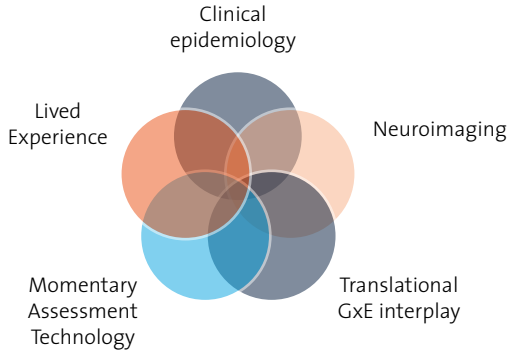


Figure 2.1: Division 2 Expert Groups

quality issues across projects and generally to act as institutional 'memory' of important issues that may occur in any phase of research. They are described in brief below.

(1) Translational Gene-environment Interplay
This group has its focus on the design of translational gene-environment interplay studies in the field of mental health disorder etiology, severity and course. The genetics expert group coordinates the design of gene-environment interplay studies as well as the choice of various genetic and exposure-related experimental methodologies, choice of polygenic scores, pathway scores, epigenetic scores and, sometimes, genes of interest for the different research lines. It offers a platform for bringing together several disciplines in order to conduct adequately designed, multi-disciplinary and translational human and animal research.

(2) Momentary Assessment Technology
This group directs our technological platform to innovate and implement novel ways to phenotype mental states on the basis of intensive time series collected digitally in daily life. It supervises and increases the quality of momentary assessment technology data collections and analyses, and develops statistical expertise and analytic possibilities.

(3) Neuroimaging
To combine expertise on various neuroimaging modalities and analytical techniques so that gene-environment interplay research can use phenotypes of brain structure and function as outcome, in collaboration with the Scannexus brain imaging facility.

(4) Clinical Epidemiology and Services Research
This groups ensures the correct use of research methods (epidemiology and health services research), meta-analytical and meta-epidemiological approaches and statistical techniques in Division 2.

(5) Lived Experience
Division 2 has initiated the first User Research Centre in the Netherlands, with a focus on lived experience of mental illness as a starting point for formulating research questions and PhD trajectories. The lived experience expert group in Division 2 formulates grant applications and develops novel academic strategies to make research more relevant for those with lived experience and create awareness of the rapid transitions taking place in mental health services and framing of mental illness.

Composition
Division 2 comprises the larger part of the Department of Psychiatry and Neuropsychology of Maastricht UMC+. The two main disciplines are psychiatry and psychology. However, Division 2 also has staff at the level of epidemiology, neurobiology, statistics, molecular genetics and informatics.

Financing
Division 2 was supported by VENI (Reininghaus, Veling), VIDI (Myin-Germeys, van Amelsvoort), Zon-Mw (multiples), NWO Graduate School (Van Os) FP7 large scale grants (Van Os, van Amelsvoort) and other sources (Dutch Brain Foundation, fonds Nuts-Ohra, NARSAD, NIMH, National programmes, Rubicon, Marie-Curie, ERC).

Objectives and Research Area

Vision, mission and objectives:
To improve the lot of the mentally ill by conducting impactful and replicable research from the perspective of person-environment interactions

Strategy and Research Area
The work in Division 2 over the past 6 years fits the paradigm of experimental medicine. Experimental medicine describes investigations in humans that seek to characterise the aetiological and therapeutic mechanisms of mental disorder (treatment) as relevant for novel approaches to diagnosis and treatment. Experimental medicine is tri-directional, in that (i) effective translation of results from preclinical experimental medicine studies into later-phase clinical research is an important outcome, as is (ii) the generation of new hypotheses to be explored using the latest research technologies and (iii) the implications of the findings for public health and health services research.

Division 2 has focused on the broad theme of person-environment and person-treatment interactions, in particular research on gene-environment and gene-therapy interplay in mental health and illness, within a translational and public health context, bringing together human and animal components of gene-environment/gene-therapy interaction research as well as translating these findings to the clinic, not only in the sense of individual patient care, but also including a public health and health services organisation component.

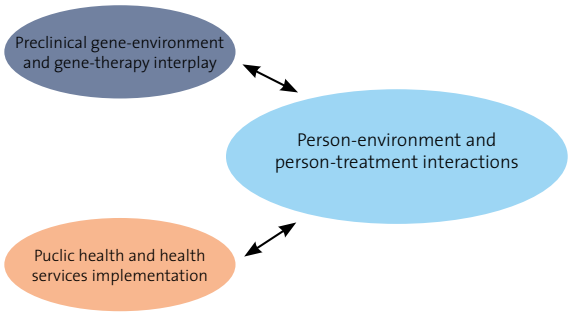


Figure 2.2: Strategy Division 2

Specific targets of the past six years

Specific targets to help meet the mission and objectives are:

- Increased focus on transdiagnostic aspects of psychopathology
- Development of collaborative trans-European data collections
- Development of a mental health research agenda for Europe (ROAMER)
- Development and implementation of momentary assessment technology in clinical practice
- Increased level of user participation
- More impactful (i.e. more relevance for clinical practice and public health) trans-expert group experimental medicine research
- Creating novel funding opportunities through Health Foundation Limburg

Research Quality

Division two has developed its own strategy to ensure quality. This strategy was driven by the following initiatives:

A. Data collection standard operating procedures

Division 2 has taken measures to improve data collection procedures and create a sustainable high-quality research environment. To this end, Division 2 has appointed 3 study coordinators who are responsible for all the quality assurance aspects of research projects including:

- Developing, updating and seeing to the full implementation of standard operating procedures (SOP's) for all aspects of research including capacity for research ('wilsbekwaamheid'), informed consent, setting up a new study, adequate training of research assistants, venepuncture, data entry, data analysis, interviewing patients, version management of documents, etc.
- Maintaining and controlling an updated Masterfile for each study in Division 2

B. Expert statistical input in research projects

Division 2 has been able to appoint Dr. Wolfgang Viechtbauer, a world-class statistician and expert, amongst others, in meta-analysis, multi-level approaches, R-based analysis of twin data, polygenic score approaches and network analysis. Dr Viechtbauer pursues his own lines of research, but also co-supervises all complex statistics. He also provides regular in-house courses on the most frequently used complex statistical procedures in Division 2. Plans are underway to establish a departmental wiki as a platform to collect and disseminate information about ongoing projects/studies, standard operating procedures, and to provide a central repository describing various research methods and statistical analysis techniques commonly used within the department. This will facilitate orientation for new department members and enhance the preservation of expertise and knowledge over time.

Statistical analysis in Division 2 is always reproducible and syntax is always shared between PhD student and supervisor (or statistician in case of complex procedures).

C. Expert epidemiological input in research projects

Dr. Marjan Drukker, an expert epidemiologist and statistician, provides input in methodological issues in epidemiological, experimental and genetically sensitive research and co-supervises statistics in the department.

D. Creating awareness of meta-epidemiological issues

Meta-epidemiology is a relatively new area of meta-issues in research, focussing on factors that can impact on the quality, validity, relevance and credibility of research. Division 2 has critically followed issues brought forward by various influential writers relating to the various forces undermining mental health research including non-replicability, non-replication, information-gain bias, publication bias, excess significance, approximate replication, undisclosed multiple testing, selective testing, selective reporting and selective study design factors (Button et al., 2013, David et al., 2013, Dwan et al., 2008, Evangelou et al., 2012, Haidich et al., 2013, Ioannidis, 2005, Ioannidis and Trikalinos, 2007, Ioannidis, 2011, Ioannidis, 2013, Lumbreras et al., 2009, Siontis et al., 2011, Young et al., 2008). Division 2, during it latest Research Retreat, has critically analysed the content, organisation, and achievements of its own mental health research, with a view to analyse gaps, weaknesses and opportunities in such a way that the likelihood of valid and relevant

findings is increased. This reflects a continuing effort and a continuing vigilance with regard to the forces that may undermine the nature and relevance of scientific activity.

As a result, Division 2 currently attempts to practice the following principles:

(i) Increased focus on large-scale multinational data-collections, ensuring statistical power and possibility of within-sample replication of results
(ii) Less focus on short-term information-value driven research practice
(iii) Continuous meta-epidemiological debate, creating awareness regarding the dangers ofproducing irrelevant 'false positive' and 'non-replicable' findings and questionable use of statistics.
(iv) Less focus on short-term 'information value-driven' cycles of research.
(v) Less focus on artificial scarcity occasioned by impact factor criteria and more focus on open access.
(vi) Continuing focus on high quality research into the psychological and biological mechanisms of psychopathological phenomena and their treatment

Relevance to society

Most of the research in Division 2 is of direct impact to patients and users of mental health services. Prof. van Os and Prof. Delespaul outlined these issues in their 2014 book: 'De DSM-5 voorbij: Persoonlijke diagnose in een nieuwe ggz' (Diagnosis Publishers; 2014), which is now in its fourth edition, and their 2015 book: Goede GGZ!, which have attracted widespread media attention. It has now become the driving force behind a local pilot for disruptive change in mental health care, supported by insurers and ministry of VWS.

Impact of novel mHealth PsyMate® platform on patient outcomes

The burden of mental health problems in populations in the EU is high, and well exceeds the capacity of mental health services relying on professio nals providing 1-on-1 care (Murray et al., 2012, Vos et al., 2012, Olesen et al., 2012, Wittchen et al., 2011). Mental health care costs and use of psychotropic medications in the EU have spiralled over the years (Braithwaite, 2014, Sikirica et al., 2013, Gustavsson et al., 2011, Olesen et al., 2012), and alternative approaches are urgently required, given meta-analytic evidence that passive medication monotherapy of mental health problems is not optimal (Cuijpers et al., 2014, Weich et al., 2014). Indeed, one of the major gaps in European mental health services, identified by the EU-FP7 ROAMER consortium (van der Feltz-Cornelis et al., 2014, Haro et al., 2014), is the need for novel mHealth active self-management or co-management treatment paradigms that can meet the challenge posed by the public health character of mental health problems and constraints on the supply of services in the EU.

Division 2 has developed novel mHealth Momentary Assessment Technology for use in clinical practice and as a public health self-management tool. This novel development, embedded in the PsyMate® platform, was discussed in Lancet Technology (Lancet. 2011 Aug 6;378(9790):475).

Scholars have repeatedly attempted to port the Experience Sampling Method of data collection to mobile computers (eg PSION, NEWTON or PALM PDA devices). We defined the first release of the (Psycho-Ecological Assessment Systems) PEAS® specs and implemented it for Palm devices. Alternative options came from Apple that released the first iPhone (2007) but restricted the customized use. A Software Development Kit (iOS 1.x SDK) was first released in 2008 and the functionality needed for an ESM app gradually became available over the years (http://en.wikipedia.org/wiki/IOS_SDK#SDK_release_history). Meanwhile Google had pre-commercial drafts of Android in 2007-2008 but only developed workable commercial versions with Android OS version 2.x (Gingerbread SDK release in 2010). The field had to wait, as only recently the functionality needed for ESM became available. The politics of major players in the mobile device field were unclear in 2008. Consequently we decided to develop our own hardware. In collaboration with a rapid prototyping partner (Wingz & VEDS in Eindhoven) we developed the PsyMate®. We updated the specs for the embedded PEAS software to release (3.0) and integrated this in a web-based database (the PsyRes® database). **The original PsyMate® was a smartphone-size device** that could be pre-programmed with a large set of protocols (using a custom-developed scripting). In total 1300 devices were built and used in research programmes in almost all continents worldwide (Europe, North and South America, Asia and Australia). However, the operational costs and handling remained complex. The original PsyMate device could not be implemented in regular, non-academic clinical practice. But the database integration and the study protocol definition, as well as the first generation feedback module was implemented and more than 20 research projects were successfully managed by the PsyMate® device.
By 2012, smartphones were the platform of choice to

develop **custom mobile apps**. We therefore initiated development of **Psymate as a mobile app**. Major players as Apple™ and Samsung™ have the necessary resources to fine tune the hardware and build it at reduced costs with lots of additional relevant functionality (for communication, sensors, etc). More importantly, potential users often have their own compatible device. Also, clinicians and/or research teams can buy devices for less than 100 EUR. The standards of iOS and Android guarantee that software investments are sustainable and the SDK's offer the necessary resources to develop the required functionality and develop for different platforms in parallel. We updated the PEAS specs to version 4.0 (Delespaul, 2012) and included the wireless functionality (Bluetooth, WiFi, EDGE/GPRS/G3/G4) to use cloud-based technology. We recently updated the PEAS specs (in version 4.x) to make the app completely scriptable using standard JavaScript. This dramatically improved the operational logistics allowing us to move the computerized EMA technology into the clinical field. At the time of writing this proposal, we have an app running with excellent functionality, which we refer to as: **PsyMate®**.

- We have conducted a number of randomised controlled trials using PsyMate® mHealth technology, showing direct benefit to patients with mental disorders either directly or indirectly by elucidating treatment mechanisms (Kramer et al., 2014, Geschwind et al., 2011b, Wichers et al., 2009, Wichers et al., 2010, Wichers et al., 2011a, Wichers et al., 2011b, Forkmann et al., 2014).
- We have conducted a number of self-monitoring studies using PsyMate® mHealth technology showing the value of self-monitoring in prediction of outcome, mechanisms of symptoms, mechanisms of stress, trauma and pain, dosing of medication, coping and staging of psychopathology (Geschwind et al., 2011a, Gevonden et al., 2014, Glaser et al., 2010, Henquet et al., 2010, Hohn et al., 2013, Jacobs et al., 2011, Lardinois et al., 2011, Lataster et al., 2010, Lataster et al., 2011, Lataster et al., 2013, Mujagic et al., 2014, Myin-Germeys et al., 2009, Thewissen et al., 2011, van Os et al., 2014a, van Os et al., 2014b, Wichers et al., 2010, Wigman et al., 2013b, Wigman et al., 2013a).
- We are working with insurers (80K grant by CZ) to construct a national web-based PsyMate® mHealth public health initiative for mild mental disorders to free mental health care capacity in the Netherlands. We expect this will have far-reaching consequences on mental health care in the Netherlands.

Development of novel movement disorder technology

Prof. van Harten and his team in Division 2 are developing two electronic instruments to measure respectively bradykinesia and dyskinesia and/or tremor.

- The bradykinesia is registered using five wireless inertial sensors (XSENS) that capture mean cycle duration, amplitude and velocity of four movement tasks.
- Dyskinesia (and tremor if present) is registered with a load cell in a 3D printed housing, as the degree of force instability during a steady-state tracking task and measuring the variations in the force applied over time.

Research on both electronic instruments showed them to be valid and highly reliable.

Impact of other clinical research on patient outcomes

- We have shown the cost-benefit of a regional integrated care approach for psychosomatic disorders (Leue et al., 2010).
- We have shown the value of different psychotherapies and neurofeedback in the treatment of depression and are in the process of conducting a range of experimental studies testing these (Bockting et al., 2011, Schweizer et al., 2010, Huibers et al., 2014, Peeters et al., 2013a, Lemmens et al., 2011).(Peeters et al., 2013b, Peeters et al., 2014)
- We are in the process of rigorously investigating the impact of mobile phones on human brain physiology (Roggeveen et al., 2015b, Roggeveen et al., 2015a).
- We have shown the value of carbon-dioxide inhalation for the diagnosis and treatment of anxiety disorders (De Cort et al., 2012, Leibold et al., 2013, Esquivel et al., 2012, Schutters et al., 2011, Knuts et al., 2010, Schutters et al., 2012).

Systematic review and Meta-analyses with direct impact on health care

We have conducted a range of clinically highly relevant meta-analyses summarising the diagnostic, treatment and outcome literature in mental and somatic health disorders (Ernest et al., 2012, de Bruin et al., 2010, de Bruin et al., 2009, Hursel et al., 2009, Crutzen et al., 2013, van Amelsvoort et al., 2009, Viechtbauer, 2010, Jansen et al., 2011, Tenback et al., 2009, Fett et al., 2011, Hursel et al., 2011, Bak et al., 2014, Menne-Lothmann et al., 2014, Abel zur Wiesch et al., 2014, Kaymaz et al., 2012, Linscott and van Os, 2013, van der Werf et al., 2014, Van Os et al., 2009, Viechtbauer and Cheung, 2010, Szerencsi et al., 2012, Koning et al., 2010, Varese et al., 2012, Kruidenier et al., 2012).

The first User Research Centre in the Netherlands

Division 2 is proud to host the first User Research Centre (URC) in the Netherlands. The User Research Centre is a facility where academics with lived experience in psychiatry (i.e. patients with mental illness) complete PhD projects and post-doc trajectories, investigating issues that are within the remit of Division 2 but developed entirely from the user perspective. The first PhD completion was in 2014, based on user-led interventions to reduce self-stigma (Dr. C. van Zelst). A successful postdoc in the User Research Centre is conducted by Dr. P. Groot, based developing methods for n=1 single case experiments for optimal dosing of psychotropic medication. This project has attracted funding from multiple sources. Another PhD project with external funding in the URC is on the first randomised controlled trial of peer support in the Netherlands with exciting results that have now been submitted for peer review (Drs. W. Boevink). A very successful initiative of the URC was the website www.psychosenet.nl, which now attracts around a 1000 unique visitors per day and has proven to be a good way to conduct health promotion, empowerment and self-management for patients with severe mental illness. It has also generated a long overdue debate in the Netherlands, amongst others at the Royal Netherlands Academy of Arts and Sciences on 20th May 2015, about meta-epidemiological issues in schizophrenia research and mental health practice.

Division 2 has yearly conferences with stakeholder groups and members of Division 2 furthermore participate in many patient and relative associations.

International Master in Affective Neuroscience

Division 2 is home to The International Master in Affective Neuroscience, a postgraduate research Master representing a joint degree of the universities of Maastricht and Florence. The programme is intended for graduates in medicine, psychology, neuroscience or behavioural sciences, and focuses on the latest developments in the field of anxiety, fear, compulsivity, addiction, aggression and the neuroscience of emotions in general. It offers a challenging programme allowing students to step into the frontline of scientific research. The core component of the programme is an individual research project. Under supervision of one of our experienced faculty members, students conduct their own scientific study and publish the results in a peer-reviewed journal. To help developing scientific skills, the programme includes workshops and conference-like teaching settings at the Summer Courses.

A unique feature is distanced teaching; the main part of the curriculum is an individual research project that is conducted in the participants' own working environment, in their own country. This means that the Master can easily be combined with their current job, since there is no need to move abroad for a long period of time. During the programme, participants are supported by e-workshops and keep in touch via the Internet.

The programme is an international collaboration of scientists from the universities of Maastricht, Florence, Paris Diderot, Tel Aviv, Bristol, Bonn and Imperial College London. With an international faculty of invited speakers and students from all over the world, the Master is truly an international programme. The different cultural backgrounds of the students create an interesting mix of practices and opinions. The Master's diploma is a Master of Science in Affective Neuroscience degree from the Universities of Maastricht and Florence. This Master's degree is accredited in the Netherlands by NVAO and by the European Union (EACIC).
Yearly, 40 participants take part in the summer course in Florence after a selection process, 12 take the intensive winter seminar in Maastricht. Up to now 8 participants have subsequently progressed

Media Exposure

Members of Division 2 are regularly in the Media including Nieuwsuur, Tros RADAR, Zembla and all major newspapers in the Netherlands (Volkskrant, NRC, Trouw).

Funding from societal groups and charities

Division 2 currently receives around 100k-200k euro in funding from societal groups and charities that specifically support initiatives with direct societal impact. These include Stichting Koningsheide, Stichting Kaptein, Stichting de Weijerhorst, K. fonds, Rotary, Lions, Fonds Nuts-Ohra and private donations.

Talent Policy

Senior staff at Division 2 actively participates in (i) the honour's programme at Maastricht UMC+ and (ii) the joint Research Master of Maastricht UMC and FPN. Top talent students are thus recruited in an early phase.

Scientific Integrity

Division 2 practices a specific strategy to ensure quality and scientific integrity, which is driven by four initiatives (see above):
A. Data collection standard operating procedures
B. Expert statistical input in research projects
C. Expert epidemiological input in research projects
D. Creating awareness of meta-epidemiological issues.

Trends and strategic plans

Trends

There is an urgent call for neuroscience research to become more 'impactful' and relevant for society (Paulus, 2015). Division 2 was strongly involved in the FP7 ROAMER project, setting the agenda for societally relevant mental health research over the next decade, outlined below.

ROAMER six research priorities for policy action in mental health and well-being research

	Research Priority	Illustrative Actions/Research Questions
1.	Research into mental disorder prevention, mental health promotion and interventions in children, adolescents and young adults	• To perform and sustain long-term prospective cohort studies on the determinants of mental health and well-being to study risk and protective factors for mental disorders • Developing pharmacological and psychological treatments for children and adolescents • How can mental health promotion and social exclusion prevention in schools be improved? • Does prevention of depression among pregnant women protect against later mental disorder or dysfunction (e.g. depression) among children? What are the cost-benefits? • Longitudinal observational studies to analyse the effects of intense use of new media in early age and adolescence on later emotional and cognitive competence
2.	Focus on the development and causal mechanisms of mental health symptoms, syndromes and well-being across the lifespan (including older populations)	• What are the functional characteristics of neurobehavioural mechanisms across the lifespan? • To determine what social and biological factors underlie risk or resilience factors for mental disorders across the life span • To study the effects of financial crises on mental health • How do vulnerabilities and stress influence critical developmental trajectories for poor health and specific mental disorders across the lifespan (but particularly in childhood and adolescence)? • To study what brain abnormalities predict future mental disorder using longitudinal structural and functional neuroimaging
3.	Developing and maintaining international and interdisciplinary research networks and shared databases	• Increase the number, quality and efficiency of international and interdisciplinary networks • Multidisciplinary training programmes for mental health research across different countries • Implementation of standardised European research outcomes, databases and terminology for mental health and well-being research • Establish access to European mental health databases across different studies with standardised mental health outcomes

4.	Developing and implementing better interventions using new scientific and technological advances	• Strengthening research on new approaches and technology for mental health promotion, disorder prevention, mental healthcare and social service delivery - Testing the value of internet-based treatments as automated versions of standard psychological treatments in specialised mental health care, in "indicated" prevention and for use in primary care settings in particular - Testing 'real time' psychometric feedback over the course of treatment (supported by modern software) to adapt dosage and intensity of treatment to service users' complexity and problem profile in order to promote better outcomes - To examine acceptability and adherence of eHealth treatments (e.g. for depression), the clinical improvement at one-year follow-up, and the cost-effectiveness of the intervention in comparison with conventional psychological therapies • Understanding why some individuals do not respond to treatment by identifying relevant, and potentially developmentally specific, mediating and moderating variables of evidence-based
5.	Reducing stigma, empowering service users and carers in decisions about mental health research	• How might carers and family members of people with mental health problems perceive and experience stigma by association? • What are the best methods for measuring and valuing unpaid care? • What are the most cost-effective elements of anti-stigma interventions? • Studying the role of stigma in the wider context of inequalities (health inequalities, etc.) and implement interventions to assess the place of stigma in public services • Establish better national or local interventions to address stigma, social exclusion and discrimination by carefully defining the essential questions (i.e. who should be targeted? how?, by whom?, when?) and to determine how they can be evaluated and by whom, along with their cost-effectiveness
6.	Health and social systems research that addresses quality of care and takes account of socio-cultural and socio-economic contexts and approaches	• Investigating the impact of differences in the organisation and delivery of national healthcare systems on well-being of individuals with mental disorders and carers • Health-systems-level research on the cost-effectiveness of different ways of financing, regulating, organising and providing services to promote and protect mental health • Designing and evaluating methods to assess outcomes from mental health services that can be easily and reliably implemented

It is our strategy to align ourselves with the ROAMER agenda, particularly as regards points 2-6 (see Table above). We believe Division 2 is already strongly present in these areas and has good opportunities to expand - within the realm of the expertise of Division 2.

Strategic plans

Moving towards 'impactful biological psychiatry'

There has been an urgent call to move away from the "case-control" paradigm in biological psychiatry towards more 'impactful', i.e. relevant, biological psychiatry (Paulus, 2015). The classical case-control paradigm in biological psychiatry, in combination with non-replication, methodological weaknesses and poor internal validity of designs has resulted in a host of ambiguous findings but little in terms of novel clinical applications. In line with the call for 'impactful' research, Division 2 is embracing clinical pragmatism above case-control paradigms directed at elucidating mechanisms.

Bridging the social-biological gap

A student wanting to find out about psychiatry may get the impression that two languages are spoken in mental health: one public health, taking into account the natural perspectives of high prevalence, graded trajectories from health to illness, social determinants, empowerment and self-determination, resilience, positive mental health and prevention; and one biomedical, focusing on illness and diagnostic labels, brain disease, animal research, genetic liability, biological determinants and pharmacological interventions.

The existence of two languages in mental health research is one of the explanations of the limited crosstalk between areas distributed over the public health and natural sciences, even though the application of scientific paradigms to mental health research, including those derived from neuroscience, psychiatry, public health, epidemiology, social science, sociology, psychology and philosophy have expanded exponentially. In other words, research in mental health has expanded exponentially, however in widely different directions, showing signs of increasing fragmentation rather than integration. If natural science and public health are to join forces, this will have to be at the level of research endeavours in which the results are interpreted on the basis of a common language.

There are some pointers as to which elements may be used to construct a common language. First, research in public health highlights powerful effects of the social environment on onset and persistence of syndromes of mental ill-health, the existence of vulnerable and resilient subgroups, and possible cognitive, neural and behavioural mediation of environmental effects. Second, research in psychology and psychiatry indicates that most mental disorders as defined in DSM and ICD represent quantitative deviation from health. Third, research in basic population genetics highlights the importance of (epi)genetic variation in terms of short-term and long-term adaptation to the social environment. Fourth, research in social neuroscience highlights the role of the brain in enabling man to navigate the social world and to build models of the way in which one's current context – which includes both the social environment and one's internal states and traits – impacts on how we attach meaning to social cues. There is increasing interest in the role of culture in these processes, for example how cultural variation may impact on social cognition and the process of empowerment in relation to one's circumstances.

The above four elements indicate that genetic variation and neural processes form the biological roots of human sociality, resulting in the mutual constitution of cultures and selves; they also suggest that health and illness result from complex interactions between the physical, cultural, and social environments. Thus, a common theme emerges linking deviation from mental health, genetic variation and neural function, which can be formulated as dynamic adaptation to the individual-level and wider social environment. Dynamic adaptation to the environment may constitute a point of entry towards a common language in mental health research, linking social and natural sciences. This will continue to be a major goal of Division 2.

A cross-disciplinary perspective

Research in the last decades has been carried out at many levels and across many disciplines. Although of late there has been a move towards more cross-discipline and cross-technology approaches, research in the different areas (psychopathology, psychopharmacology, non-pharmacological treatments, health technology assessment, services research, epidemiology, public health, early intervention, genetics, imaging, animal research, post-mortem research, cognitive mechanisms) continues to be conducted mostly from a within-area rather than a cross-area perspective. More cross-disciplinary research is required, also in Division 2.

User involvement, mHealth and disruptive innovation in mental health carte

Three main recommendations in Roamer was for (i) user involvement in research, in particular for the purpose of giving service users a voice in the research process, using "lived experience" to inform the research process, moving users from being objects of research to active participants in it and introducing an emancipatory approach of people with lived experience; (ii) introduction of new mHealth technologies in research, with a particular focus on introducing phenotypes of intensive time series of mental states and context for the purpose of experimental medicine research, and testing 'real time' psychometric feedback over the course of treatment (supported by modern software) to adapt dosage and intensity of treatment to service users' complexity and problem profile in order to promote better outcomes; and (iii) disruptive innovation in mental health care with a particular focus on investigating the impact of differences in the organisation and delivery of healthcare systems on well-being of individuals with mental disorders and carers; health-systems-level research on the cost-effectiveness of different ways of financing, regulating, organising and providing services

to promote and protect mental health; designing and evaluating methods to assess outcomes from mental health services (ROM) that can be easily and reliably implemented. Division 2 over the years has increasingly been developing activities in these three areas and has decided to continue to align itself with these.

Viability

We believe that the main factor driving viability of the work in Division 2 is (i) coherence and focus, (ii) a strategy to produce research that is impactful and relevant to patients and (iii) a successful strategy to engage patients in research beyond the level of superficial consulting. We thus believe that the viability of Division 2 is directly linked to its capacity to produce research that resonates with the mental health partners and the patients who use these services aligned in the network. There is certainly no shortage of research questions in clinical practice and we believe that funding bodies will increasingly take up these pragmatic research questions. As Division is well placed to benefit from these new opportunities and meet the new directions of mental health research as laid down in the ROAMER initiative, viability is excellent.

Novel developments 2015

Important developments in 2015 were:

a. Completion of data collection of the FP7 EUGEI project, yielding a very rich dataset on gene-environment interaction in psychosis at all levels of enquiry.
b. Development of new mHealth tools together with CZ, a large insurer.
c. First analyses and publication in the area of clinical network analysis using PsyMate intensive time series.
d. Excellent progress of the SmartScan project, investigating the impact of selfmanagement on brain plasticity.
e. Several strategic novel appointments at the level of lecturer and senior lecturer.
f. Completion and publication of the ROAMER roadmap for Mental Health.
g. Dr. Peter Groot appointed at User Research Centre.
h. Initiation proceedings for novel chair in Anxiety Disorders at Division II.

2.3 Division III: Neuroscience

Division Leader:
Bart Rutten, MD, PhD

Deputies:
Prof. Y. Temel, MD, PhD
J. Prickaerts, PhD

Staff:
Prof. M.de Baets, MD, PhD
T. Berendschot, PhD
Prof. W. Buhre, MD, PhD
M. van Duinen, PhD
L. Eijssen, MSc, PhD
D. Gavilanes, MD, PhD
Th. Gorgels, PhD
G. Hoogland, PhD
D. van den Hove, PhD
A. Jahanshahianvar, PhD
Prof. Bert Joosten, PhD
Prof. A. Kijlstra, PhD
Prof. M. van Kleef, MD, PhD
G. van Koeveringe, MD, PhD
I. Koneczny, MSc, PhD
Prof. B. Kramer, MD, PhD
M. Lagiere, MSc, PhD
F. van Leeuwen, PhD
Prof. K.-P. Lesch, MD, PhD
M. Losen, PhD
Prof. M. Marcus, MD, PhD
P. Martinez, PhD
C. Meriaux, MSc, PhD until July 2015
J. Mey, PhD
L. Nijs, MSc, PhD
Prof. K. van Overbeeke, MD, PhD
J. Prickaerts, PhD
A. Saxena, PhD until November 2015
Prof. H. Steinbusch, PhD
Prof. R. Stokroos, MD, PhD
T. Strekalova, PhD
J. Vangeneugden, MSc, PhD
Prof. H. Vles, MD, PhD
J. de Vry, PhD
Prof. C. Webers, MD, PhD
Prof. L. Zimmermann, MD, PhD

Goals & Results

The Division Neuroscience performs fundamental and translational neuroscience research on the biological mechanisms involved in experience-dependent neuroplasticity, neurodegeneration and regeneration across the life span. It should be noted that the division is currently developing and converging the activities of the different research lines as described below into the thematic research lines:

1 Neurobiology and Neuropsychopathology
2 Neuropsychopharmacology
3 Neuroinflammation
4 Neuromodulation

Thus, we aim to gain knowledge of physiological and pathophysiological mechanisms underlying affective, cognitive and motor functions and disorders thereof and to develop strategies for improving healthy living, as well as preventing and treating neurological and psychiatric disorders.

Our main research lines converge on cell signalling, regulation of neurotransmitter functioning, brain plasticity and biological mechanisms mediating gene-environment interactions (such as epigenetic control of gene expression and neuroinflammation) in a lifetime perspective. Thus, our neuroscience studies combine fundamental and clinical expertise and interests on developmental programming (including prenatal and perinatal life), experience-dependent plasticity during sensitive time-windows and age-related changes of the nervous system. Technological expertise in our division is centralised in our expertise groups that are coordinated by senior staff members and supported by experienced technicians.

In addition to investigations on overt dysfunctions involving mainly the central nervous system such as in depression, dementia and psychosis, we also investigate mechanisms mediating central control of peripheral bodily function such as pain, vision and neuro-urogenital functioning.

Our researchers conduct several study paradigms to answer clinically relevant research questions, typically by combining a range of techniques and approaches such as detailed cellular work, experimental animal studies as well as observational human studies and preclinical trials.
The multidisciplinary staff consists of professionals from relevant disciplines within research and clinic. There are collaborations within world-wide international networks of research offering a strong academic environment.
By doing so, we attempt to improve scientific knowledge on healthy functioning of the brain, on the aetiology of disorders while translating relevant scientific findings swiftly into new neurotherapies including life-style interventional, pharmacotherapeutical, antibody-based or deep brain stimulation based strategies.

The results of the research efforts in division 3 are described by the different Principal investigators and expertise groups.

2.3.1 Research lines

1	Neurobiology and Neuropsychopathology
	1.1 Alzheimer disease; neurodegeneration and posttranslational modifications of proteins
	1.2 Neuroepigenetics
2	Neuropsychopharmacology; Signal Transduction
3	Neuroinflammation; Nervous system neuroinflammtion: immunotherapy and autoimmunity.
4	Neuromodulation
	4.1 Experimental Neurosurgery
	4.2 Modulation of chronic pain
	4.3 Functional Neuro-Urology
	4.4 Ophthalmology
	4.5 Neonatology, Developmental Neuroscience

1. Neurobiology and Neuropsychopathology	
1.1 Alzheimer disease; neurodegeneration and posttranslational modifications of proteins	
PI:	F.W. van Leeuwen, PhD
Staff:	Prof. H. W.M.Steinbusch, PhD
PhD-students:	R.J.G. Gentier, PhD
Associated researchers:	Prof. D. A. Hopkins, PhD
Focus of research:	Protein quality control in Alzheimer's disease

Efficient neuronal function depends on cellular homeostasis. In view of the modest number of human genes, other mechanisms such as posttranslational modifications (e.g., ubiquitination and phosphorylation) contribute too many functions such as control of short-lived proteins, transcription factors and degradation of aberrant proteins. These homeostatic control mechanisms are often flawed during aging and disease. Our research focuses on quality control mechanisms such as exerted by the ubiquitin-proteasome system (UPS). We have discovered that mutant ubiquitin (UBB^{+1}) accumulates in the hallmarks of Alzheimer's disease (AD), suggesting that it has a function in this multifactorial disease. Indeed, UBB^{+1} inhibits the UPS dose dependently and results in neuronal dysfunction. We developed tools (e.g., transgenic animals) to study the effects of UBB^{+1} in vivo. We have addressed anatomical, neurochemical and behavioural aspects (e.g., nest building, Morris water maze and fear conditioning) in these UBB+1mice (line#3413) as well as genetic crossbreeds with the AD mouse model line (APP-Swe/PSEN1, Δ exon9). Significantly, interactions between UBB^{+1} and Aβplaque formation have already been shown, e.g., plaque load changes. Aβ plaque formation is a prominent cellular hallmark of AD. To date, immunization trials in AD patients turned out not to be effective in terms of curing or ameliorating dementia. However, in studies on transgenic animals (line 85; APP Swe PSEN1Δexon 9) it was shown that there is limited clearance of pre-existing amyloid plaques. Most likely, immunization trials in humans were initiated too late, suggesting treatment of AD needs to start earlier which is not yet a realistic option. Therefore, more knowledge on the mechanism of Aβ plaque formation is required before reconsidering trials. Our new data implicate that there is strong cross talk between a failing protein quality control by the UPS and Aβ plaque formation mediated via specifically by γ-secretase.
For more than a decade a relation between a dysfunctional UPS and Aβ plaque formation has been surmised. Recently, it was shown that pooled GWAS studies, pathway analysis and proteomics also identified protein ubiquitination as one of the key modulators of AD and pointed to a dysfunctional UPS as a causative factor of AD. It is now possible to address this issue by using our transgenic lines (e.g., lines #3413 with postnatal UBB+1 overexpression and proteasomal inhibition, line#85 with Aβ plaque formation starting at 4 months of age and their crossbreed (i.e., lines #3413 x #85. What we know: In the crossbreed Aβ plaque generation is attenuated during the critical period by a dysfunctional UPS while γ secretase activity (not those of α and β) is enhanced resulting in impaired contextual memory. Apparently

there is strong interaction between a failing protein quality control and Aβ plaque formation. What is not known: The mechanism of the link between the UPS and Aβ plaque formation is unknown. We surmise that the expression of E3 ligase synoviolin is upregulated and RER1 (retention in endoplasmic reticulum) is down regulated in the crossbreed. These results show a striking inverse correlation between γ secretase activities and Aβ plaque load and will contribute to a better understanding of strategies to ameliorate or cure AD, via γ secretase modulation.
Remarkably, via stimulation of γ secretase. This idea is currently worked out via collaborations with groups abroad. Furthermore it was shown that accumulation of basic amino acids at mitochondria dictates the cytotoxicity of UBB^{+1}. This work was done using yeast models as a read out and validated in post-mortem AD tissue (collaboration with Dr. R. Braun, Bayreuth, Germany).

1. Neurobiology and Neuropsychopathology	
1.2 Neuroepigenetics	
PI's:	B. Rutten, MD, PhD, D. van den Hove, PhD, G. Kenis, PhD, Raul Delgado, PhD
Research Staff:	Prof. K.P. Lesch, MD, Prof. H. Steinbusch, PhD, A. Ramirez, MD, I. Ramaekers, PhD
Postdocs:	L. Eijssen, PhD, L. de Nijs, PhD, D. Mastroeni, PhD, J. Vangeneugden, PhD, N. Leibold, PhD, E. Pishva, PhD
PhD students:	C. Hammels, MSc., M. van den Hurk, MSc., A. Iatrou, MSc., R. Lardenoije, MSc., M. Levy, MSc., M. Weidner, MSc, M. Ali, MSc, R. Riemens, MSc.
Associated Researchers:	Prof. T. Van Amelsvoort, MD, PhD, G. Hoogland, PhD, Prof. B. Leonard, PhD, Prof. J. van Os, MD, PhD, Rainald-Schmidt-Kastner, MSc, Prof. K. Schruers, MD, PhD, T. Strekalova, PhD, Prof. F. Verhey, MD, PhD, P-J. Visser, PhD, P. Aalten, PhD
Focus of research:	Understanding the role of gene-environment (GxE) interactions and associated epigenetic mechanisms in the pathophysiology of psychiatric and neurodegenerative disorders

The organization of DNA into chromatin enables the cell to use powerful regulatory mechanisms broadly defined as epigenetics. Epigenetic changes are reversible and responsive to environmental influences, unlike genetic mutations, which represent rare events with permanent consequences on genes. Research on Neuroepigenetics aims to characterize the molecular basis that underlies sensitivity to environmental exposures and associated gene-environment (GxE) interactions in (neuro) psychiatric and neurodegenerative phenotypes and disorders, with a particular interest in epigenetics.

This programme examines several aspects of epigenetic regulation, such as DNA methylation at promoter sites, chromatin modifications, gene silencing induced by miRNAs, and other novel epigenetic mechanisms, for their roles in disease and dysfunction consequent to environmental conditions. The ultimate goal of this programme is to identify molecular and cellular pathways that are causally involved in the etiologies of psychiatric disorders, to identify biologic markers that predict disease onset and course, to determine the reversibility of neurobiological changes, and to find novel preventive and therapeutic strategies.

Neuroepigenetics focuses on two main research themes/questions. First, what are the neurobiological underpinnings of neuropsychiatric and neurodegenerative phenotypes, with a particular focus on mechanisms involving gene-environment interactions? Second, what is the role of epigenetic mechanisms in mediating gene-environment interactions in and long-term consequences of (developmental) environmental perturbations?

These research themes/questions are applied to Alzheimer's disease, depression and anxiety disorders, schizophrenia and epilepsy. State-of-the-art technologies are being employed to analyze the epigenetic changes in single genes, signaling pathways or the entire genome in response to variations in environmental exposure. Research involves various innovative, translational projects using in vitro cell cultures, in vivo animal models, and human tissues and/or biologic samples to examine (epi)genetic modifications and to determine the precise mechanism responsible for these changes.

2. Neuropsychopharmacology; Signal Transduction	
PI:	J. Prickaerts, PhD
Research Staff:	Prof. Y. Temel, MD, PhD, Prof. F. Verhey, MD, PhD, Prof. M. De Baets, MD, PhD, Prof. H.W.M. Steinbusch, PhD, P. Aalten, PhD, D. van den Hove, PhD, B. Rutten, MD, PhD
Postdocs:	N. van Goethem, PhD, M. van Duinen, PhD, J. De Vry, Ir. PhD
PhD-students:	S. Akkerman Msc., P. Heckman Msc., B. van Hagen Msc., E. Argirousi Msc.
Co-investigators extern:	A. Blokland, PhD, A. Sambeth, PhD, Prof. J. Ramaekers, PhD (FPN), Prof. H. Schmidt, MD, PhD (CARIM), Prof. O. Bruno, PhD, E. Fedele, PhD (University of Genoa, Italy), D. Puzzo, PhD (Città, Universitaria, Catania, Italy), Prof. R. D'Hooge, PhD (Katholieke Universiteit van Leuven, België), L. Wennogle, PhD (Intra-Cellular Therapies, New York, USA)
Focus of research:	Cellular signal transduction in affective and cognitive processes in health and disease

The major aim is to unravel the mechanism of action of signaling pathways both in health and disease (Alzheimer's disease and depression), while at the same time exploring the therapeutic potential of key factors in the affected signaling pathway. The focus in this respect is on the growth factor Brain Derived Neurotropic Factor (BDNF) and the second messengers cAMP and cGMP. In the field of signal transduction in cognitive processes/disorders we have shown that phosphodiesterase (PDE) inhibitors, which inhibit the degradation of cAMP and/or cGMP by PDEs, improve memory processes in rats independently of cerebrovascular effects. This is of major importance since this indicates that the second messengers can be targets for new drugs to improve memory function directly. Therefore, the biological mechanism of action of specific PDE inhibitors to improve memory is investigated in depth in collaboration with international academic partners (eg. University of Genoa) and pharmaceutical companies. A proof of concept study funded by a grant from ZonMW investigates the memory improving potential of a specific PDE type 4 inhibitor in human subjects with age-associated memory impairment. This is done in collaboration with Division 1 of MH&NS and the Faculty of Psychology and Neuroscience (FPN). The same stakeholders are involved in a recently initiated longitudinal study with different age- and patient (MCI) cohorts to find (epi)genetic biomarkers predicting cognitive decline. Next to this, parallel preclinical and clinical studies focus on new therapeutic targets besides PDEs to stimulate signal transduction. These studies are part of the HEaL (Human Enhancement and Learning) project, which is an initiative between schools (MHeNs, CARIM) and faculties (FHML, FPN and SBE) at Maastricht University with the aim to enhance memory function and thus quality of life. Finally, besides using pharmacological interventions, signaling is manipulated in mouse models of Alzheimer's disease or depression via gene transfer techniques including optogenetics and an innovative microelectroporation approach. The results of these studies will help us to find new therapeutic targets for affective and cognitive disorders.

3. Neuroinflammation; Nervous system neuroinflammation: immunotherapy and autoimmunity	
PI's:	P. Martinez, PhD & M. Losen, PhD
Research Staff:	B. Rutten, MD PhD, Prof. J. van Os, MD PhD, PhD, Prof. M. De Baets, MD PhD, P. Molenaar, PhD
Postdocs:	Koneczny, MSc, PhD
PhD-students:	C. Hoffmann, MsC, M. Mane-Damas, MsC, S. Crivelli, MsC, S. Zong, MSc, E. Erdag, MSc
Technician:	S. Vincken
Focus of research:	Understanding neuroinflammation in neurodegenerative diseases and nervous system autoimmunity

Our team is studying neuroimmunological mechanisms of the innate and adaptive immune response in the peripheral and central nervous system, with focus on antibody-mediated autoimmune diseases. We are working on various diseases, including myasthenia gravis (MG), Alzheimer's disease (AD), schizophrenia and depression.

An important goal of our work is the development of new methods to diagnose psychosis with autoimmune origin

(projects funded by ZonMw and the Hersenstichting) in order to enable specific (immunosuppressive) treatment of patients.

Additionally, we study the role of lipids and their transporters in the early inflammatory process of neurodegenerative diseases. In particular, we investigate the function/dysfunction of danger signal molecules e.g., serum amyloid P component and the ceramide transporter. This work is supported by the Internationale Stichting Alzheimer Onderzoek (ISAO).
Additionally, our team is leading a consortium funded by Memorabel/ZonMw studying the role of sphingolipids in AD.

Finally, we are working on the development of relevant experimental CNS autoimmune models of mental illness, work funded by a recently awarded Aspasia grant.

In MG, we are investigating the possible use of proteasome inhibitors for targeting autoimmune plasma cells. Long-living plasma cells are resistant against broad-range immunosuppressants and are therefore a major problem in the current treatment of MG and other antibody-mediated autoimmune diseases. Plasma cells depend on their proteasome to sustain high-rate protein synthesis. Consequently, proteasome inhibitors have the capacity to kill plasma cells by inducing the terminal unfolded protein response.

With support from the Princess Beatrix Fonds and The Netherlands Organisation for Health Research and Development, we are investigating disease pathology in a rare form of MG with muscle-specific kinase antibodies. For this purpose, we are generating monoclonal autoimmune B-cells from these patients. The cell lines are used to define fine antigen-specificities of individual patients' antibodies and to develop an animal model that can be used for testing future therapies.

4. Neuromodulation	
4.1 Experimental Neurosurgery	
PI's:	Prof. Y. Temel, MD PhD, L. Ackermans, MD PhD, A. Jahanshahi, PhD, G. Hoogland, PhD, P. Kubben, MD PhD, O. Schijns, MD PhD
Postdocs:	S. Hescham, PhD, M. Janssen, MD PhD,
PhD-students:	M. Alahmari, M. Aldehri, F. Gubler, R. Haeren, P. Janssen, B. Isaacs, A. Mulders, L. Peng, G. van Zwieten, M. Raijmakers, F. Schaper, A. Smeets, J. Smits, Y. Yakkioui.
Research interests:	Neuromodulation, Basal Ganglia, Neurodegeneration, Epilepsy, Biology of skull base tumors

Our group is steadily growing. We have recruited new PIs, postdoctoral researchers and PhD students. Our research includes clinical and experimental studies. In this respect, we have conducted studies to improve the surgical therapy for Parkinson's disease patients by developing novel targeting and evaluation methods (ultrahigh field MR imaging and M-health based approaches such as TREMOR12). Moreover, we have started to characterize the blood-brain barrier in patients with drug-refractory temporal lobe epilepsy. In our experimental studies, our main focus is on developing novel therapies as well as understanding the mechanisms behind neuromodulation approaches. Some examples are tailored neurostimulation in Parkinson's disease, Huntington's disease mRNA interference -based therapy in Huntington's disease, neuromodulation in dementia, epilepsy and tinnitus. In addition, we study neurodevelopmental changes consequential to febrile seizures and investigate the cellular mechanisms underlying the skull base tumors such as Chordoma and Meningioma.

These lines of research are supported by grants from the ZonMw, NWO, Cure Huntington's Disease Intitiative (CHDI, New York, USA), transnational University Limburg, Prosensa BV, Medtronic, Hersenstichting Nederland, and Saudi Ministry of Health.

4. Neuromodulation	
4.2 Modulation of chronic pain	
PI:	Prof. E.A. Joosten, PhD
Research Staff:	Prof. M. van Kleef, MD, PhD , M. Sommer, MD, PhD, A.Balthazar, MSc, PhD, H. Gramke, MD, PhD; Hon Prof.B.Linderoth
PhD-students:	Glenn Franken, Msc; R. Slangen, MSc, M. van Beek, MSc, M. Theunissen Msc., D. Hoofwijk Msc., B. Stessel Msc., C. Vossen Msc; Nynke van den Hoogen, Msc; Koen Meuwissen, Msc, B.Brouwer, Msc; E.Koetsier, Msc
Focus of research:	Part A: The understanding and application of neuromodulatory techniques, in particular spinal cord stimulation and pulsed radiofrequency, in order to minimize chronic (neuropathic) pain
	Part B: Identification of predictors of chronic postoperative pain and investigating approaches aimed at prevention and detection of chronic postoperative pain

Part A: Today Spinal Cord Stimulation (SCS) is used in the treatment of intractable neuropathic pain (NPP). Despite the existence of SCS as a pain therapy for over 40 years, up till now only two randomized clinical trials (RCT's) have been performed: one in patients with CRPS-1(Chronic Regional Pain Syndrome) and the other one in patients with Failed Back Surgery Syndrome (FBSS), both of which provide limited clinical evidence that SCS relieves neuropathic pain.
We extend implementation of SCS in other NPP syndromes and designed and completed a pilot study on the clinical effect of SCS in painful diabetic polyneuropathy (PDP). As a follow-up, an RCT (R. Slangen, MsC) on the effect of SCS in PDP is currently ongoing. In order to understand the underlying mechanism of action of SCS in PDP a rat model for PDP was developed in the laboratory and the effect of various stimulation parameters was analysed (M.van Beek , Hon prof.B.Linderoth). new spinal cord stimulation paradigms including High-Frequency Burst stimulation and Dorsal Root Ganglion Stimulation are studied in separate projects (K.Meuwissen and E.Koetsier respectively). We further study the role of SCS in small fiber neuropathies experimentally as well as clinically (Drs.B.Brouwer) in collaboration with Prof. K.Faber, MD PhD (Department of Neurology).
From a basic scientific point of view the role of glial cells (as immune-regulatory cells) in the modulation of chronic pain (or plasticity of the nervous system) has our prime interest.
Pulsed Radiofrequency as a minimally invasive therapy for treatment of chronic lumbar radicular pain (low back pain) is being studied based on an RCT. In a rat model of lumbar radicular pain, the mechanism of action PRF is being studied (Glenn Franken)..

Part B: Chronic postoperative pain is associated with an enormous socio-economic burden and can result from a plethora of clinical conditions. In our research, we focus primarily on trauma-induced neuropathies in the peripheral and/or central nervous system, which are a common cause of chronic pain. The initial pathological events at the site of nerve damage form the drive of pathological events higher up in the neuraxis, and are considered to be fundamental to the establishment and chronification of acute pain into chronic postoperative pain (projects D. Hoofwijk, B. Stessel). We aim at understanding the genetic and psychological (the latter in collaboration with Prof. M. Peeters, Faculty of Psychology) processes underlying chronification of postoperative pain. Together with Division 3 MHeNs (Dr B.Rutten and Dr.G.Kenis)) and the University of Bonn (Germany) genome wide analysis study has been performed on a cohort of chronic postoperative pain patients (R.van Reij; D Hoofwijk) and experimental studies have been initiated (Roel van Reij; N.van den Hoogen).
Development and use of event-related potentials (ERP) allow to study many aspects of pain construct, interrelations and mechanisms and are now quantified based on a new developed analyses method in Event related fixed interval areas (ERFIAs) (project C. Vossen; Dr R. Lousberg, Division 2 MHeNs). In line with this we developed the PsyMate app, a tool to monitor fluctuations in mood, affect, and context, and also pain. Therefore, we currently perform a pilot study to investigate the feasibility of the PsyMate in day case surgery and to gain more insight in how fluctuations in acute postoperative pain co-vary with pain-related psychological and contextual factors and with cortical processing of pain as analysed via ERFIAs (C. Vossen; collaboration Prof. J. van Os, Division 2 MHeNs).

4. Neuromodulation	
4.3 Functional Neuro-Urology	
PI:	Prof. G. Van Koeveringe, MD, PhD
Research staff:	Prof. Ph. van Kerrebroeck, MD, PhD
Postdocs:	C. Meriaux, PhD, M. Rahnama'i, MD, PhD
PhD-students:	A. Schueth, MSc, R. Hohnen, MSc, K. Rademakers, MD, J. Drossaerts, MD, D. Vrijens, MSc, A. Zare MD, D. Oerlemans MD.
Focus of research:	NeuroUrology: Lower urinary tract signaling, control mechanisms and neuro-modulation

The research focus is directed towards fundamental understanding of bladder and lower urinary tract physiology, pharmacology and the origins and treatment of lower urinary tract dysfunction. Three project lines are ongoing in order to study different levels of bladder dysfunction in a translational research programme based in the Research School for Mental health and Neuroscience, The Neurointervention Center (NIC), the MUMC+ profile Neurosciences and in close association with the clinical urology department and the Pelvic Care Centre Maastricht.
Line 1: Characterisation, analysis and physiological and structural mapping of control pathways within the urinary bladder wall and their connections with the central nervous system. In this basic research line, multiple pharmacological pathways have been studied in the intrinsic control mechanism inside the bladder wall, involving the network of interstitial cells and autonomous bladder activity. This part of the research is performed in collaboration with M. van Zandvoort, PhD (dept of Genetics and Cell biology). The way by which this mechanism is efferently modulated or afferently used by the central nervous system is subject to future electrophysiological recording and tracer studies. In a collaborative project with the Neurosurgery department (Prof. Y. Temel) connections of the lower urinary tract to specific brainstem areas such as PAG and dorsal raphe are being studied. Furthermore the assessment of the control pathways, by means of for example analysis of the non-voiding detrusor activity is expanded to animal models representing different mechanisms of diseases affecting bladder control such as a guinea pig hyperdistention underactive bladder model and an Alzheimer transgenic mouse model (behavioural studies in association with the Neuro-psychology group of Dr J. Prickaerts, PhD). The determination of the respective contribution of either bladder or brain/nerve dysfunction to these diseases will contribute to a better understanding of the clinical problems and (patho)physiological mechanisms. Moreover knowledge of these systems is necessary to understand and improve current treatment regimens such as: neurostimulation, neuromodulation and both peripheral and central pharmacological therapy. These activities are currently being funded by an EU FP7-ITN Marie Curie grant and partly by the Astellas Europe fund Prize 2012.
Line 2: The bladder and urinary sphincter control system in humans in the normal and the diseased state. Bladder and sphincter pressures during different disease states and during innovative treatment techniques are studied using high-resolution urodynamic measurements in combination with innovative imaging. A large part of these studies are performed in collaboration with the High Flux MRI facility, Scannexus in order to develop a physiological and imaging biomarkers. (funded by a Kootstra Fellowship, Dr Rahnamai and the Astellas Europe fund prize 2015'). A new tissue engineering study has been initiated to treat structural defects leading to functional problems in the lower urinary tract. A relationship is sought between psychological profile and the degree of bladder fullness perception. Related to this new research areas are being explored in collaboration with the Pelvic care center Maastricht and the department of Psychiatry with the focus on associations of functional bladder and pelvic floor complaints in combination with psychiatric comorbidity. For the underactive bladder, an algorithm for detection diagnosis and evaluation is being developed using patient databases from Hannover and from the Pelvic care center Maastricht, in a collaborative project with the university of Hannover (M. Oelke) In a retranslational way, a link is made with line 1 in which an underactive bladder model is developed using acute and chronic hyperdistention. This research is funded by an Astellas research grant.
Line 3: Neuromodulation in humans for complaints of overactive bladder and voiding dysfunction (over- and underactive bladder and bladder outlet), supervised by Prof. Ph. Van Kerrebroeck, MD PhD and co-supervised by G. A. van Koeveringe, MD PhD. In this research line both working mechanisms (using techniques and models described above) and an optimisation of the current neuromodulation treatments by means of determination of predictive factors and optimisation of techniques are the main subjects to be studied. Patient selection through for example determination of certain psychological patient traits (in collaboration with C. Leue, MD PhD, dept of Psychiatry), sub-characterisation of the diseases and evaluation of the largest urological neuromodulation patient cohort will be done using different possible psychological, physiological, biochemical and imaging biomarkers.

4. Neuromodulation	
4.4 Ophthalmology	
PI:	Prof. C. Webers MD PhD
Research staff:	Prof. R. Nuijts MD PhD, H. Beckers MH PhD, T. Berendschot PhD, J. Schouten MD PhD, T. Gorgels PhD
PhD-students:	R. Battu Msc., C. Bertens Msc, J. Brekelmans Msc., S. Dabir Msc., E. de Clerck Msc., M. Dickman Msc., M. Elshout Msc., B. Hegde Msc, J. Hoevenaars Msc., W. Hubens Msc, C. Jayadev Msc., S. Jonker Msc., R. Kumar Msc, A. Mallipatna Msc., N. Makhotkina Msc., P. Mokhles Msc., S. Mohan Msc, N. Pahuja, MSc, H. Rao, Msc., H. Römkens MSc, R. Simons MSc, A. Tan MSc, R. Teja Msc, N. Visser MSc, S. Wang Msc, L. Wielders MSc, S. Zhang MSc.
Focus of research:	Scientific research focuses on glaucoma, corneal diseases and cataract and ocular neurodegenerative changes in diabetes and other chronic diseases.

Research is primarily clinical in nature, with a direct impact for patients (clinical trials, clinical decision models) and society (efficiency research and cost-effectiveness models). Research results contribute directly to sustainable care by preventing diseases and by controlling growth in care costs thanks to cost-effective solutions. Further, abnormalities of both neural and vascular tissues are directly measurable in the living eye.
Research is concentrated along the following lines:
Glaucoma: Modelling (identification of risk factors for disease progression), imaging (anterior chamber morphometry, nerve tissue analysis) and the development of new treatment strategies (glaucoma filtration implant). In addition, basic studies on retinal ganglion cells, trabecular meshwork and aqueous humor aim to discover the molecular pathology of glaucoma and to design new (neuroprotective) treatments. Omics research and systems biology are used to integrate findings.
Cataract and Refractive Surgery: Development of innovative cataract surgical technologies such as femtosecond laser assisted cataract surgery. Development of biomaterial applications for sustained release of drugs. Improvement of presbyopia correction using adaptive optics and toric (multifocal) intraocular lenses, intracorneal inlays and scleral implants.
Corneal Transplantation: Optimizing lamellar corneal surgery for diseases of the cornea and development of regenerative medicine models using corneal stem cells and biomaterial technology.
Prevention: Development of retinal vascular analysis for early detection and monitoring of diseases such as diabetic retinopathy, age related macular degeneration and Alzheimer's Disease and research into the influence of diet in these diseases.
The Maastricht study: In a large epidemiological cohort study 5000 diabetes and 5000 controls are measured with state of the art measurement modalities to study causes and consequences of diabetes and other chronic diseases. Imaging techniques of the optic nerve, cornea and retina will provide new insights into neuro-degenerative changes in these syndromes.

4. Neuromodulation	
4.5 Neonatology, Developmental Neuroscience	
PI:	Prof. B. Kramer, MD, PhD
Research Staff:	Prof. H. Steinbusch, PhD, Prof. L. Zimmermann, MD, PhD, Prof. J. Vles, MD, PhD A. Gavilanes, MD, PhD, D. van den Hove, PhD, T. Wolfs, MSc, PhD
PhD-students:	K. Cox MSc, M. Sparnaaij, MSc, R. Jellema, MSc, M. Seehaase, MSc, M. Gantert, Msc, Andrea Sannia, MSc, Francesco Risso, MSc, Alejandro Borghesi, MSc, M. Gantert, MSc, M. Nikiforou, MSc, E. Kuypers, MSc, D. Ophelders, MSc
Focus of research:	Asphyxia and inflammation

The department of Pediatrics continued its research line on perinatal hypoxia-ischemia in newborn rats and preterm sheep and in patient studies.
In the past years, we have developed an understanding of the effects of hypoxia-ischemia on the immune system of

the exposed fetus with profound modulation of inflammatory responses. We studied the effects on isolated astrocytes in a cell culture model of hypoxia and glucose deprivation.
We published two key papers in the pursuit of translating the identified mechanisms of disease into clinical care. We tested a clinical grade stem cell product which is already in clinical trials in our model of hypoxia-ischemia in preterm lambs where we could show a neuroprotective effect on brain function and baro-receptor reflex. These findings substantiate the possibility of stem cells in the treatment of brain injury after hypoxia-ischemia.
We also investigated the possibilities of a postnatal treatment for neuroprotection by administerng propofol after hypoxia-ischemia. Propofol protected the newborn brain against hypoxic ischemic brain injury.
These multiple approaches to treat brain injury were discussed in invited reviews.

3. Facts and Figures

3.1 Earning Power

In this section, we present information concerning resources and funding.
Direct funding is provided mainly by the MUMC+ and comes indirectly from the Dutch Ministry of Education, Culture and Science. Research Funding: funds received in competition from national and international science foundations. Contracts: funds from third parties.

Direct Funding at Division level

Div.	Year	Granted Organisation	Project	Amount in €	Acquired by
1	2015	Maastricht University	Kootstra fellowship* April 2015.	20.947	F. Schaper
1	2015	Maastricht University	Kootstra fellowship** Oktober 2015.	28.969	R. Handels
SUBTOTAL CNP&CNS				**49.916**	
2	2015	Maastricht University	Kootstra fellowship** April 2015.	28.969	E. Pishva
2	2015	Maastricht University	Kootstra fellowship** April 2015.	28.969	N. Leibold
SUBTOTAL MENTAL HEALTH				**57.938**	
3	2015	Maastricht University	Kootstra fellowship** April 2015.	28.969	S. Hescham
SUBTOTAL NEUROSCIENCE				**28.969**	
TOTAL MHeNs				**136.823**	

** Kootstra Talent Fellowships: Awarded by the Faculty Health, Medicine and Life Sciences. Talented future PhD students: The fellowship is meant to bridge the time between graduation of a talented student in Medicine, Health or Life Sciences and the start of an official contract as a PhD-student.*

*** Talented future postdocs: The fellowship is meant to bridge the time between graduation of the PhD-student and the start of an official contract as a postdoc.*

National Research Funding at Division level

Div.	Year	Granted organisation	Project	Amount in €	Acquired by
1	2015	ZonMw	Memorabel fellowship Vos/ projectnummer 70-73305-98-502 / Pathophysiology of SNAP in individuals with mild cognitive impairment.	187.887	S. Vos
1	2015	NWO	NWO project Inge Verheggen / dossiernr. 406-15-031 / correspondentienr: 2015/20251/MaGW / Blood-brain barrier function: the key to successful cognitive aging.	219.170	F. Verhey
1	2015	ZonMw	ZonMw InLife / dossiernr. 70-73305-98-611 / Evaluation of the usefulness and effectiveness of a virtual social platform for carers of people with dementia.	108.927	M. De Vugt
SUBTOTAL CNP&CNS				**515.984**	
SUBTOTAL MENTAL HEALTH				**–**	

Div.	Year	Granted organisation	Project	Amount in €	Acquired by
3	2015	ZonMw	ZonMw/File: 80-84300-98-61023/ project no.: 843001603 / Corneal Transplantation by DMEK (Descemet Membrane Endothelial Keratoplasty) - is it really better than DSAEK?	249.550	F. Van den Biggelaar / R. Nuijts
3	2015	ZonMw	JPND / project no. 733051064 / Targeting epigenetic dysregulation in the brainstem in Alzheimer's Disease (EPI-AD).	168.000	D. Van den Hove
3	2015	ZonMw	VENI Stimulating Neuronal Identity (File 91616043).	250.000	A. Jahanshahi
SUBTOTAL NEUROSCIENCE				**667.550**	
TOTAL MHeNs				**1.183.534**	

National and international Funding at Division level

Div.	Year	Granted organization	Project	Amount in €	Acquired by
1	2015	(PR) Alzheimer Nederland	"Alzheimer Nederland"	95.000	F. Verhey
1	2015	(PR) DFG	DFG / Individual grant JA 2336/1/ Exciting networks: multi-modal mapping and modulating network breakdown in early Alzheimers disease.	169.311	H. Jacobs
1	2015	(Non PR) Health Foundation Limburg	Alzheimer Campagne Fonds.	60.000	F. Verhey / M. De Vugt
1	2015	(Non PR) Stichting Noaber Foundation	Stichting Noaber Foundation / project: digitization NPO.	225.000	F. Verhey / I. Ramakers
1	2015	(PR) Michael J. Fox Foundation	MJFF / Cognitive Behavioral Therapy for anxiety disorders in patients with Parkinson's disease: a Randomized, Controlled Trial study on the clinical effectiveness and changes in cerebral connectivity.	471.361	A. Leentjens
1	2015	(PR) Prinses Beatrix Spier Fonds	PBSF Faber / W.OR145-25 / Myotonic Dystrophy type 1: Dutch Registry And Follow-up study (MYODRAFT study).	233.233	C. Faber
1	2015	(PR) ISAO	ISAO / project no. #15007 / H. Jacobs- How noradrenalin modulates memory and the brain in Alzheimer's disease.	100.000	H. Jacobs
SUBTOTAL CNP&CNS				**1.353.905**	
2	2015	(Non PR) Mondriaan Zorggroep	Research collaboration Mondrian / Psychiatric Epidemiology	59.000	J. Van Os
2	2015	(Non PR) Fonds Psychische Gezondheid	Fund for Mental Health / project no. 2014 6870 / Tapering strips for drugs that need to be phased out.	35.384	J. Van Os
2	2015	(Non PR) Fonds NutsOhra	PsychoseNet 2.0 of fund NutsOhra.	159.890	J. Van Os
SUBTOTAL MENTAL HEALTH				**254.274**	

Div.	Year	Granted organization	Project	Amount in €	Acquired by
3	2015	(PR) Hersenstichting Nederland	Hersenstichting / project no. WS2014(1)-05 / Exosomes derived from mesenchymal stem cells: a promising therapy for white matter disease in preterm infants.	50.000	R. Jellema
3	2015	(PR) Hersenstichting Nederland	HS Martinez / BG 2014-2 / Mobility with psychiatric disabilities: Development and application of diagnostic tests for psychosis patients with an autoimmune disorder.	40.000	P. Martinez-Martinez
3	2015	(Non-PR) Astellas Pharma B.V.	Astellas Urology / Underactive Bladder animal model development.	76.586	G. Van Koeveringe
SUBTOTAL NEUROSCIENCE				**166.586**	
TOTAL MHeNs				**1.774.765**	

Industrial Funding

Div.	Year	Granted organisation	Project	Amount in €	Acquired by
1	2015	Takeda	Takeda Aalten / proj.nr. 1000266998 / Cognition and (epi)genetics in memory clinic patients with Mild Cognitive Impairment and Subjective Cognitive Decline: a longitudinal behavior genomics study.	1.090.090	P. Aalten
1	2015	Piramal Imaging Ltd	Piramal Imaging Ltd / Clinical research in patients undergoing FBB PET imaging and clinical outcomes.	5.082	R. Handels
SUBTOTAL CNP&CNS				**1.095.172**	
SUBTOTAL MENTAL HEALTH				**–**	
3	2015	Medtronic	Medtronic Temel / The ultra-high field MRI research, in order to improve the understanding of the structure, function and connectivity of relevant DBS targets.	112.000	Y. Temel
3	2015	AMARNA STEM CELLS BV	AMARNA STEM CELLS BV / The Efficacy of bone marrow derived stem cells on the recovery of a balloon compressed spinal cord in T-cell deficient rats and compared with a vehicle treated group of animals.	200.000	B. Kramer
3	2015	Takeda	Takeda Prickaerts / proj.nr. 1000266992 / Aging-Related Memory Impairment: A Behavior-Genomics Study.	481.016	J. Prickaerts
3	2015	Tetra Discovery Partners	Tetra - donepezil / The effects of putative cognition enhancers on memory in rodents.	32.800	J. Prickaerts

Div.	Year	Granted organisation	Project	Amount in €	Acquired by
3	2015	Astellas European Foundation	Astellas Sajjad Rahnama'i / An Imaging Biomarker for Bladder Activity Disorders: Functional Magnetic Resonance 7 Tesla Imaging (fMRI) in combination with urodynamics to study the effect of bladder sensory stimulation on Brain activity in Patients with a Bladder activity disorder, including the effect of antimuscarinic and beta mimetic agents.	139.000	M. Rahnama'i
3	2015	Chiesi Farmaceutici	Chiesi 5 / In vivo proof of inactivation of surfactant by preceding chorioamnionitis by Ureaplasma.	249.340	B. Kramer
3	2015	UM, TUE, DSM, provincie Limburg	InSciTe / OCDC-trial.	1.443.108	R. Nuijts / F. Van den Biggelaar
SUBTOTAL NEUROSCIENCE				**2.657.264**	
TOTAL MHeNs				**3.752.436**	
Overall total MHeNs				**6.847.558**	

3.2 Research staff

Research staff input at School level (n fte/year)

Position	2015
Senior Research staff*	
inclusive external funding	
Tenured staff	20,96
Non-tenured staff	23,26
Subtotal senior research staff	44,22
PhD students	42,88
inclusive external funding	
Total research staff	**87,10**
Supporting staff	19,91
Total staff	**107,01**

Research staff input at Mental Health (n fte/year)

Postion	2015
Senior Research staff	
inclusive external funding	
Tenured staff	4,38
Non-tenured staff	5,73
Subtotal senior research staff	10,11
PhD students	7,89
inclusive external funding	
Total research staff	**18,00**
Supporting staff	10,08
Total staff	**28,08**

Research staff input at Cognitive Neuropsychiatry & Clinical Neuroscience (n fte/year)

Postion	2015
Senior Research staff	
inclusive external funding	
Tenured staff	9,01
Non-tenured staff	8,57
Subtotal senior research staff	17,58
PhD students	18,89
inclusive external funding	
Total research staff	**36,47**
Supporting staff	4,57
Total staff	**41,04**

Research staff input at Neuroscience (n fte/year)

Postion	2015
Senior Research staff	
inclusive external funding	
Tenured staff	7,57
Non-tenured staff	8,96
Subtotal senior research staff	16,53
PhD students	16,10
inclusive external funding	
Total research staff	**32,63**
Supporting staff	5,26
Total staff	**37,89**

4. Output Results

4.1 Aggregated results of the School Output 2015

This overview presents the output, expressed as peer reviewed publications. The full list of publications are reported at our website (publications MHeNs 2015). In chapter 4.2 the best 5 publications per year, per division are listed illustrating the core research.
In addition the overview below shows the number of PhD-theses. A full list of PhD-theses is listed in chapter 4.3.

Academic publications in refereed journals (wi-1)	2015
Division I	**164**
Division 2	**103**
Division 3	**210**
Total Divisions	**477**
Total MHeNs	**438**
PhD theses	**47,33**

**Since some of the same publications are included in various Divisions there is a difference between the total number of the divisions and MH&NS in its entirety*

4.2 Best Publications 2015

Division I: Cognitive Neuropsychiatry & Clinical Neuroscience

1. **Jansen, W.J.,** Ossenkoppele, R., Knol, D.L., Tijms, B.M., Scheltens, P., **Verhey, F.R.,** Visser, P.J., Amyloid Biomarker Study, G., **Aalten, P.,** Aarsland, D., Alcolea, D., Alexander, M., Almdahl, I.S., Arnold, S.E., Baldeiras, I., Barthel, H., van Berckel, B.N., Bibeau, K., Blennow, K., Brooks, D.J., van Buchem, M.A., Camus, V., Cavedo, E., Chen, K., Chetelat, G., Cohen, A.D., Drzezga, A., Engelborghs, S., Fagan, A.M., Fladby, T., Fleisher, A.S., van der Flier, W.M., Ford, L., Forster, S., Fortea, J., Foskett, N., Frederiksen, K.S., Freund-Levi, Y., Frisoni, G.B., Froelich, L., Gabryelewicz, T., Gill, K.D., Gkatzima, O., Gomez-Tortosa, E., Gordon, M.F., Grimmer, T., Hampel, H., Hausner, L., Hellwig, S., Herukka, S.K., Hildebrandt, H., Ishihara, L., Ivanoiu, A., Jagust, W.J., Johannsen, P., Kandimalla, R., Kapaki, E., Klimkowicz-Mrowiec, A., Klunk, W.E., **Kohler, S.,** Koglin, N., Kornhuber, J., Kramberger, M.G., Van Laere, K., Landau, S.M., Lee, D.Y., de Leon, M., Lisetti, V., Lleo, A., Madsen, K., Maier, W., Marcusson, J., Mattsson, N., de Mendonca, A., Meulenbroek, O., Meyer, P.T., Mintun, M.A., Mok, V., Molinuevo, J.L., Mollergard, H.M., Morris, J.C., Mroczko, B., Van der Mussele, S., Na, D.L., Newberg, A., Nordberg, A., Nordlund, A., Novak, G.P., Paraskevas, G.P., Parnetti, L., Perera, G., Peters, O., Popp, J., Prabhakar, S., Rabinovici, G.D., **Ramakers, I.H.,** Rami, L., Resende de Oliveira, C., Rinne, J.O., Rodrigue, K.M., Rodriguez-Rodriguez, E., Roe, C.M., Rot, U., Rowe, C.C., Ruther, E., Sabri, O., Sanchez-Juan, P., Santana, I., Sarazin, M., Schroder, J., Schutte, C., Seo, S.W., Soetewey, F., Soininen, H., Spiru, L., Struyfs, H., Teunissen, C.E., Tsolaki, M., Vandenberghe, R., Verbeek, M.M., Villemagne, V.L., **Vos, S.J.,** van Waalwijk van Doorn, L.J., Waldemar, G., Wallin, A., Wallin, A.K., Wiltfang, J., Wolk, D.A., Zboch, M. and Zetterberg, H., Prevalence of cerebral amyloid pathology in persons without dementia: a meta-analysis. *JAMA, 2015. 313(19): p. 1924-38.[IF 37,700]*

2. **Handels, R.L., Joore, M.A.,** Tran-Duy, A., Wimo, A., **Wolfs, C.A., Verhey, F.R**., and Severens, J.L., Early cost-utility analysis of general and cerebrospinal fluid-specific Alzheimer's disease biomarkers for hypothetical disease-modifying treatment decision in mild cognitive impairment. *Alzheimers Dement, 2015. 11(8): p. 896-905.[IF 12,407]*

3. **Vos, S.J., Verhey, F.,** Frolich, L., Kornhuber, J., Wiltfang, J., Maier, W., Peters, O., Ruther, E., Nobili, F., Morbelli, S., Frisoni, G.B., Drzezga, A., Didic, M., van Berckel, B.N., Simmons, A., Soininen, H., Kloszewska, I., Mecocci, P., Tsolaki, M., Vellas, B., Lovestone, S., Muscio, C., Herukka, S.K., Salmon, E., Bastin, C., Wallin, A., Nordlund, A., de Mendonca, A., Silva, D., Santana, I., Lemos, R., Engelborghs, S., Van der Mussele, S., Alzheimer's Disease Neuroimaging, I., Freund-Levi, Y., Wallin, A.K., Hampel, H., van der Flier, W., Scheltens, P., and **Visser, P.J.,** Prevalence and prognosis of Alzheimer's disease at the mild cognitive impairment stage. *Brain, 2015. 138(Pt 5): p. 1327-38.[IF 9,196]*

4. **van de Haar, H.J., Burgmans, S., Hofman, P.A., Verhey, F.R., Jansen, J.F., and Backes, W.H.,** Blood-brain barrier impairment in dementia: current and future in vivo assessments. *Neurosci Biobehav Rev, 2015. 49: p. 71-81.[IF 8,802]*

5. **van Veenendaal TM, IJff DM, Aldenkamp AP, Hofman PA, Vlooswijk MC, Rouhl RP, de Louw AJ, Backes WH, Jansen JF.** Metabolic and functional MR biomarkers of antiepileptic drug effectiveness: A review. *Neurosci Biobehav Rev. 2015;59:92-9. (IF 8,802)*

Divison II: Mental Health

1. **Selten, J.P.,** Lundberg, M., Rai, D., and Magnusson, C., Risks for nonaffective psychotic disorder and bipolar disorder in young people with autism spectrum disorder: a population-based study. *JAMA Psychiatry, 2015. 72(5): p. 483-9.[IF 12.008]*

2. **Smeets, F., Lataster, T., Viechtbauer, W., Delespaul, P.,** and G.R.O.U.P, Evidence that environmental and genetic risks for psychotic disorder may operate by impacting on connections between core symptoms of perceptual alteration and delusional ideation. *Schizophr Bull, 2015. 41(3): p. 687-97.[IF 8.450]*

3. **Reininghaus U,** Kempton M, Valmaggia L, Onyejiaka A, **van Os J,** McGuire P, Murray R, Wyke, T,Morgan C. Stress Sensitivity as a Psychological Mechanism in the Onset of Psychosis: An Experience Sampling Study. *Schizophr Bull. 2015;41:S152-S. .[IF 8.450]*

4. **Bakker, G., Vingerhoets, W.A.,** van Wieringen, J.P., de Bruin, K., Eersels, J., de Jong, J., Chahid, Y., Rutten, B.P., DuBois, S., Watson, M., Mogg, A.J., Xiao, H., Crabtree, M., Collier, D.A., Felder, C.C., Barth, V.N., Broad, L.M., **Bloemen, O.J., van Amelsvoort, T.A.,** and Booij, J., 123I-iododexetimide preferentially binds to the muscarinic receptor subtype M1 in vivo. *J Nucl Med, 2015. 56(2): p. 317-22.[IF 6.160]*

5. **Viechtbauer, W.,** Lopez-Lopez, J.A., Sanchez-Meca, J., and Marin-Martinez, F., A comparison of procedures to test for moderators in mixed-effects meta-regression models. *Psychol Methods, 2015. 20(3): p. 360-74.[IF 4.45]*

Division III: Neuroscience

1. **Temel, Y. and Jahanshahi, A.,** Neuroscience. Treating brain disorders with neuromodulation. *Science, 2015. 347(6229): p. 1418-9.[IF 33,611]*

2. de Witte, L.D., **Hoffmann, C.,** van Mierlo, H.C., Titulaer, M.J., Kahn, R.S., **Losen M, Molenaar P,** De Hert M, Roeder CH, van Beveren N, **Rutten BP,** van Os J, **Martinez-Martinez P.,** Absence of N-Methyl-D-Aspartate Receptor IgG Autoantibodies in Schizophrenia: The Importance of Cross-Validation Studies. *JAMA Psychiatry, 2015. 72(7): p. 731-3. [IF 12,008]*

3. **Lardenoije, R., Iatrou, A., Kenis, G.,** Kompotis, K., **Steinbusch, H.W.,** Mastroeni, D., Coleman, P., Lemere, C.A., Hof, P.R., **van den Hove, D.L., and Rutten, B.P.,** The epigenetics of aging and neurodegeneration. *Prog Neurobiol, 2015. 131: p. 21-64. [IF 9,992]*

4. Leibold, N.K., **van den Hove, D.L.,** Esquivel, G., De Cort, K., Goossens, L., Strackx, E., Buchanan, G.F., **Steinbusch, H.W., Lesch, K.P.,** and Schruers, K.R., The brain acid-base homeostasis and serotonin: A perspective on the use of carbon dioxide as human and rodent experimental model of panic. *Prog Neurobiol, 2015. 129: p. 58-78.[IF 9,992]*

5. **van Beek, M.,** Slangen, R., Schaper, N.C., Faber, C.G., **Joosten, E.A.,** Dirksen, C.D., van Dongen, R.T., Kessels, A.G., and **van Kleef, M.,** Sustained Treatment Effect of Spinal Cord Stimulation in Painful Diabetic Peripheral Neuropathy: 24-Month Follow-up of a Prospective Two-Center Randomized Controlled Trial. *Diabetes Care, 2015. 38(9): p. e132-4. [IF 8,42]*

4.3 PhD Theses 2015

Division I

Last name	Initials	Thesis defence	Promotor	Co-promotor	Titel Thesis
Ament	B.H.L.	21–01–2015	Prof. Dr. G.I.J.M. Kempen, MD PhD / Prof. Dr. F.R.J. Verhey, MD PhD	M.E. de Vugt MD PhD	*Frailty in old age; conceptualization and care innovations.*
Bakkers	M.	17–04–2015	Prof. C.G. Faber, MD PhD / Prof. M. de Baets, MD PhD	I.S.J. Merkies MD PhD	*Small fibers, big troubles; diagnosis and implications of small fiber neuropathy.*
Beerhorst	K.P.G.M.	13–11–2015	Prof. A.P. Aldenkamp, MD PhD / Prof. Van Oostenbrugge, MD PhD	P. Verschuure MD PhD	*Bone disease in chronic epilepsy: fit for a fracture.*
Brands	I.M.H.	23–01–2015	Prof. C.M. van Heugten, MD PhD / Prof. D.T. Wade, MD PhD	S.Z. Stapert MD PhD/ S. Köhler MSc PhD	*The adaptation process after acquired brain injury: Pieces of the puzzle.*
Chenault	M.N.	22–10–2015	Prof. B. Kremer, MD PhD / Prof. M.P.F. Berger, MD PhD	L.J.C. Anteunis AUD PhD	*Assessing Readiness for Hearing Rehabilitation.*
Ebus	S.C.M.	27–05–2015	Prof. A.P. Aldenkamp, MD PhD	Prof. J.B.A.M. Arends MD PhD / Prof. P.J. boon MD PhD	*Interictal epileptiform acivity as a marker for clinical outcome.*
Hamel	R.E.G.	03–07–2015	Prof. F. Verhey, MD PhD	I.H.G.B. Ramakers MSc PhD / P.J. Visser MSc PhD	*The course of mild cognitive impairment and the role of comorbidity.*
Hof	J.R.	06–03–2015	Prof. B. Kremer MD PhD/ Prof. R.J. Stokroos MD PhD	L.J.C. Anteunis AUD PhD	*Hearing loss in young children; challenges in assessment and intervention.*
Klinkenberg	S.	06–02–2015	Prof. J.S.H. Vles, MD PhD / Prof. A.P. Aldenkamp, MD PhD	H.J.M. Majoie MD PhD	*VNS in children; more than just seizure reduction.*
König	A.V.	22–10–2015	Prof. F. Verhey, MD PhD	P. Aalten MD PhD/ R. David MD PhD	*The Use of Information and Communication Technologies (ICT) for the Assessment of patients with Alzheimer's Disease and related disorders.*
Pons van Dijk	G.	29–10–2015	Prof. J. Lodder MD PhD/ Prof. H. Kingma MsC PhD	A.F. Lenssen MD PhD	*Taekwondo and physical fitness components in middle-aged healthy volunteers; the Sekwondo study.*
Smeets	S.M.J.	12–11–2015	Prof. C.M. van Heugten, MD PhD / Prof. Ponds, MD PhD	I. Winkens MD PhD	*Insights into insight: Studies on awareness of deficits after acquired brain injury.*

Last name	Initials	Thesis defence	Promotor	Co-promotor	Titel Thesis
Spauwen	P.J.J.	23–09–2015	Prof. F. Verhey, MD PhD / Prof. C.D.A. Stehouwer, MD PhD	M.P.J. van Boxtel MD PhD	*Cognition and Type 2 Diabetes. The interplay of risk factors.*
Tielemans	N.S.	28–05–2015	Prof. C.M. van Heugten, MD PhD	V.P.M. Schepers MD PhD	*Proactive coping post stroke: The Restored4Stroke Self-Management study.*
Van Dooren,	F.E.P.	29–10–2015	Prof. F. Verhey, MD PhD	M.T. Schram MD PhD	*Diabetes and Depression: exploring the Interface between Pathophysiological and Psychological factors.*
Vanhoutte	E.K.	13–03–2015	Prof. C.G. Faber, MD PhD / Prof. P.A. van Doorn, MD PhD	I.S.J. Merkies MD PhD	*Peripheral Neuropathy outcome measures; Standardisation (PeriNomS) study part 2: Getting consensus.*

Division II

Last name	Initials	Theses Defence	Promotor	Co-promotor	Title Thesis
Evers	L.J.M.	14–12–2015	Prof. L.M.G. Curfs, MD PhD / Prof. T. v. Amelsvoort, MD Phd	-	*22q11 1.2 deletion syndrome: intelligence, psychopathology and neurochemistry at adult age.*
Gevonden	M.J.	25–9–2015	Prof. J.P.Selten, MD PhD	Prof. J. Booij, MD PhD	*The odd one out: exploring the nature of the association between minority status and psychosis.*
Güloksuz	I.S.	2–12–2015	Prof. J.J. van Os, MD PhD MRCPsych	B.P.F. Rutten, MD PhD M. Drukker, PhD	*Biological mechanisms of environmental stressors in psychiatry.*
Hartmann	J.A.	14–1–2015	Prof. J.J. van Os, MD PhD MRCPsych	C. Simons, PhD M.C. Wichers, PhD	*A good laugh and a long sleep; Insights from prospective and ambulatory assessments about the importance of positive affect and sleep in mental health.*
Hernaus	D.M.J.	22–1–2015	Prof.I.Myin-Germeys, PhD	D. Collip, PhD	*Dopayours is not dopamine: genetic, environmental and pathological variations in dopaminergic stress processing.*
Janssens	M.	22–1–2015	Prof.I.Myin-Germeys, PhD	H.W.G. Lataster, PhD	*Exploring course and outcome across the psychosis-continuum.*

Last name	Initials	Thesis defence	Promotor	Co-promotor	Titel Thesis
Knuts	I.J.E.	27–5–2015	Prof.I.Myin-Germeys, PhD	K. Schruers, MD PhD	*Influencing panic; Experimental and clinical studies into determinants of panic severity.*
Kramer	I.M.A.	30–4–2015	Prof. J.J. van Os, MD PhD MRCPsych	C. Simons, PhD M.C. Wichers, PhD	*Zooming into the micro-level of experience: An approach for understanding and treating psychopathology.*
Leeuw van der	C.	23–6–2015	Prof. J.J. van Os, MD PhD MRCPsych	M. Marcelis, MD PhD	*Blood, bones and brains; peripheral biological endophenotypes and their structural cerebral correlates in psychotic disorder.*
Lothmann e/v Menne	C.	29–1–2015	Prof. J.J. van Os, MD PhD MRCPsych	M.C. Wichers, PhD N.E. Jacobs, PhD	*Affect dynamics; A focus on genes, stress, and an opportunity for change.*
Nierop van	M.M.	30–1–2015	Prof.I.Myin-Germeys, PhD	R. van Winkel, MD MSc PhD	*Surviving Childhood, New perspectives on the link between childhood trauma and psychosis.*
Peeters	S.C.T.	24–6–2015	Prof. J.J. van Os, MD PhD MRCPsych	M. Marcelis, MD PhD	*The idle mind never rests: functional brain connectivity across the psychosis continuum.*
Pishva	S.E.	3–12–2015	Prof. J.J. van Os, MD PhD MRCPsych	B.P.F. Rutten, MD PhD G. Kenis, PhD	*Environmental Epigenetics in Mental Health and Disorders.*

Division III

Last name	Initials	Thesis Defence	Promotor	Co-promotor	Titel Thesis
Assen, van	T.	11–06–2015	Prof. G.L. Beets, MD PhD / Prof. M. van Kleef, MD PhD	R.M.H. Roumen, MD PhD / M.R.M. Scheltinga, MD PhD	*Anterior Cutaneous Nerve Entrapment Syndrome; Epidemiology and surgical management.*
Biallosterski	B.T.	25–09–2015	Prof. Ph.E.V.A. van Kerrebroeck, MD PhD / Prof. S. de Wachter, PhD	G.A. van Koeveringe, MD PhD / M.S. Rahnama'i, MD PhD	*Structural and functional aspects of sensory-motor Interaction in the urinary bladder.*
Borghesi	A.	28–01–2015	Prof. L.J.I. Zimmermann, MD PhD / Prof. B.W.W. Kramer, MD PhD	D. Gazzolo, MD PhD / A.W.D. Gavilanes, MD PhD	*Stem and Progenitor Cells in Preterm Infants: Role in the Pathogenesis and Potential for Therapy.*
Bouman	A.C.	08–05–2015	Prof. M. van Kleef, MD PhD/ Prof. A.E. Marcus, MD PhD/ Prof. E.A. Joosten, PhD	H. Gramke, MD PhD	*Risks and Benefits of Regional Anesthesia in the Perioperative Setting.*

Last name	Initials	Thesis Defence	Promotor	Co-promotor	Titel Thesis
Cheng	Y.	21–12–2015	Prof. R.M.M.A. Nuijts, MD PhD	J.S.A.G. Schouten, MD PhD	*Clinical Outcomes After Innovative Lamellar Corneal Transplantation Surgery.*
Cox - Limpens	K.E.M.	13–03–2015	Prof. J.S.H. Vles, MD PhD /Prof. L.J.I. Zimmermann, MD PhD	A.W.D. Gavilanes, MD PhD	*Mechanisms of endogenous brain protection; Clues from the transcriptome.*
Gentier	R.J.G.	05–11–2015	Prof. H.W.M. Steinbusch, PhD / Prof. D.A. Hopkins, PhD	F.W. van Leeuwen, PhD	*UBB+1; an important switch in the onset of Alzheimer's disease.*
Goethem, van	N.P.	25–06–2015	Prof. H.W.M. Steinbusch, PhD	J.H.H.J. Prickaerts, PhD	*α7 nicotinic acetylcholine receptors and memory processes: mechanistic and behavioral studies.*
Hamaekers	A.E.W.	11–12–2015	Prof. W.F. Buhre, MD PhD / Prof. M. van Kleef, MD PhD	-	*Rescue ventilation using expiratory ventilation assistance; innovating while clutching at straws.*
Hescham	S.A.	15–12–2015	Prof. Y. Temel, MD PhD	A. Blokland, PhD / A. Jahanshahianvar, PhD	*Novel insights towards memory restoration.*
Janssen	M.L.F.	13–05–2015	Prof. Y. Temel, MD PhD / Prof. V. Visser-Vandewalle, MD PhD/ Prof. A. Benazzouz, MD PhD	-	*Selective stimulation of the subthalamic nucleus in Parkinson's disease; a dream of near future?*
Keijzers	M.J.	10–07–2015	Prof. J.G. Maessen, PhD / Prof. M.H.V. de Baets, MD PhD	A.M.C. Dingemans, MD PhD	*The thymus: when a rudimentary organ becomes active.*
Leibold	N.K.	25–06–2015	Prof. H.W.M. Steinbusch, PhD	K.R.J. Schruers, PhD / D.L.A. van den Hove, PhD	*A Breath of fear; a translational approach into the mechanisms of panic.*
Linssen	A.M.	13–02–2015	Prof. B. Kremer, MD PhD	L.J.C. Anteunis, PhD / M.A. Joore, PhD	*Considerations in designing an adult hearing screening programme.*
Nunes	J.P.	21–12–2015	Prof. H.W.M. Steinbusch, PhD	Prof. K-P. Lesch, PhD/ T. Strekalova, PhD / B.H. Cline, PhD	*Insulin receptor sensitization improves affective pathology in various mouse models.*
Pujol-López	Y.	30–10–2015	Prof. H.W.M. Steinbusch, PhD	G.R.L. Kenis, PhD / Aye Mu Myint, PhD	*Development and psycho neuro immunological mechanisms in depression.*
Risso	F.	28–01–2015	Prof. J.S.H. Vles, MD PhD	D. Gazzolo, MD PhD / A.W.D. Gavilanes, MD PhD	*Urinary and salivary S100B monitoring in high risk infants.*
Shetty	R.	18–6–2015	Prof. R.M.M.A. Nuijts, MD PhD / Prof. C.A.B. Webers, MD PhD	T.T.J.M. Berendschot, PhD	*Understanding the Clinical, Immunological and Genetic Molecular Mechanism of Keratoconus.*

Last name	Initials	Thesis Defence	Promotor	Co-promotor	Titel Thesis
Speth	A.W.M.	16–09–2015	Prof. J.S.H. Vles, MD PhD / Prof. R.J.E.M. Smeets, MD PhD	Y.J.M. Janssen-Potten, PhD	*Effects of botulinum toxin A injections and bimanual task-oriented therapy on hand functions and bimanual activities in unilateral Cerebral Palsy.*
Tian	Y.	17–09–2015	Prof. C.A.B. Webers, MD PhD / Prof. A. Kijlstra, PhD	T.T.J.M. Berendschot, PhD	*Uveitis and age related macular degeneration(AMD).*
Vinekar	A.S.	28–10–2015	Prof. C.A.B. Webers, MD PhD	N.J.C. Bauer, PhD	*Retinopathy of Prematurity. Recent advances in tele-medicine screening, risk factors and spectral domain optical coherence tomography imaging.*
Zundert, van	T.C.R.V.	04–06–2015	Prof. A.E. Marcus, MD PhD / Prof. W.F. Buhre, MD PhD/ Prof. J.R. Brimacombe, MD PhD / Prof. C.A. Hagberg, MD PhD		*Improvements Towards Safer Extraglottic Airway Device.*
Zwanenburg	A.A.	19–11–2015	Prof. T. Delhaas, PhD / Prof. B.W.W. Kramer, MD PhD	T.G.A.M. Wolfs, MsC PhD / P. Andriessen, PhD	*Cerebral and cardiac signal monitoring in fetal sheep with hypoxic-ischemic encephalopathy.*

5. Master's and PhD education

5.1 Master's Programmes

MHeNs is involved in the curricula of several Master's programmes:

Research Master in Cognitive and Clinical Neuroscience

The Research Master in Cognitive and Clinical Neuroscience (RM CCN) focuses on cognition and brain and behaviour in health and disease, where it takes perspectives on a micro, meso- or macro-level depending on the specific specialisation. The two year's programme (120 ECTS) consist of five distinct specialisations:

- Cognitive Neuroscience
- Neuropsychology
- Psychopathology
- Fundamental Neuroscience
- Neuroeconomics

The different specializations are jointly organized by the faculties Psychology and Neuroscience (FPN), Health, Medicine and Life Sciences (FHML) and the School of Business and Economics (SBE). The tracks Psychopathology and Fundamental Neuroscience are coordinated by MHeNs staff members (Dr Nancy Nicolson and Dr Jos Prickaerts, resp.), and other staff members of the three MHeNs divisions participate in three of the five specialisations (Neuropsychology, Psychopathology and Fundamental Neuroscience). The number of admissions of students in this program is illustrated in table 1 below.

International Master in Affective Neuroscience

The International Master of Affective Neuroscience is a postgraduate joint degree programme from the Universities of Maastricht and Florence. The programme teaches scientific competences in the subspecialty of affective neuroscience, dealing with the latest developments in the field taught by leading scientists. The programme is a combination of distance teaching, scientific research and residential courses. The division Mental Health is co-organizer of this joint master's degree programme. Chairman of the Board is Dr K. Schruers, Associate Professor of Experimental Psychiatry of the division Mental Health.
In 2015, 28 students were enrolled in the program (of which 12 students 1st year; 7 students 2nd year; 5 Summer Course participants 1st year and 4 Summer Course participants 2nd year). 4 Master students graduated in 2015.

Master Biomedical Life Sciences (BMS)

The 2 year's programme Biomedical Sciences (120 ECTS) is a programme of the transnational University Limburg (tUL) and offered in cooperation (and at two locations) between Maastricht University and Hasselt University (Diepenbeek, Belgium). The BMS programme offers five research specialisations: Cardiovascular Biology and Medicine, Clinical Molecular Sciences, Neuroscience, Nutrition and Metabolism, Oncology and Developmental Biology. Of the 71 students that have started in 2014, 10 students have chosen a neuroscience related research training and master thesis in their second year (2015).
In addition, within the BMS programme, MHeNs and 3 other EURON partners (University of Lille, Université catholique de Louvain and the University of Cologne) have started a Double Degree Master's programme with 3 Japanese universities (Tohoku University, Toho University and Kyoto Prefectural University of Medicine) in the framework of an EU-financed exchange program that will run from October 2013 – 2017 / http://www.eujpneuro.eu). In 2015, 5 BMS students went to Japan for their 2nd Master's year (speciality Neuroscience) and will receive a Double Degree from Maastricht University and from one of the Japanese universities. In addition, one Japanese student spent his 2nd Master's year in Maastricht and finalized a neuroscience related thesis.

Table 1 Influx of Master students per year (2011-2015)

	2011	2012	2013	2014	2015
RM CCN	**66**	**80**	**70**	**95**	**90**
Cognitive Neuroscience	18	17	15	20	19
Neuropsychology	23	25	18	23	23
Psychopathology	16	18	14	19	14
Fundamental Neuroscience	9	17	17	22	23
Neuroeconomics	–	3	6	11	11

Master Physician-Clinical Investigator (MSc/MD)

This four-year FHML programme offers the opportunity to combine a medical degree with a clinical investigator degree. MHeNs, and in particularly the division 1 and 2, are involved in this program of FHML, as being coordinators of different modules, coordination of the neuroscience internships, and several other important teaching roles within the programme.

5.2 PhD Programme

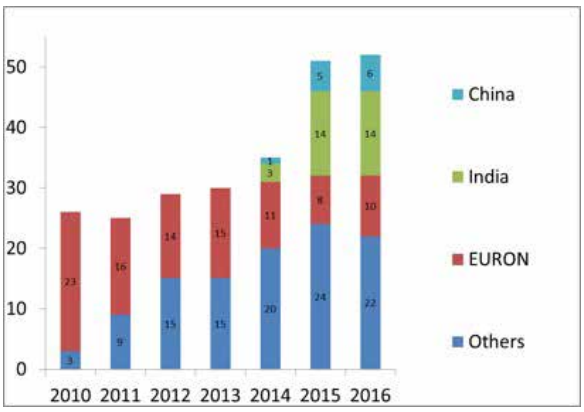
In 2015, MHeNs has 205 registered PhD candidates, of whom 66 are employed by MHeNs as regular PhD students. Furthermore, there are 139 external promovendi. Regular PhD contracts are for 3 or more common 4 years. Each candidate is supervised by at least two researchers, including at least one full professor. MHeNs has established educational guidelines, whereby PhD students with a 4-year contract are expected to complete educational activities equivalent to at least 20 European credits (EC/ECTS). The PhD students formulate and regularly update their personal education plan in consultation with his/her supervisors, based on an assessment of previously acquired competencies, skills specifically needed for the PhD research, more general knowledge and skills, and future career plans. The PhD student programme of MHeNs has a strong multidisciplinary character and is embedded within the European Graduate School of Neuroscience (EURON). As part of their training, PhD candidates are expected to follow both general courses offered by Maastricht University (for example, writing skills, statistics, teaching skills, and career development) and more specific, research-related courses organized by MHeNs and EURON (Annex 1).
In addition PhD students have had the opportunity to present their work via oral or poster presentations at the annual Research Day of MHeNs (Oct. 6th, 2015) and in addition at the annual EURON PhD days (Oct. 5th, 2015).
To stimulate the interaction and research collaboration across the three MHeNs divisions, the full-day PhD workshop series "Topics in Translational Neuroscience" were initiated in 2010. These workshops consist of two parts: introductory talks in the morning and an interactive program of using group discussion, debates or assignments in the afternoon. In 2015 MHeNs has organized the 9th MHeNs one-day workshop for PhD students "When the brain is under attack: auto-antibodies and neurotransmitters as key player in neurological and psychiatric diseases" (April 15th, 2015).

European Graduate School of Neuroscience (EURON)

EURON is a research and training network of 11 Belgian, German, French, Dutch and Luxembourg universities whose partners aim to share expertise and knowledge to offer Master and PhD students a unique chance to broaden their research competencies and horizon. Ever since 1995, MHeNs has been the principal coordinator of EURON.
EURON aims for joint PhD positions between partner universities resulting in joint or double PhD doctorates and continues to work towards the accreditation of a joint Master programme in Translational Neuroscience (EMTN). EURON organizes PhD courses and workshops with input of the expertise of all EURON partners.

Figure 1 shows the international profile of the MHeNs (regular) PhD students. During the last years not only the number of PhD students has increased but also the number of PhD students working in joint international programmes for instance the EURON network or in collaborative programmes with India and China.

Figure 1 Number of PhD students involved in international collaborative research programmes



MHeNs and EURON certificate

To receive a MHeNs certificate at the end of the PhD trajectory, the PhD candidate needs to have the following activities included in the required 20 EC: at least one presentation (oral or poster) of the PhD research at a national or international congress; two or more presentations at the annual MHeNs Research Day; participation in two or more MHeNs Topics in Translational Neuroscience workshops. There are separate requirements for the MHeNs certificate and the EURON certificate; it is possible to obtain both. For the EURON certificate the most important requirement is a scientific exchange visit(s), related to the PhD

research, preferably to other EURON research groups (or other international research group) for a total period of at least 3 months. In 2015, 5 PhD candidates qualified for the MHeNs certificate whereas 6 PhD candidates qualified for the EURON certificate.

MHeNs Educational Committee

Four senior committee members (Dr Pauline Aalten, MD PhD, Dr Nancy Nicolson, PhD, Dr Jos Prickaerts, PhD, Dr Nicole Senden, PhD) meet once every 3 months; representing all three MHeNs divisions their backgrounds and areas of educational expertise span the allied Master tracks, the MHeNs PhD programme and the EURON PhD training programme.

MHeNs PhD coordinator

The MHeNs PhD coordinator's role is to facilitate communication between promovendi and the MHeNs Board, to monitor the School's PhD educational programme and develop new course offerings, and to provide confidential support and guidance. Since 2008, Dr N. Nicolson has served in this role.

Monitoring of PhD progress and satisfaction

The online monitoring system TRACK plays a central role in assuring the quality of the PhD trajectory. Track not only enables closer monitoring of the PhD students via twice-yearly progress assessments, but also enables PhD students and supervisors to develop, update, and share the individual Training and Supervision Plan (TSP), the Personal Research Plan, and the PhD's portfolio of educational and professional activities, as well as research output. Furthermore, in an annual survey, PhD students assess their own progress, education, and career development; quality of supervision is assessed in a strictly confidential section of this survey, visible only to the PhD coordinator. This information is used to improve the quality of the PhD training program in general, but also (as needed, and with the respondent's permission) to investigate individual interventions to facilitate progress or improve communication within the research team. Via TRACK document folders as well as via the MHeNs website promovendi have access to all information needed at each stage of the PhD trajectory: end-terms, UM dissertation regulations, requirements for obtaining the MHeNs education certificate, etc. Additional information is regularly forwarded to them by the PhD coordinator and the MHeNs office. The quality of the PhD dissertation is guaranteed by MHeNs guidelines (3-4 published/ accepted international, peer-reviewed, first-authored papers) and approval by the promoter and the independent dissertation assessment committee.

MHeNs PhD representation

PhD students from each division elected two representatives (Division 1: Lizzy Boots (until March 2015), Isabelle Bos (since March 2015) and Joany Millenaar; Division 2: Iris Lange and Stijn Michielse; Division 3: Maarten van Beek (until March 2015), Sandra Schipper (until October 2015), Roy Lardinoije (since September 2015) and Artemis Iatrou (since September 2015)) who form the PhD committee of the school. One of the committee members is selected as PhD representative, for 2015 this was Isabelle Bos. The role of the PhD committee and the PhD representative is to facilitate communication between PhD students, the PhD coordinator and the MHeNs Board, to facilitate communication among PhD students over the three MHeNs divisions and to help develop PhD grassroots initiatives. They meet on a regular basis to discuss PhD matters (every two months) and think of ways to improve or further develop PhD education, for example by implementing activities such as discussion rounds, symposia, etc. In addition they organised "Pizza meetings" on the following topics: "The use of LinkedIn and other social media to boost your career" presented by Eefje Schoonewille on March 17th, "Hands-on Excel Workshop" presented by Arjan Blokland on September 7th and "R and R studio, a powerful and free alternative for all your data analysis needs!" presented by Wolfgang Viechtbauer on December 8th. To stimulate collaboration between divisions and giving the PhD Students the opportunity to get to know each other, the PhD representatives organise annually a Mingle day. The annual 2015 Mingle day took place on October 30rd and was organised with interesting discussions and workshops regarding the theme "Being healthy and creative at work".

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Based in Europe, focused on the world. Maastricht University is a stimulating environment. Where research and teaching are complementary. Where innovation is our focus. Where talent can flourish. A truly student oriented research university.

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