Specialisation in Fundamental Neuroscience (FN)

The specialisation in Fundamental Neuroscience provides students with both the theoretical background and practical experience of researchers at the interface between neuroscience and psychology, thus offering interdisciplinary cross-integration. The focus is on acquiring 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 basic research. In addition, the specialisation provides an in-depth study into state-of-the-art knowledge of physiological and pathophysiological mechanisms underlying psychological, psychiatric and neurological disorders (e.g. affective disorders, cognitive disorders, motor disorders). Within this context, the role of the emerging fields of neuroinflammation and pain is also studied. Main research topics include cell signalling, brain plasticity, neurodegeneration, regeneration, genetics and epigenetics in a translational setting (in both animal and human). Teaching is undertaken by a multidisciplinary team from the Faculty of Psychology and Neuroscience (FPN) and, in particular, the School for Mental Health and Neuroscience of the Faculty of Health, Medicine and Life Sciences (FHML). The staff consists of professionals from relevant disciplines and includes biological psychologists, molecular biologists, neuropsychologists, neurobiologists, neuroanatomists, psychopharmacologists, immunologists and psychiatrists. The specialisation in Fundamental Neuroscience trains researchers to be equipped for investigations into the underlying fundamental molecular mechanisms of psychological and psychiatric disorders in academic as well as industrial settings.

Coordinator Fundamental Neuroscience
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Overview RM in Fundamental Neuroscience (FN)

Period	Research Master in Fundamental Neuroscience (FN) Year 1 (2016-2017) Track Coordinator: Jos Prickaerts
Period 0	Introduction week: **PSY4950** Introduction in Problem-Based Learning (training for non-UM students*) (- credits): Wladimir van Mansum
Throughout Year 1 and 2	Electives: **PSY4156** Elective: Course OR **PSY4157** Elective: Review OR **PSY4158** Elective: Research (3 credits each): 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 **PSY4313** Neuroanatomy (4 credits): Jörg Mey *Practical training*: PSY4344 Mammalian Macro- and Microscopical Neuroanatomy: Jörg Mey **PSY4106** Advanced Statistics I (3 credits): Nick Broers *Practical training:* PSY4119 SPSS I and Lisrel: Nick Broers
	Workshop: **PSY4113** Scientific Writing (1 credit): Jim Schumacher
Period 2 31-10-2016 – 23-12-2016	**Core courses:** **PSY4314** Neurodegeneration (4 credits): Bart Rutten *Practical training*: PSY4351 Immunocytochemical Staining of Human Postmortem Tissue and Evaluation of the Staining using the Multihead Microscope: Bart Rutten **PSY4315** Biopsychological Neuroscience (4 credits): Jos Prickaerts *Practical training:* PSY4343 Neuropsychological Experiment: Jos Prickaerts **PSY4106** Advanced Statistics I: Nick Broers *Practical training*: PSY4119 SPSS I and Lisrel: Nick Broers
Christmas break	
Period 3 09-01-2017 – 03-02-2017	**Core courses:** **PSY4320** Neurological Neuroscience (5 credits): Govert Hoogland *Practical training*: PSY4347 Genotyping your NMDA Receptor: Govert Hoogland
	Workshop: **PSY4332** Surgery for Intractable Movement and Psychiatric Disorders (1 credit): Ali Jahanshahianvar
	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 courses:** **PSY4317** Neuroimmunology and Inflammation (5 credits): Mario Losen, Pilar Martinez-Martinez *Practical training*: PSY4349 Neuroinflammation: Mario Losen **PSY4336** Neuroplasticy and Pain (5 credits): Bert Joosten *Practical training*: PSY4346 Cell Culture: Bert Joosten **PSY4107** Advanced Statistics II (total of 3 credits): Gerard van Breukelen *Practical training*: PSY4117 SPSS II: Gerard van Breukelen

	Workshop: **PSY4337** Commercialising Science and Technology (total of 2 credits): Wynand Bodewes **PSY4832** Biomedical Brain Imaging (3 credits): Lisbeth Evers, Desmond Tse
	PSY4100 Colloquia: Milene Bonte, Matthias Wibral, Jos Prickaerts, Eric Vuurman, Anne Roefs, Wim Riedel
Period 5 10-04-2017 – 09-06-2017	**Core courses:** **PSY4321** Psychiatric Neuroscience (5 credits): Daniel van den Hove, Gunter Kenis *Practical training*: PSY4352 Western Blotting: Daniel van den Hove, Gunter Kenis **PSY4322** Electrophysiology: From Single Cell Activity to 'Cognitive' Markers (4 credits): Inge Timmers **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	**Workshop:** **PSY4112** Research Grant Writing Workshop (1 credit): Pauline Aalten, Sebastian Köhler **PSY4371** Psychiatric Epidemiology (1 credit): Wolfgang Viechtbauer
	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 Fundamental Neuroscience (FN) Year 2 (2017-2018)
Period 1	**Core course:** **PSY5112** Research Grant Writing Course (3 credits): Pauline Aalten, Sebastian Köhler
	Skills training: **PSY4221** EEG and ERP (2 credits): Fren Smulders
	Workshop: **PSY5332** Behavioural Tests and Models (1 credit): Jos Prickaerts **PSY5331** Molecular Genetics (1 credit): Gunter Kenis **PSY5313** Laboratory Animal Sciences (3 credits): Saskia Seeldrayers *Practical training:* PSY5350 Handling Animals and Small Experimental Manipulations: Saskia Seeldrayers
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

Title	Introduction to Molecular Biochemical Techniques
Period	1
Code	PSY4311
ECTS credits	5
Organisational unit	Psychiatry and Neuropsychology (FHML)
Coordinator	Pilar Martinez-Martinez
Descriptions	This course focuses on fundamental biological concepts including cellular organisation, DNA, RNA and proteins. Additionally, this course provides students with a conceptual understanding of the most important concepts in molecular neuroscience. Students are made familiar with selected aspects of molecular biology that provide the non-specialist with the principles for understanding the structure and functional relationships of molecular biology techniques.
Goals	Knowledge of: Cell biology, molecular biology, biochemistry, regulation of gene and protein transcription, research methods in molecular cell biology and vocabulary (e.g. scientific and technical words). Skills: acquisition of basic laboratory techniques, including preparation of buffers, working under sterile conditions, pipetting, pH titration, a protein assay (standard curve), RNA extraction and DNA isolation conventional PCR and Western blot, literature search, preparation of oral presentations, goal oriented group discussion of research problems.
Instruction language	EN
Prerequisites	This introductory 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.
Recommended literature	DNA Science: a first edition (2nd ed.). New York: CSHL press.
Teaching methods	Lecture(s) Paper(s) Presentation(s) Research Skills Tutorials
Assessment methods	Attendance Presentation Written exam
Key words	RNA, DNA, protein, ELISA, RIA, PCR, western blot

The practical training associated with PSY4311 Introduction to Molecular Biology and Biochemistry is PSY4341 Practical training: Genes and Proteins.

Title	**Practical training: Genes and Proteins**
Period	1
Code	PSY4341
ECTS credits	-
Organisational unit	Psychiatry and Neuropsychology (FHML)
Coordinator	Pilar Martinez-Martinez
Descriptions	This practical training provides students with a practical understanding of the most important techniques in molecular neuroscience. Students are made familiar with selected aspects of molecular biology that provide the non-specialist with the principles for understanding the structure and functional relationships of molecular biology techniques This includes basic laboratory techniques such as pipetting, pH titration and a protein assay. Specific techniques performed in the lab are DNA/RNA isolation and analysis, DNA synthesis and PCR
Goals	Knowledge of: Standard techniques in molecular research laboratories, acquaintance with terms of molecular biology/biochemistry.
Instruction language	EN
Prerequisites	Read carefully the mandatory literature listed below
Recommended literature	Lodish, H. et al., Molecular Cell Biology; Alberts, B. et al., Essential Cell Biology. In both books the chapters and panels on protein separation and analysis and on gene expression analysis.
Teaching methods	Papers and textbook chapters Research Skills Training Work in subgroups
Assessment methods	Attendance Final paper Written exam
Key words	general laboratory techniques, RNA, DNA isolation, protein purification, ELISA, PCR/ RT-PCR, western blot

Title	Introduction to Psychology
Period	1
Code	PSY4312
ECTS credits	5
Organisational unit	Neuropsychology and Psychopharmacology (FPN)
Coordinator	Eef Theunissen
Descriptions	In this course students acquire an overview of human cognitive psychology. A selected number of psychological themes are covered, surveying knowledge on how humans act and interact, how they differ from each other, how they reason and speak and how they 'know' things. The course focuses on 'normal' human performance, but malfunction and psychopathology are also covered. The major emphasis of the course is on understanding human behaviour by means of cognitive, non-biological theories and paradigms.
Goals	Knowledge of: Social psychology, motivation, perception, personality, behaviour, consciousness, psychological assessment, cognitive psychology.
Instruction language	EN
Prerequisites	This introductory course is required for students with a biological background. The parallel course PSY4311 is required for students with a psychological 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.
Recommended literature	Journal articles; Book chapters.
Teaching methods	Assignment(s) Lecture(s) Paper(s) PBL Presentation(s)
Assessment methods	Attendance Final paper Participation
Key words	introduction, behaviour, cognition, psychology

Title	**Neuroanatomy**
Period	1
Code	PSY4313
ECTS credits	4
Organisational unit	Psychiatry and Neuropsychology (FHML)
Coordinator	Jörg Mey
Descriptions	It is essential to have a basic knowledge of the brain anatomy when working in the field of molecular neuroscience. The aim of the course is to acquaint students with the neuroanatomical terminology and provide insight into the spatial and functional organisation of the brain.. Many specific brain areas can be linked to particular functions. Thus, knowledge of the brain anatomy and its main functions allows direct linkage of specific neurological or psychiatric disorders to particular brain areas. In addition, various other methods of modern brain imaging (both *in vivo* and *ex vivo*) are discussed. The course also encompasses some practical training in which students participate in different practicals to study human, sheep and rat macro and micro brain anatomy.
Goals	Knowledge of: Basic human neuroanatomy, brain imaging, microglia and macroglia, neurons, blood brain barrier, ventricular system, brain vasculature, immunohistochemistry.
Instruction language	EN
Prerequisites	
Recommended literature	Journal articles; Book chapters.
Teaching methods	Assignment(s) Lecture(s) PBL Skills Training(s)
Assessment methods	Attendance Written exam
Key words	neuroanatomy, glia, neurons, blood brain barrier, ventricular system, immunohistochemistry

The practical training associated with PSY4313 Neuroanatomy is PSY4344 Practical training: Mammalian Macro- and Micro-scopical Neuroanatomy

Title	**Practical training: Mammalian Macro- and Microscopical Neuroanatomy**
Period	1
Code	PSY4344
ECTS credits	-
Organisational unit	Psychiatry and Neuropsychology (FHML)
Coordinator	Jörg Mey
Descriptions	You will participate in different practical training sessions to study human, sheep and rat macro and micro brain anatomy. *Practical training 1*: Studying human brain anatomy macroscopically using plastic brain models and plastinated human brains; *Practical training 2*: Dissecting a sheep brain and study mammalian brain anatomy. Special attention is paid to the limbic system and the basal ganglia; *Practical training 3:* Staining of rat brain slices using histochemistry and multi-colour fluorescent labelling with antibodies. Afterwards, these slices are studied microscopically to gain insight in the rat brain anatomy at a cellular level.
Goals	Knowledge of: Human neuroanatomy, sheep neuroanatomy, rat neuroanatomy, microscopy, immunohistochemical staining techniques.
Instruction language	EN
Prerequisites	
Recommended literature	Book chapters.
Teaching methods	Skills Training(s)
Assessment methods	Attendance
Key words	neuroanatomy, immunohistochemistry, human, rat, sheep

PSY4106 Advanced Statistics I will be offered in all RM specialisations. ***See CN***

The practical training associated with PSY4106 Advanced Statistics I is PSY4119. Practical training: SPSS I and Lisrel will be offered in all RM specialisations. ***See CN***

Title	Neurodegeneration
Period	2
Code	PSY4314
ECTS credits	4
Organisational unit	Psychiatry and Neuropsychology (FHML)
Coordinator	Bart Rutten
Descriptions	This course provides an in-depth description of neurodegenerative processes that occur during the development of neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease and Huntington's disease, which are some of the most debilitating disorders that a person can have. Although clinical manifestations of these neurodegenerative diseases are different, they share common features in neuropathology and in the underlying molecular mechanisms. Since they share inclusions (e.g. plaques and tangles) with accumulations of aberrant proteins, the modern terminology for these diseases is conformational diseases. The aim of this course is to gain insight into the mechanisms of neurodegenerative processes, such as the deposition of aggregated proteins, the loss of neurons and synapses, alterations in neurogenesis and inflammatory processes, alterations in metabolic/oxidative state and discussion over whether these are the cause or consequence of the disease. Moreover, this course covers the influences of genetic and environmental factors on disease progression and strategies for therapy. Major emphasis is on the molecular, i.e. the neurochemical and neurobiological mechanisms that affect disease progression. Transgenic animal models as well as brain cell cultures are used to study these.
Goals	Knowledge of: Tauopathies: Alzheimer's disease (AD), Frontal tempolar dementia, Progressive supranuclear palsy, Pick's disease, Argyrophilic grain disease, Synucleinopathies: Parkinson disease, Multisystem atrophy. Polyglutamine diseases: Huntington, and Spinocerebellar ataxias. Mixed pathogies; Diffuse Lewy body disease, Number of affected persons; World wide, USA and The Netherlands, early and late onset AD, Aging, Amyloid beta cascade hypothesis, amyloid precursor protein, Presenelin 1 and 2, Tau, ubiquitin, ApoE polymorphism, risk factors, oxidative stress, loss of synapses, energy metabolism, plaques, tangles, neuronal loss, gliosis, cytoarchitecture of hippocampus and neocortex.
Instruction language	EN
Prerequisites	Laboratory skills are recommended.
Recommended literature	Van Leeuwen et al., Frameshift mutants of amyloid precursor protein and ubiquitin-B are prominent in Alzheimer and Down patients. Science 279, 242-247, 1998; Irmler, M., et al., Long-term proteasomal inhibition in transgenic mice by UBB^{+1} expression results in dysfunction of central respiration control reminiscent of brainstem neuropathology in Alzheimer patients, Acta Neuropathologica, 124, 197-197, 2012; Mucke, L., and Selkoe D.J. Neurotoxicity of Amyloid β-protein: Synaptic and Network Dysfunction, Cold Spring Harbor Perspectives in Medicine 1-17, 2012.

Teaching methods	Assignment(s) Lecture(s) Presentation(s) Research Skills Training(s) Work in subgroups PBL
Assessment methods	Attendance Presentation Written exam
Key words	tauopathies (e.g. Alzheimer's), synucleinopathies (e.g. Parkinson), polyglutamine diseases (Huntington), neurodegenerative mechanisms

The practical training associated with PSY4314 Neurodegeneration is PSY4351 Practical training: Immunocytochemical Staining of Human Postmortem Tissue and Evaluation of the Staining Using the Multihead Microscope

Title	**Practical training: Immunocytochemical Staining of Human Postmortem Tissue and Evaluation of the Staining using the Multihead Microscope**
Period	2
Code	PSY4351
ECTS credits	-
Organisational unit	Psychiatry and Neuropsychology (FHML)
Coordinator	Bart Rutten
Descriptions	An immunocytochemical procedure will be followed to label plaques (ABeta) and neurofibrillary tangles (abnormal Tau) and to the staining will be evaluated afterwards using the multihead microscope.
Goals	Knowledge of: Collecting Postmortem tissue, fixation, paraffin, immunocytochemical staining, recognition of neuropathological hallmarks in Tauopathies: Alzheimer's disease (AD); plaques, tangles Synucleinopathies: Parkinson disease, Multisystem atrophy. Polyglutamine diseases: Huntington, and Spinocerebellar ataxias. Mixed pathogies; Diffuse Lewy body disease, early and late onset AD, Amyloid beta cascade hypothesis, amyloid precursor protein, Tau, ubiquitin, GFAP, gliosis, cytoarchitecture of hippocampus and neocortex.
Instruction language	EN
Prerequisites	
Recommended literature	Handbooks on practical immunohistochemistry (on EleUM).
Teaching methods	Lecture(s) PBL Research Skills Training(s)
Assessment methods	Attendance Observation Take home exam
Key words	tauopathies (e.g. Alzheimer's), synucleinopathies (e.g. Parkinson), polyglutamine diseases (Huntington), neurodegenerative mechanisms

Title	**Biopsychological Neuroscience**
Period	2
Code	PSY4315
ECTS credits	4
Organisational unit	Psychiatry and Neuropsychology (FHML)
Coordinator	Jos Prickaerts
Descriptions	This course provides an in-depth description of biopsychological concepts that are relevant to the field of neuroscience. It covers elements from functional neuroanatomy, neurophysiology and psychopharmacology, as applied to brain and behaviour research. Major emphasis will be placed on the macro- and microanatomy of the brain and on molecular, i.e. neurochemical and neurobiological, mechanisms related to neurotransmission, hormones and drug action. With respect to 'function', a detailed description is given of processes underlying sexual behaviour, affective behaviour, motivated behaviour and cognitive processes. The course also encompasses practical training in a neuropsychological experiment in which you will participate to investigate the link between biology and psychology. You have to analyse the data collected during the experiment and makes a poster of the results.
Goals	Knowledge of: Biology underlying fundamental psychological processes.
Instruction language	EN
Prerequisites	
Recommended literature	Papers from scientific journals; Book chapters from books are provided.
Teaching methods	Assignment(s) Paper(s) PBL Presentation(s) Skills
Assessment methods	Attendance Final paper Presentation
Key words	neurotransmitters, hormones, signal transduction, memory, affect, motivation

The practical training associated with PSY4315 Biopsychological Neuroscience is PSY4343 Practical training: Neuropsychological Experiment

Title	**Practical training: Neuropsychological Experiment**
Period	2
Code	PSY4343
ECTS credits	-
Organisational unit	Psychiatry and Neuropsychology (FHML)
Coordinator	Jos Prickaerts
Descriptions	You will participate as a test subject in a neuropsychological experiment which investigates the link between a biological response and and psychological function, in particular cognitive function. Next, you have to analyse the data collected during the experiment and make a poster based on the results.
Goals	Knowledge of: Neuropsychological experiment, data analysis, making poster.
Instruction language	EN
Prerequisites	
Recommended literature	
Teaching methods	Research
Assessment methods	Attendance Participation
Key words	neuropsychological experiment, poster

Title	**Neurological Neuroscience**
Period	3
Code	PSY4320
ECTS credits	5
Organisational unit	Neurosurgery/ Psychiatry and Neuroscience (FHML)
Coordinator	Govert Hoogland
Descriptions	Neurological disorders such as epilepsy and movement disorders (e.g. Parkinson's disease, Huntington's disease) arise from a primary structural/molecular lesion (e.g. trauma, disrupted brain development, gene defect) followed by a chronic process of neuronal network reorganisation. Once this process has reached a critical stage the patient will manifest clinically observable symptoms. Though drug therapy is the first choice in treating patients with neurological disorders, this introduces side effects and pharmacoresistance in a considerable number of patients. Hence, alternative treatment options are explored, some of which are established and some which are still in an experimental stage. Surgical treatment strategies aim at restoring the function of the pathologic neuronal network by i) electrical modulation of the network, ii) disrupting or isolating the pathologic network by resective surgery and iii) building new networks by gene therapy, stem cell transplantation or induction of cytogenesis. One of the challenges that this approach faces is the anatomical and functional demarcation of the pathologic network. As with any therapy, its efficacy depends on selecting suitable candidates, which implies a multidisciplinary workup. The course focuses on the underlying molecular mechanisms as well as the (lack of) rationale behind the treatment options. Students gain experience with the multidisciplinary workup and the molecular assays that are currently explored to characterise these disorders. The course also encompasses practical training in which students have to genotype their own NMDA receptor.
Goals	Knowledge of: Translational research approaches for neurological disorders including epilepsy and movement disorders.
Instruction language	EN
Prerequisites	
Recommended literature	Papers from scientific journals; Book chapters from books.
Teaching methods	Lecture(s) Skills PBL
Assessment methods	Attendance Presentation Written exam
Key words	epilepsy, movement disorders, genetics, electrophysiology, functional neurosurgery

The practical training associated with PSY4320 Neurological Neuroscience is PSY4347 Genotyping your NMDA Receptor

Title	**Practical training: Genotyping your NMDA Receptor**
Period	3
Code	PSY4347
ECTS credits	-
Organisational unit	Neurosurgery/ Psychiatry and Neuroscience (FHML)
Coordinator	Govert Hoogland
Descriptions	Students isolate their own DNA and use this in a restriction fragment polymorphism assay to analyse their individual NMDA genotype. The data is discussed in groups in the light of seizure susceptibility based on journal articles.
Goals	Knowledge of: Genotyping, data analysis.
Instruction language	EN
Prerequisites	
Recommended literature	
Teaching methods	Research
Assessment methods	Attendance Participation
Key words	genotyping, polymorphism, NMDA receptor

Title	**Neuroimmunology and Inflammation**
Period	4
Code	PSY4317
ECTS credits	5
Organisational unit	Psychiatry and Neuropsychology (FHML)
Coordinator	Mario Losen, Pilar Martinez-Martinez
Descriptions	Neuroimmunology is the study of interactions between the immune and the nervous systems. Immune mechanisms and inflammatory processes play an important role in maturation and aging during normal life span. Moreover, brain and spinal cord trauma, neurodegenerative brain diseases and autoimmune diseases involve activation of immune mechanisms and inflammation, which in turn contribute to disease development. This course explains the function of the immune system in general with a special focus on the immune privileged central nervous system. In particular, the course emphasizes the role of inflammatory cells and proinflammatory molecules such as lipids and antibodies in Alzheimer's disease, multiple sclerosis, Parkinson's disease and mood disorders. A special focus is placed on the molecular basis of novel treatment approaches for these diseases and regulation of the inflammatory mediators in neurodegeneration. The course also encompasses a practical on neuroinflammation in which students learn to use different relevant biochemical assays.
Goals	Knowledge of: The immune system and its interaction with the nervous system in health and disease.
Instruction language	EN
Prerequisites	
Recommended literature	Janeway, C.A. Jr. et al. Immunobiology, The immune system in health and disease.
Teaching methods	Assignment(s) Lecture(s) Paper(s) PBL Presentation(s) Skills Work in subgroups
Assessment methods	Attendance Final paper Presentation Written exam
Key words	neuroimmunology, inflammation, macrophages and microglia, B cells, T cells, dendritic cells, blood brain barrier (BBB), lipids, antibodies

The practical training associated with PSY4317 Neuroimmunology and Inflammation is PSY4349 Practical training: Neuroinflammation

Title	**Practical training: Neuroinflammation**
Period	4
Code	PSY4349
ECTS credits	-
Organisational unit	Psychiatry and Neuropsychology (FHML)
Coordinator	Mario Losen
Descriptions	Students participate in a neuroinflammation practical which will be based on ongoing experimental Research in the School for Mental health and Neuroscience These practicals focus on the characterization of autoantibodies against neuronal receptors, using techniques such as enzyme-linked immunosorbent assays (ELISA), cell-based assays (CBA) and immunofluorescence (IF) microscopic analysis. Such techniques are clinically relevant to detect autoantibodies from individuals with neuropsychiatric diseases, including for example myasthenia gravis or NMDA encephalitis.
Goals	Knowledge of: Neuroinflammation markers, biochemical assays and data analysis.
Instruction language	EN
Prerequisites	
Recommended literature	
Teaching methods	Research
Assessment methods	Attendance Final paper
Key words	neuroinflammation, ELISA, FACS, cell culture

Title	Neuroplasticity and Pain
Period	4
Code	PSY4336
ECTS credits	5
Organisational unit	Anesthesiology (FHML)
Coordinator	Bert Joosten
Descriptions	Acute (physiological) nociceptive pain is protective and helps us to deal with potentially threatening or damaging environmental stimuli. However, pain is not always considered adaptive and beneficial to our survival. Pain can become chronic and can also become very resistant to pain medicine in the present drug arsenal. Finding out which molecular and cellular mechanisms are involved in the transition from acute to chronic pain and/or the ability to mediate chronic pain itself is expected to result in an improved pain management as it allows for mechanism-based treatment approaches. This course covers the basic understanding of nociceptive signaling. Moreover, it will be discussed how nociception can be modulated. Conditions of pain amplification will be then be discussed with particular attention to neuropathic pain and post-surgical pain. Peripheral and central sensitization will be discussed as processes of molecular neuroplasticity, which lays the foundation for amplification of nociceptive signaling under pathological conditions. In the last decade it has become clear that neuro-inflammation and particularly the activation of non-neuronal cells such as central glia (microglia and astrocytes) contribute largely to amplification of pain (e.g. chronic pain) during such pathological conditions. Glial activation, via release of pro-inflammatory factors and other neuroactive mediators, is an important contributor to neuroplasticity and includes central sensitization. A better understanding of processes of neuro-inflammation and neuroplasticity in conditions of chronic pain are thought to aid in development of novel, more effective pain therapies. This course is subdivided into three parts. The first part focuses on nociceptive and inflammatory pain, discussing processes of neuroplasticity and pain, with special attention paid to the cellular and molecular nature of peripheral and central sensitization. The second part covers chronic pain conditions and underlying cellular and molecular mechanisms. The third part aims to integrate the knowledge obtained in the first two parts of the course in a translational way (bench-to-bedside-and-back-to-bench approach).
Goals	Knowledge of: Nerve injury and neuro-inflammation, cellular and molecular pain mechanisms, cellular and molecular plasticity, peripheral and central sensitization, pain management, cell culture techniques, translational research.
Instruction language	EN
Prerequisites	
Recommended literature	Journal articles; Book chapters.
Teaching methods	Assignment(s) Lecture(s) Paper(s) PBL Presentation(s) Skills Training(s)

Assessment methods	Attendance Final paper Presentation Written exam
Key words	pain conditions, cellular and molecular neuroplasticity, neuro-inflammation, translational research

The practical training associated with PSY4336 Neuroplasticity and Pain is PSY4346 Practical training: Cell Culture

Title	**Practical training: Cell Culture**
Period	4
Code	PSY4346
ECTS credits	-
Organisational unit	Anesthesiology (FHML)
Coordinator	Bert Joosten
Descriptions	During this practical session, students acquire skills in cell culturing. To this end, a murine cell line will be used to assess toxicity of materials used as treatments of neuropathic conditions. Moreover, demonstrations about animal models of pain, and behavioral tests to assess pain, are presented to students. Each student analyses data collected during the practical session and produces a short written report.
Goals	Knowledge of: Cell culture, animal models of pain, behavioral tests for pain assessment, translational pain modelling.
Instruction language	EN
Prerequisites	
Recommended literature	
Teaching methods	Presentation(s) Skills Training(s)
Assessment methods	Attendance
Key words	cell culture, pain models, pain assessment

Title	**Psychiatric Neuroscience**
Period	5
Code	PSY4321
ECTS credits	5
Organisational unit	Psychiatry and Neuropsychology (FHML)
Coordinator	Daniel van den Hove, Gunter Kenis
Descriptions	The main aim of this course is to gain insights into the molecular neurobiology of psychiatric disorders and how these phenotypes can be studied in animal models (i.e. the principle of translation). The first part of this course focuses on the psychobiology of stress, emotions and associated disorders such as depression and anxiety disorders. Chronic and/or excessive stress may lead to the development of psychiatric conditions such as depression and anxiety, diseases in which a patient shows inadequate coping associated with a severe disruption of daily life. A major challenge in research on stress and related disorders is to unravel the molecular basis of persistent changes in behaviour that explain the symptoms of mental illness and their (partial) reversal during treatment. A major focus during the course is on the limbic system, the sympathetic nervous system and the hypothalamo-pituitary-adrenal axis as key players of emotional regulation in health and disease. Furthermore, the roles of different neurotransmitter systems such as the serotonergic system will be discussed in depth. The second part of the course deals with the neurobiology of major psychotic disorders such as schizophrenia. In particular, this course addresses the molecular processes that influence psychosis-related cognitive domains from a translational point of view. Students will also study the mechanisms by which adverse environmental exposures de-regulate key brain structures that influence the mesocorticolimbic dopaminergic system - a core phenomenon in psychosis pathophysiology.
Goals	Knowledge of: Psychobiology of stress, neurobiology of psychiatric disorders, anxiety, anxiety disorders, panic disorder, major depression, psychosis, schizophrenia, molecular psychiatry, gene-environment (GxE) interactions, environmental exposure, functional neuroanatomy, (neuro)psychiatric (endo)phenotypes, animal models for psychiatric disorders, translational neuropsychiatry, the pathophysiology of mental disorders, hypothalamic-pituitary-adrenal axis, mesocorticolimbic system.
Instruction language	EN
Prerequisites	
Recommended literature	Journal articles; Book chapters.
Teaching methods	Assignment(s) Lecture(s) Paper(s) PBL Presentation(s) Work in subgroups
Assessment methods	Attendance Final paper Presentation Written exam

Key words	stress, depression, anxiety disorders, panic disorder, schizophrenia, gene-environment (GxE) interactions

The practical training associated with PSY4321 Psychiatric Neuroscience is PSY4352 Practical training: Western Blotting

Title	**Practical training: Western Blotting**
Period	5
Code	PSY4352
ECTS credits	-
Organisational unit	Psychiatry and Neuropsychology (FHML)
Coordinator	Daniel van den Hove, Gunter Kenis
Descriptions	The objective of this practical is to learn the principles of working with *in-vitro* model systems and to use Western Blotting to measure protein levels. After an introduction, students will design their own small research project. During the entire course, students work on this project and conduct the necessary experiments. Students use human cell lines to examine the neuroplastic/toxic effects of stress hormones (e.g. cortisol) in relation to molecular biological changes. The effects on neurotrophic factor signaling are determined by Western Blotting.
Goals	Knowledge of: Western blotting, cell culture, neuroplasticity, psychopharmacology, protein chemistry, psychobiology of stress, neurobiology of psychiatric disorders, anxiety, anxiety disorders, major depression, molecular psychiatry, environmental exposure, functional neuroanatomy, (neuro)psychiatric (endo)phenotypes, animal models for psychiatric disorders, translational neuropsychiatry, the pathophysiology of mental disorders.
Instruction language	EN
Prerequisites	
Recommended literature	Journal articles; Book chapters.
Teaching methods	Assignment(s) Lecture(s) Paper(s) Presentation(s) Research Skills Training(s) Work in subgroups
Assessment methods	Attendance Final paper Presentation
Key words	western blot, stress, depression, anxiety disorders, neurotrophic factors

PSY4107 Advanced Statistics II will be offered in all RM specialisations. ***See CN***

The practical training associated with PSY4107 Advanced Statistics II is PSY4117. Practical training SPSS II will be offered in all RM specialisations. ***See CN***

Title	**Electrophysiology: From Single Cell Activity to 'Cognitive' Markers**
Period	5
Code	PSY4322
ECTS credits	4
Organisational unit	Cognitive Neuroscience (FPN)
Coordinator	Inge Timmers
Descriptions	Our brain is busy all the time, whether we are awake or asleep. There are thousands of neurons which are in constant communication with each other. Neurotransmitters and electrical currents convey information from one cell to another, which in turn produces electrical signals. This course is an introduction into the field of brain electricity. Students first learn about how currents develop (i.e., role of molecules, ion channels or membrane) and how they can be measured (e.g., patch clamp or single-cell recording). Next, discussions focus on how these currents are perceived in electrophysiology. Students also determine what the differences are in measurements using various species. For instance, can electrodes be placed in humans using the same approach that is used for rats? Finally, students will learn what these currents mean in terms of e.g., event-related potentials or (de)synchronisation measures. In addition to the theoretical basis, students will discuss some of the practical issues when performing electrophysiological recordings, such as measurement settings and electrode positions. This is accompanied by the presentation of pictures and short videos on how measurements in animals and humans are performed.
Goals	Knowledge of: Electrochemical processes in neurons, patch clamp and single-neuron recordings, event-related potentials in various species, EEG frequencies and event-related (de)synchronisation, source localization, electrophysiology in psychological research.
Instructionlanguage	EN
Prerequisites	
Recommendedliterature	Journal articles; Book chapters; Research reviews.
Teaching methods	Lecture(s) PBL Presentation(s)
Assessment methods	Attendance Active participation Presentations Final paper Written exam
Keywords	electrophysiology, signal transduction, patch clamp, single-cell recording, electroencephalography, translational

PSY5112 Research Grant Writing Course will be offered in all RM specialisations. ***See CN***

Skills training

1. *PSY4221 EEG and ERP is equal to the Master's module PSY4034 EEG and ERP (DP & CN)*
2. *PSY4221 EEG and ERP (in CN, NE,* ***FN,*** *NP. In NP it will be offered as an Elective).* ***See CN***

Methodological and technical workshops

Scientific Writing will be offered in all RM specialisations. Offering times vary according to RM specialisation:
FN: PSY4113. See CN PSY4110

Title	Surgery for Intractable Movement and Psychiatric Disorders
Period	3
Code	PSY4332
ECTS credits	1
Organisational unit	Neurosurgery/ Psychiatry and Neuroscience (FHML)
Coordinator	Ali Jahanshahi
Descriptions	The aim of this course is to guide the participants through the first key steps of neuroscience experiments related to movement and psychiatric disorders. Students receive relevant knowledge via lectures and will have the opportunity to practically apply this in a hands-on setting. Students are also shown stereotactic surgery that is used to selectively lesion brain areas, to chronically infuse drugs into brain areas and to deep brain stimulate and electrophysiologically record from brain areas. Also, there are demonstrations and discussions on behavioral tests used to study the functional consequences of the neurosurgical interventions.
Goals	Knowledge of: Stereotactic surgery for movement and psychiatric disorders.
Instruction language	EN
Prerequisites	
Recommended literature	
Teaching methods	Lecture(s) Research
Assessment methods	Attendance Written exam
Key words	stereotactic surgery, brain lesions, deep brain stimulation, drugs, electrophysiology

Title	Commercialising Science and Technology
Period	4
Code	PSY4337
ECTS credits	2
Organisational unit	Maastricht Centre for Entrepreneurship
Coordinator	Wynand Bodewes
Descriptions	This course focuses on the process of turning science into products and products into businesses. University labs and corporate Research and Development departments increasingly rely on professionals that help to bridge science production (conference presentations, scientific publications and patents) to value creation (revenues, funding for fundamental and applied research). Understanding the bridging of science and business is essential, not only for those who want to work in a commercial setting, but also for those who aspire a career in (academic) research. In this course, students will learn how and why universities and companies engage in technology licensing. Students will explore how technology transfer and licensing can be instrumental to research funding. They will learn how the dynamics of science production and deployment have implications for scholarly publication. These aspects are of increasing importance to academic researchers as universities seek to enlarge their research budgets by selling or licensing their intellectual property. Consequently, research funds such as the Dutch STW insist that grant applications document how research outcomes will impact society (in addition to papers, patents, and publications). In the course students will also explore legal and governance issues that pertain to the licensing of university (or corporate) know-how to entrepreneurial start-ups or established companies.
Goals	Knowledge of: Commercialisation, entrepreneurship, patents, licensing, research funding, industry-university relationships.
Instruction language	EN
Prerequisites	
Recommended literature	Reader with papers and cases.
Teaching methods	Assignment(s) Interactive lecture(s)
Assessment methods	Attendance Participation Final paper
Key words	commercialising science and technology, patents, entrepreneurship, licensing

PSY4372 Functional Brain Imaging will be replaced by: **PSY4832** Biomedical Brain Imaging. ***See DN***

PSY4112 Research Grant Writing Workshop will be offered in all RM specialisations. ***See CN***

Title	**Molecular Genetics**
Period	1
Code	PSY5331
ECTS credits	1
Organisational unit	Psychiatry and Psychology (FHML)
Coordinator	Gunter Kenis
Descriptions	There is currently a lot of research effort and activity in the identification of genes for susceptibility to psychiatric and neurological disorders. This workshop focuses on how genetic variations confer risk of complex diseases. Students will gain insight, by using theoretical models, into how these alterations affect DNA transcription, RNA processing and protein synthesis, ultimately leading to variation in phenotype expression. An initial overview is given of sources of genetic variation, ranging from large scale alterations in the genome structure to common variations such as single nucleotide polymorphisms. Advantages and disadvantages of current strategies in genomic research, such as genome wide association studies, will be examined. Regulation of gene expression including epigenetic processes such as DNA methylation and histone modifications are then discussed. Students also study advances in molecular genetic technologies, including next generation sequencing strategies, and how these can be efficiently incorporated in future studies on the genetic basis of neurological and psychiatric disorders. At the end of this course, students will be able to better understand, interpret and critically evaluate recent reports on large scale genetic studies of common complex diseases.
Goals	Knowledge of: Genetic variation, polymorphisms, copy number variations, haplotypes, linkage analysis, linkage disequilibrium, mendelian inheritance, population genetics, epigenetics, genetics of complex neuropsychiatric diseases, genome wide association studies, regulation of gene expression, DNA methylation, histone modifications, gene-environment interplay, micro-RNA.
Instruction language	EN
Prerequisites	
Recommended literature	Journal articles; Book chapters.
Teaching methods	Assignment(s) Lecture(s) Presentation(s) Work in subgroups
Assessment methods	Attendance Final Paper
Key words	DNA, RNA, genetic variation, polymorphism, gene expression, genetics, epigenetics, genetic association, heritability

Title	Behavioural Tests and Models
Period	1
Code	PSY5332
ECTS credits	1
Organisational unit	Psychiatry and Neuropsychology (FHML)
Coordinator	Jos Prickaerts
Descriptions	Neuroscience research involves the use of a wide variety of behavioural tests and models with laboratory animals. There are several criteria that neuroscientists can use to select behavioural tests and models. Eventually data has to be analysed, integrated and interpreted. How is this all done? Examples from mainly cognitive and affective tests and models are given. You will learn about these issues by analysing, interpreting and presenting data from experiments as well as from literature.
Goals	Knowledge of: Concepts of behavioural animal testing, raw data management and analysis, interpretation of behavioural data.
Instruction language	EN
Prerequisites	
Recommended literature	Papers from scientific journals; Book chapters from books are provided.
Teaching methods	Assignment(s) Lecture(s) Paper(s) Presentation(s)
Assessment methods	Attendance Final paper Presentation
Key words	test, model, in vivo, validity, translation

Title	Laboratory Animal Sciences
Period	1 (FN and DN)
Code	PSY5313
ECTS credits	3
Organisational unit	Central Animal Facilities (CPV)
Coordinator	Saskia Seeldrayers
Descriptions	This workshop will teach you careful and responsible use of laboratory animals in biomedical research. Next to technical and methodological aspects of planning and execution of animal experiments, time is spent on ethical considerations, well-being of animals and alternatives for animal research. This workshop offers you a series of lectures on Laboratory Animal Science (Alternatives, Behavior, Anatomy, Physiology, Genetics, Laws & Regulations, Ethics) on the one hand and a task assignments focusing on designing procedures and projects, the proper choice of an animal model and the 3R's (replacement, reduction and refinement). The workshop consists of a basic course and species-specific modules (theory and practical part). More information on: http://www.maastrichtuniversity.nl/web/Faculties/FHML/TargetGroup/PhDStudents/GeneralCourses/LabAnimalScience.htm
Goals	Knowledge of: Basic facts and principles which are essential for the humane use and care of laboratory animals and for the quality of research.
Instruction language	EN
Prerequisites	-A Bachelor degree in a biological or zootechnical discipline, or -Knowledge of the basic subjects of biology of at least 18.75 ECTS in total, including at least 7.5 ECTS on anatomy/zoology and 7.5 ECTS on physiology. Thus to be able to participate in this workshop, you need to prove that you have had sufficient training in anatomy and physiology. All students have to provide a list of courses that they followed. If your educational background does not cover this requirement you have to take an additional exam, i.e. if either your knowledge of anatomy or physiology is deemed insufficient, you can study these topics at home and participate in an exam before the workshop.
Recommended literature	Principles of laboratory animal science (Eds. Zupthen, Baumans and Ohl). Revised edition; Further material will be provided on ELEUM.
Teaching methods	Assignment(s) Lecture(s) Presentation(s) Skills Work in subgroups
Assessment methods	Attendance Written exam
Key words	experimental designs, ethics, animal care, animal welfare, legislation

The practical training associated with PSY5313 Laboratory Animal Sciences Workshop is PSY5350 Practical training: Handling Animals and Small Experimental Manipulations

Title	**Practical training: Handling Animals and Small Experimental Manipulations**
Period	1 (FN and DN)
Code	PSY5350
ECTS credits	-
Organisational unit	Central Animal Facilities (CPV)
Coordinator	Saskia Seeldrayers
Descriptions	Students learn to perform procedures on animals in specific modules. This includes basic and appropriate biology (species specific), minimally invasive procedures (species specific) and principles of surgery.
Goals	Knowledge of: Handling of animals and invasive procedures.
Instruction language	EN
Prerequisites	The practical species-specific modules are only accessible for students who completed the Basic course and need a practical training to perform tasks during their research master internship (FN). Students are only allowed to participate in the practical modules if they have a confirmation of an accepted internship with laboratory animals.
Recommended literature	Principles of laboratory animal science (Eds. Zupthen, Baumans and Ohl). Revised edition.
Teaching methods	Skills Work in subgroups
Assessment methods	Attendance Observation
Key words	handling animals, surgery, invasive procedures

Electives

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

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