Specialisation: "Drug Development and Neurohealth" (DN)

The specialisation in Drug Development and Neurohealth (DN) provides students with theoretical background and practical experience of research & development in drug treatments and personalised healthcare. The DN perspective includes discovering and developing treatments for brain diseases and to apply new insights from all disciplines across neuroscience, (clinical) pharmacology and genetics/genomics. The overarching theme is the pipeline of drug discovery & development, it follows the development of drug treatment from molecule to bedside, from chemical design to therapeutic application. This includes pre-clinical research (microorganisms/animals) and clinical trials (on humans) and may include the step of obtaining regulatory approval to market the drug.

In order to study mechanisms of action and efficacy of drugs that are aimed at neuropharmacological brain targets associated with affective-, neurodevelopmental-, neurodegenerative and neurovascular disorders, DN applies methods such as the molecular biological (e.g. proteomics, genomics), neuroanatomical (e.g. immunocytochemistry), electrophysiological (e.g. EEG, ERP) and behavioural techniques (e.g. rodent and human tests) necessary for preclinical and clinical research.

Teaching is undertaken by a multidisciplinary team from the departments of Neuropsychology & Psychopharmacology, Toxicogenomics, Pharmacology, Clinical Pharmacy and Toxicology, Psychiatry & Neuropsychology (Faculties of Psychology and Neuroscience; -Health, Medicine and Life Sciences). The staff consists of biological- /neuro-psychologists, (clinical) pharmacologists, toxicologists and pharmacists. The DN specialisation trains researchers to be equipped for drug discovery & development and personalised healthcare for treatment of brain disorders in academic as well as industrial settings.

Coordinator Drug Development and Neurohealth
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Overview of RM in Drug Development and Neurohealth (DN)

Period	Research Master in Drug Development and Neurohealth (DN) Year 1 (2016-2017) Track Coordinator: Wim Riedel
Period 0	Introduction week: **PSY4950** Introduction in Problem-Based Learning (training for non-UM students*) (- credits): Wladimir van Mansum
Throughout Year 1	**Electives**: **PSY4156** Elective: Course OR **PSY4157** Elective: Review OR **PSY4158** Elective: Research (3 credits each): Vincent van de Ven OR **PSY4159** Elective Research DN (6 credits): Vincent van de Ven OR **PSY4160** Elective: Review DN (6credits): Vincent van de Ven
Period 1 05-09-2016- 28-10-2016	**Core Courses: **** **PSY4311**** Introduction to Molecular Biochemical Techniques (5 credits): Pilar Martinez-Martinez *Practical training:* PSY4341 Genes and Proteins: Pilar Martinez-Martinez OR **PSY4312**** Introduction to Psychology (5 credits): Eef Theunissen **PSY4814** Drug Metabolism and Safety (5 credits): Jacco Briedé **PSY4106** Advanced Statistics I (3 credits): Nick Broers *Practical training:* PSY4119 SPSS I and Lisrel: Nick Broers
Period 2 31-10-2016 – 23-12-2016	**Core courses:** **PSY4812** Drug Discovery (5 credits): Arjan Blokland, Harald Schmidt *Practical training:* PSY4821 Robot-based High-Throughput Screening: Arjan Blokland, Harald Schmidt **PSY4813** Big Data in Drug Discovery & Development (4 credits): Jos Kleinjans, Danyel Jennen *Practical training:* PSY4822 Computer Supported Training in Big Data in Drug Discovery & Development: Jos Kleinjans, Danyel Jennen **PSY4106** Advanced Statistics I: Nick Broers *Practical training:* PSY4119 SPSS I and Lisrel: Nick Broers
	Workshop: **PSY4831** Valorisation (1 credit): Henri Theunissen
Christmas break	
Period 3 09-01-2017 – 03-02-2017	**Core course:** **PSY4811** Medical Needs & Failures, Target Discovery (4 credits): Wim Riedel, Harald Schmidt
	Skills training: **PSY4108** Neuroanatomy (1 credit): Jos Prickaerts
	Workshop: **PSY4833** Drug Discovery & Development Project Management (1 credit): Rudy Schreiber
	PSY4100 Colloquia (total of 1 credit): Milene Bonte, Matthias Wibral, Jos Prickaerts, Eric Vuurman, Anne Roefs, Wim Riedel
Period 4 06-02-2017 – 07-04-2017	**Core course:** **PSY4815** Clinical Development (3 credits): Wim Riedel, Harald Schmidt **PSY4816** Pharmacoepidemiology, Drug Safety & Pharmaceutical Policy (4 credits): Frank de Vries, Andrea Burden **PSY4107** Advanced Statistics II (total of 3 credits): Gerard van Breukelen

	Practical training: PSY4117 SPSS II: Gerard van Breukelen
	Workshop: **PSY4832** Biomedical Brain Imaging (3 credits): Lisbeth Evers, Desmond Tse **PSY4110** Scientific Writing (1 credit): Jim Schumacher
	PSY4100 Colloquia: Milene Bonte, Matthias Wibral, Jos Prickaerts, Eric Vuurman, Anne Roefs, Wim Riedel
Period 5 10-04-2017 – 09-06-2017	**Core course:** **PSY4322** Electrophysiology: From Single Cell Activity to 'Cognitive' Markers (4 credits): Inge Timmers **PSY4817** Personalised Healthcare (4 credits): Marlies van Duinen **PSY4107** Advanced Statistics II: Gerard van Breukelen *Practical training:* PSY4117 SPSS II: Gerard van Breukelen
	PSY4100 Colloquia: Milene Bonte, Matthias Wibral, Jos Prickaerts, Eric Vuurman, Anne Roefs, Wim Riedel
Period 6 12-06-2017-07-07-2017	**Core course:** **PSY4415** Neuropsychopharmacology (total of 3 credits): Jan Ramaekers
	Workshop: **PSY4335** Psychopharmacology (1 credit): Peter van Ruitenbeek **PSY4112** Research Grant Writing Workshop (1 credit): Pauline Aalten, Sebastian Köhler
	PSY4100 Colloquia: Milene Bonte, Matthias Wibral, Jos Prickaerts, Eric Vuurman, Anne Roefs, Wim Riedel

**Students from Erasmus Rotterdam receive an exemption for PBL training*

***PSY4311: This introduction course is required for students with a psychological background. The parallel course PSY4312 is required for students with a biological background. Thus, students enroll in either PSY4311 or PSY4312. The course coordinators of both courses evaluate which of the two courses a student is required to take.*

Period	**Research Master in Drug Development and Neurohealth (DN) Year 2 (2017-2018)**
Period 1	**Core course:** **PSY5112** Research Grant Writing Course (3 credits): Pauline Aalten, Sebastian Köhler **PSY5812** Applied Therapeutics (3 credits): Jan Ramaekers, Paddy Janssen
	Workshop: **PSY5332** Behavioural Tests and Models (1 credit): Jos Prickaerts
	Electives: **PSY4156** Elective: Course OR **PSY4157** Elective: Review OR **PSY4158** Elective: Research (3 credits each): Vincent van de Ven OR **PSY4159** Elective Research DN (6 credits): Vincent van de Ven OR **PSY4160** Elective: Review DN (6credits): Vincent van de Ven
32 weeks	**PSY5107** Research Proposal**, PSY5120/5121** Research Internship & **PSY5103** Master's Thesis (50 credits): Sandra Mulkens

PSY4950 will be offered in all RM specialisations. ***See CN***

Colloquia

PSY4100 Colloquia will be offered in all RM specialisations. ***See CN***

Core courses

PSY4106 Advanced Statistics 1 and PSY4119 SPSS I and Lisrel ***See CN***
PSY4311 Introduction to Molecular Biochemical Techniques and PSY4341 Genes and Proteins ***See FN***
PSY4312 Introduction to Psychology ***See FN***
PSY4107 Advanced Statistics 2 and PSY4117 SPSS II ***See CN***
PSY4322 Electrophysiology ***See FN***
PSY4415 Neuropsychopharmacology ***See NP***
PSY5112 Research Grant Writing Course ***See CN***

Title	**Drug Metabolism and Safety**
Period	1
Code	PSY4814
ECTS credits	5
Organisational unit	Department of Toxicogenomics (FHML)
Coordinator	Jacco Briedé
Descriptions	This course provides an insight into human drug metabolism at the molecular and cellular level, from pharmacological to toxic levels, and drug safety evalution processes, ranging from insight into the current safety regulations to novel concepts in safety assessment based on scientific innovations in cell models to replace test animals and in-silico-tools recently developed for a better prediction of drug safety before market introduction. It will also focus on the advantages of personalized medicine, pharmacokinetics and toxicogenomics. It will provide insight into how to extract relevant information such as dose finding and pharmacokinetics, from toxicological datasets (PredTox, TG-GATEs, diXa) and how this can be used to predict (un)safety, related mechanisms and unwanted side effects of different drugs.
Goals	Knowledge of: Pharmacokinetics, drug metabolism, dose finding; toxicology, toxicogenomics drug safety evaluation, regulatory requirements; Skills: detection of the differential toxic effects on (yeast) cells containing different polymorphisms in CYPs.
Instruction language	EN
Prerequisites	
Recommended literature	
Teaching methods	Assignment Paper PBL Presentation Skills
Assessment methods	Attendance Final Paper Presentation
Key words	drug safety, pharmacokinetics, drug toxicity, in-silico tools

Title	Drug Discovery
Period	2
Code	PSY4812
ECTS credits	5
Organisational unit	Neuropsychology and Psychopharmacology (FPN) and Pharmacology and Personalised Medicine (FHML)
Coordinator	Arjan Blokland, Harald Schmidt
Descriptions	Student will become acquainted with the different strategies of drug discovery from early stages in which molecules are screened in low to high throughput screens from representative chemical or virtual libraries; subsequently, the obtained hit molecules are optimized with respect to pharmacodynamics and pharmacokinetics (ADME) to first lead compounds for in vivo testing in healthy animals and animal models of disease; this is followed by further optimization until eventually candidate molecules for registration and clinical development are defined. Patenting may occur at any point along that time-line and has to take the compound life cycle and later clinical development failures into account. Next to small molecule discovery, attention will be given to the recent development of recombinant human(ized) therapeutic antibodies. As a prerequisite for these rather standard processes, classical and possible future strategies of target identification and validation will be presented and analyzed. In this context, important issues regarding the translational value of in vitro vs. in vivo models will be discussed.
Goals	Knowledge of: First stages of drug development, development from molecules to lead compound, development of therapeutic antibodies, ADME, translational issues.
Instruction language	EN
Prerequisites	
Recommended literature	Drug Discovery and Development, 2nd Edition. Technology in Transition. R. Hill (Ed). Elsevier, 2013; Journal Articles.
Teaching methods	PBL Presentation
Assessment methods	Attendance Presentation Final paper
Key words	hit, lead (optimization), candidate, target engagement, structure activity relationship (SAR), target identification and validation, low-high throughput screening, recombinant antibody, phage display, common mechanisms, ADME

The practical training associated with PSY4812 Drug Discovery is PSY4821 Practical training: Robot-based High-Throughput Screening

Title	**Practical training: Robot-based High-Throughput Screening**
Period	2
Code:	PSY4821
ECTS Credits	0
Organisational Unit	Neuropsychology & Psychopharmacology (FPN) and Pharmacology and Personalised Medicine (FHML)
Coordinator	Arjan Blokland, Harald Schmidt
Description	Practical along with Core Course 'Drug Discovery'. A visit will be made at the medium throughput screening at the department of Pharmacology and Personalised Medicine, and a site visit to a high-throughput laboratory at Grünenthal (Aachen) or J&J (Beerse). During these visits the students will also be given more background information on the automated systems.
Goals	Knowledge of: The practical aspects of Medium/High throughput screening in the pharmaceutical industry.
Language Of Instruction	EN
Prerequisites	
Recommended Literature	
Teaching Methods	Working Visit
Assessment Methods	Attendance
Keywords	medium/high throughput screening, methods, automatisation

Title	**Big Data in Drug Discovery and Development**
Period	2
Code	PSY4813
ECTS credits	4
Organisational unit	Department of Toxicogenomics (FHML)
Coordinator	Jos Kleinjans, Danyel Jennen
Descriptions	This course provides an in-depth insight how to exploit information publicly available in multiple web-based data infrastructures and how to use different software tools for drug discovery, design and further development. It will provide an introduction to how drugs can be designed using tools that can be applied for docking of potential molecular drug structures to protein targets, computerized tools that can be used to calculate properties of drugs (e.g. logP, Molecular Weight, Lipinski Parameters, etc.) and abstracted bioactivities (e.g. binding constants, pharmacology and ADMET). Also it will provide insight how to use genomics data for complementing drug structure-activity relationships, including data retrieved from patients which can be applied for identifying potential targets of drugs. The course also encompasses practical training in using these different in silico tools which will be used to gather information about potential drugs and of existing drugs.
Goals	Knowledge of: Biomarker discovery, exploring mechanisms, use of omics approaches; in-silico modelling, computerized drug-protein interactions and activities; training how to use different databases, eTox, ChEMBL, Open Phacts, Open TG-GATEs, diXa, as well as relevant software tools; Skills: Computer supported Training in Big Data in Drug Discovery & Development; Biology underlying fundamental psychological processes.
Instruction language	EN
Prerequisites	
Recommended literature	
Teaching methods	Assignment Paper PBL Presentation Skills
Assessment methods	Attendance Final Paper Presentation
Key words	omics, drug discovery & development, big data, bioinformatics

The practical training associated with PSY4813 Big Data in Drug Discovery and Development is PSY4822 Practical training: Computer supported Training in Big Data in Drug Discovery and Development

Title	**Practical training: Computer supported Training in Big Data in Drug Discovery and Development**
Period	2
Code:	PSY4822
ECTS Credits	0
Organisational Unit	Toxicogenomics (FHML)
Coordinator	Jos Kleinjans, Danyel Jennen
Description	Skill training along with Core Course 'Big Data in Drug Discovery & Development'. In this training you'll experience a hands-on approach for modern target identification and validation. You'll get familiar with the tools used in drug target evaluation and perform your own drug target analyses. Furthermore, you'll use genomics data for complementing drug structure-activity relationships and for identifying potential targets of drugs. Finally, you'll use the different data sources to categorize / group drugs via an integrated approach.
Goals	Knowledge of: Skills in using different in silico tools which will be used to gather information about potential drugs and existing drugs.
Language Of Instruction	EN
Prerequisites	
Recommended Literature	
Teaching Methods	Assignment
Assessment Methods	Attendance Presentation
Keywords	omics, drug discovery & development, big data, bioinformatics

Title	**Medical Needs & Failures, Target Discovery**
Period	3
Code	PSY4811
ECTS credits	4
Organisational unit	Neuropsychology and Psychopharmacology (FPN) and Pharmacology and Personalised Medicine (FHML)
Coordinator	Wim Riedel, Harald Schmidt
Descriptions	Student will become acquainted with existing treatments, current and new targets in Neuroscience, i.e. how current knowledge of neuropsychiatric disease processes relates to existing medicinal drugs and research and development of new medicinal drugs. In this course we will focus on identifying neurobiological substrates of the major Neuropsychiatric diseases such as Alzheimers Disease, Schziophrenia, Depression and ADHD for which there still exist largely unmet medical needs, because of incomplete or absent treatment efficacy. This will be annotated with examples from the literature. Treatment failures include marginal symptomatic treatments in Alzheimers Disease, efficacious treatments, but with abuse potential (benzodiazepines) in anxiety disorders and sleep disorders, a plausible but highly underinvestigated association between SSRI antidepressant use in adolescents and suicide rates. Some attention will also be paid to rare diseases. For example in Alzheimers Disease only symptomatic pharmacological treatments are available while to date there is extensive research and development of novel disease modifying biologics treatments. This is a therapeutic area where many clinical trials have failed in the recent past. Ongoing investigations focus on vaccine or antibody treatments aimed at clearance or prevention of amyloid plaques and neurofibrillary tangles in order to obtain primary prevention therapies. A similar review of the current status of drug discovery and development will be made for schizophrenia, depression and ADHD. Neurogenetics / neurogenomics. Attempts to define the pathogenesis of brain disorders have mostly resisted simple molecular description. To unravel the genome of neuropsychiatric diseases, from genome-wide association studies to rare variants, may take decades, even for the most well understood genetic disorders. Challenges for the field of neurogenetics will be addressed which may help to translate human genetics into new therapeutics for brain disorders.
Goals	Knowledge of: CNS Biomarkers, Clinical Targets in Neuroscience Drug Development, Pharmacological Targets in Neuroscience Drug Development, Target Identification and Target-Validation.
Instruction language	EN
Prerequisites	
Recommended literature	Journal articles.
Teaching methods	Lecture Assignment PBL Presentation
Assessment methods	Attendance Final Paper
Key words	target identification, target validation, disease dissection

Title	Clinical Development
Period	4
Code	PSY4815
ECTS credits	3
Organisational unit	Neuropsychology and Psychopharmacology (FPN) and Pharmacology and Personalised Medicine (FHML)
Coordinator	Wim Riedel, Harald Schmidt
Descriptions	Students will become acquainted with the concept of a clinical development plan and the critical path of studies in early and late development.
Goals	Knowledge of: Target product profile, single ascending dose studies, multiple ascending dose studies, experimental medicine studies, dose finding, proof of concept, efficacy, safety; phases of clinical development (I-III) and special cases, i.e. development of anti-cancer drugs and biologicals as models for drug development in neuroscience; role of biomarkers in patient stratification, target engagement and outcome/efficacy prediction; novel trial formats, e.g. adaptive trials, single-case observations, non-Bayesian statistics; relevant outcome parameters versus surrogate parameters; recent cases of development failures and reasons; drug repurposing and repositioning; development pipelines.
Instruction language	EN
Prerequisites	
Recommended literature	Drug Discovery and Development, 2nd Edition. Technology in Transition. R. Hill (Ed). Elsevier, 2013; Journal articles.
Teaching methods	Lecture Assignment PBL Presentation
Assessment methods	Attendance Final Paper
Key words	drug development, phase I, phase II, phase III, phase IV, proof of concept, dose finding, biomarkers, outcomes, trial design, repurposing/repositioning

Title	**Pharmacoepidemiology, Drug Safety & Pharmaceutical Policy**
Period	4
Code	PSY4816
ECTS credits	4
Organisational unit	Clinical Pharmacy and Toxicology, Maastricht UMC+ (FHML)
Coordinator	Frank de Vries, Andrea Burden
Descriptions	When a new medicine is granted a marketing authorization, its clinical safety profile has been assessed on the basis of results from randomised clinical trials (RCTs). The number of patients recruited for these pre-marketing (Phase-III) trials (in general up to 3,000), is able to detect adverse events that occur with frequencies of up to 1:1000 patient-years. Therefore, it is difficult to adequately assess the risk/benefit profile of a drug for regulatory authorities, such as the US Food and Drug Administration (FDA) or the European Medicines Agency (EMA). The authorities will ultimately decide whether a drug can remain on the market, whether its use will be restricted to certain subgroups of patients or whether it will be entirely pulled off the market. This problem is further enhanced by exclusion criteria for patients enrolled in RCTs, and their short duration of follow-up (generally several months up to 2-3 years). The intake of other medications or inclusion of children, elderly or pregnant women- such as in a real life setting - is often not allowed in RCTs. As a result the EMA and FDA usually request pharmaceutical companies to conduct so called post-authorisation safety (PASS) studies. Similar studies are also conducted by other stakeholders such as academia or drug regulators such as the FDA. This course will give an overview of the lifecycle of drug development, with a strong emphasis on pharmacoepidemiology in Phase IV research. It will evaluate stakeholders, legislation scientific methods and commonly used data sources to assess the risk-benefit profile of drugs after market authorisation.
Goals	Knowledge of: The latest developments of the regulatory process of drug development (Phase I-IV); common and novel pharmacoepidemiological methods for the conduct of post-authorisation safefty studies (PASS). These include meta-analysis, case-control studies, cohort studies, and case-only methods; commonly used datasources for the conduct of Phase IV research, inlcuding their strengths and limitations; risk/benefit assessments by regulatory agencies; pharmacovigilance procedures; the interactions between patients, prescribers, and payers (health insurance companies and governments).
Instruction language	EN
Prerequisites	
Recommended literature	B. Strom et al. Pharmacoepidemiology, 4th or 5th edition; KJ Rothman et al. Modern Epidemiology, 2nd or 3rd edition.
Teaching methods	Lecture PBL
Assessment methods	Attendance Written exam
Key words	pharmacoepidemiology, drug safety, pharmaceutical policy

Title	**Personalised Healthcare**
Period	5
Code:	PSY4817
ECTS Credits	4
Organisational Unit	Psychiatry & Neuropsychology (FHML)
Coordinator	Marlies van Duinen
Description	"One size fits all" no longer is the reference point of modern healthcare. This course focusses on state of the art techniques that offer solutions for tailored medicine, including genotyping, metabolomics and biomarkers. On the other hand, challenges beyond methodology such as regulation and ethics are considered as well to provide the student with a broad view of comprehension of the (im)possibilities of Personalised Healthcare.
Goals	Knowledge of: The concept of Personalised Healthcare, available markers in the field of Neuroscience e.g. PET and liquor markers, metabolomics, genotyping.
Language Of Instruction	EN
Prerequisites	
Recommended Literature	Journal articles; Websites.
Teaching Methods	Assignment Lecture PBL Presentation
Assessment Methods	Attendance Assignment Presentation
Keywords	personalised healthcare, Alzheimer's Disease, depression, schizophrenia, biomarkers, ethics, regulation

Title	Applied Therapeutics
Period	1
Code	PSY5812
ECTS credits	3
Organisational unit	Neuropsychology & Psychopharmacology (FPN) and Clinical Pharmacy and Toxicology, MUMC+ (FHML)
Coordinator	Jan Ramaekers, Paddy Janssen
Descriptions	This course addresses prevalence of psychiatric disorders and the use of psychotropic drugs. The students will be presented pharmacotherapeutic data of several drugs, necessary to start a therapeutic regimen for individual patients. Clinical pharmacological knowledge will be applied to several cases within different drug groups, i.e. cardiac and CNS drugs, with the objective to maximize drug effects while minimizing side effects (i.e. movement, cardiovascular, sexual and CNS side effects). The influence of genetic polymorphisms and drug-drug interactions on patient dependent drug choice and treatment adherence.
Goals	Knowledge of: The epidemiology of psychiatric diseases and CNS drugs in the general population; pharmacokinetic and pharmacodynamics properties of CNS drugs, including genetic polymorphisms; how to translate clinical pharmacological concepts into pharmacotherapy of psychiatric diseases.
Instruction language	EN
Prerequisites	
Recommended literature	Journal articles; Book chapters.
Teaching methods	PBL
Assessment methods	Attendance Final Paper Presentation
Key words	clinical pharmacology, pharmacotherapeutics

Skills training

PSY4108 Neuroanatomy. ***See CN***

Workshops

PSY4110 Scientific Writing. ***See CN***
PSY4335 Psychopharmacology. ***See NP***
PSY4112 Research Grant Writing Workshop. ***See CN***
PSY5332 Behavioural Tests and Models. ***See FN***

Title	Valorisation
Period	2
Code:	PSY4831
ECTS Credits	1
Organisational unit	Maastricht Valorisation Center
Coordinator	Henri Theunissen
Description	This workshop deals with the theory and practice of valorisation. Valorisation is defined as ''The process of value creation from knowledge, by making it applicable and available for economic or societal utilisation, and by translating it in the form of new business, products, services, or processes''. The main item in this workshop is to discover how economic value can be created form neurohealth research. What products, services, and tools with practical applicability and commercial spinoff can be derived from this work? Can we create patents, licenses, startups and/or research collaborations based on new findings? If so, how can this be envisaged? Who could be potential partners and how do we approach them to find appropriate developers, manfacturers, and market parties? What are critical success factors to arrive at a favourable outcome? All of these matters will be dealt with in an interactive setting with students.
Goals	Knowledge of: Valorisation theory and practice; the creation of tangible output from neurohealth research in the form of products, services and/or tools and the role patents, licenses, startups and collaborations can play to arrive at that stage.
Language Of Instruction	EN
Prerequisites	
Recommended Literature	
Teaching Methods	Assignment Lecture PBL Presentation(s) Work in subgroups
Assessment Methods	Assignment
Keywords	valorisation, value creation, startup, license, patent, collaboration

Title	**Drug Discovery & Development Project Management**
Period	3
Code:	PSY4833
ECTS Credits	1
Organisational Unit	Neuropsychology & Psychopharmacology (FPN)
Coordinator	Rudy Schreiber
Description	**Background**. A key component of every discovery project is the so-called 'progression scheme'. The stages of such a scheme typically consists of a series of activities, such as target identification and hit finding, with corresponding milestones, such as target selection and the selection of hits. Selection of the right assays, tests and models, and the implementation of relevant criteria for compounds to pass to the next stage is essential for the success of a discovery project. As is management of the compound flow through the various stages. **Project management**. In this hands-on course, the elements of the progression scheme will be explained and how the different activities are connected with each other. Subsequently, students will work in small teams to develop a progression scheme for a defined CNS discovery project. Activities and timelines will be recorded in a simplified Gantt chart. Every team will present their scheme at the end of the workshop.
Goals	Knowledge of: Progression scheme; target identification & selection; target assessment & validation; hit finding & identifcation; high throughput screening; lead finding & selection; nomination preclinical development candidate; Proof of Mechanism & Proof of Concept; behavioral models for CNS diseases; project management, multidisciplinary teams; Gantt chart.
Language Of Instruction	EN
Prerequisites	
Recommended Literature	Hughes et al (2011): Principles of early drug discovery. Br J Pharmacol 162: 1139-49.
Teaching Methods	Lecture Presentation
Assessment Methods	Attendance Presentation
Keywords	screening cascade, project stages, filter criteria, project milestones, Gantt chart

Title	**Biomedical Brain Imaging**
Period	4
Code:	PSY4832
ECTS Credits	3
Organisational Unit	Neuropsychology & Psychopharmacology (FPN)
Coordinator	Lisbeth Evers, Desmond Tse
Description	Imaging technologies provide powerful insights into the distribution, binding, and other biological effects of pharmaceuticals. Imaging techniques enable direct assessment of the relationship between drug plasma concentration and target occupancy. Neuroimaging thus allows testing whether a new chemical entity reaches brain target tissue in sufficient amounts to be pharmacologically active. Therefore neuroimaging can yield important biomarkers and surrogate endpoints during assessment of disease progression and treatment outcome.
Goals	Knowledge of: Different brain imaging methods that are used in preclinical and clinical drug development, such as PET, SPECT, MRS and MRI; opportunities and challenges of biomedical imaging during different phases of drug development will be discussed.
Language Of Instruction	EN
Prerequisites	
Recommended Literature	
Teaching Methods	Lecture PBL Presentation
Assessment Methods	Attendance Presentation
Keywords	biomedical imaging, drug development, PET, SPECT, MRS, ph-MRI

Electives

PSY4156 Elective: Course, PSY4157 Elective: Review and PSY4158 Elective: Research will be offered in all RM specialisations. ***See CN***

Title	Elective: Research DN
Period	throughout
Code	PSY4159
ECTS credits	3
Organisational unit	Cognitive Neuroscience (FPN)
Coordinator	Vincent van de Ven
Descriptions	Students can participate in (parts of) an empirical research project that is conducted and supervised by a member of the FPN or FHML scientific staff. Students can apply for an available project from the list of project descriptions; available on the 'RM Electives' section on EleUM, which is published and updated in December of each year. The application procedure is also described on the 'RM Electives' section on EleUM. Students who are selected to participate in a research elective may assist in designing the experiment or observational study, acquire empirical data, be trained in using measurement equipment, analyse empirical data, or take part in other parts of the research project. Students must write a short research report of maximally 5 pages about the practical experience obtained. Students are expected to spend 84 hours on the Elective: Research course, which includes time spent on practical work and the research report. The principal investigator of the project will supervise the practical work and grade the research report. Each student may complete maximally one Elective: Research course. The Elective: Research course must be completed and graded before the start of the internship.
Goals	Knowledge of: Planning or designing empirical research, empirical data analysis, writing research report, quantitative methods, conducting research, skill learning of data acquisition techniques, functioning in a research team.
Instruction language	EN
Prerequisites	
Recommended literature	
Teaching methods	Assignment(s) Lecture(s) Paper(s) Patient contact PBL Presentation(s) Research Skills Training(s) Work in subgroups
Assessment methods	Final paper Participation
Key words	elective, practical research, empirical research

Title	**Elective: Review DN**
Period	throughout
Code	PSY4160
ECTS credits	6
Organisational unit	Cognitive Neuroscience (FPN)
Coordinator	Vincent van de Ven
Descriptions	Students write a critical literature review based on a specialised topic, under the supervision of a member of the scientific staff of Maastricht University. Students take the initiative to locate and arrange a supervisor for the review. The review topic, content and format will be determined by mutual agreement between student and supervisor. Students are expected to devote 84 hours to the Review Elective. Each student may complete maximally one Review or one Research elective (PSY4158). The Review Elective must be completed and assessed prior to the start of the internship.
Goals	Knowledge of: Extracurricular interests, specialisation on topic of interest, supervised scientific writing, literature review.
Instruction language	EN
Prerequisites	
Recommended literature	
Teaching methods	Paper(s)
Assessment methods	Final paper
Key words	elective, review paper, paper assignment, literature review, writing assignment

Research Internship and Master's Thesis. ***See CN***