Neurosciences MSc

Vrije Universiteit Amsterdam - Fac. der Aard- en Levenswetenschappen - M Neurosciences (research) - 2017-2018

The aim of the Master programme Neurosciences is to provide students with the knowledge, skills and insight required to operate as an independent professional within the field of neurosciences and to be a suitable candidate for a subsequent course of study leading to a career in research. Having completed the programme, the student should have developed a critical scientific approach and an awareness of the ethical and societal aspects of neurosciences.

The Master programme Neurosciences at the VU University Amsterdam is a joint initiative of the Faculty of Earth and Life Sciences, the Faculty of Behavioural and Movement Sciences and the VU University Medical Center. It includes both fundamental and clinical aspects of the neurosciences and quantitative genetics. The programme is embedded in Amsterdam Neuroscience and thereby offers you the chance to integrate the full range of neuroscience disciplines.

You will study facets of neurosciences ranging from genes to behaviour, from both fundamental and clinical perspectives. In our study programme we have constructed three tracks, each designed to give you the perfect start as a researcher in a particular field of neurosciences.

More information
- All compulsory courses and electives you find in the year schedule;
- A complete description of the programme you find in the Teaching and Examination Regulations;
- For more information about the programma you can contact the academic advisor (VU students only);
- As a VU student you need to register for all courses via VUnet. Only after you completed your enrollment for the study programme you can register for courses;
- More information on all the courses you find through the links below.

Inhoudsopgave

M Neurosciences year 1

The first year consists of compulsory courses, to give you a thorough grounding in relevant disciplines. These courses are followed by a 5-month work placement. You will have a wide range of work placement opportunities to choose from, within the VU University Amsterdam and affiliated institutes.

Vakken:

Naam	Periode	Credits	Code
Behavioral Genetics	Periode 2	6.0	AM_1006
Clinical Neurosciences	Periode 2	6.0	AM_1005
Data Analysis and Visualisation	Periode 1	6.0	AM_1191
From Molecule to Mind	Periode 1	6.0	AM_1190
Internship Neurosciences I	Ac. Jaar (september)	27.0	AM_471108
Neurogenomics	Periode 3	6.0	AM_1007
Writing a Research Proposal	Periode 2	3.0	AM_1123

M Neurosciences year 2

The second year consists of optional courses, to expand your knowledge of certain areas. We have constructed six tracks, which give you a perfect start as a researcher in a particular field of neurosciences.

Vakken:

Naam	Periode	Credits	Code
Advanced Clinical Neurosciences	Periode 1	6.0	AM_1014
Advanced Neurogenomics	Periode 1	6.0	AM_470717
Complex Trait Genetics	Periode 1	6.0	AM_470733
Developmental Neurobiology of the Vertebrate Brain	Periode 2	6.0	AM_470713
Experimental and Clinical Neuroendocrinology	Periode 2	6.0	AM_470700
Functional Brain Imaging	Periode 1	6.0	AM_470715
Genomic Data Analysis	Periode 2	6.0	AM_1008
Internship Neurosciences II	Ac. Jaar (september)	25.0	AM_471109
Literature Survey Neurosciences	Ac. Jaar (september)	8.0	AM_471110
Live Cell Imaging	Periode 1	6.0	AM_470726
Methods in Behavioral Neurosciences	Periode 2	6.0	AM_470728

Neuro- and Psychopharmacology	Periode 2	6.0	AM_470718
Neuronal Networks in Vivo	Periode 2	6.0	AM_1001
Neurophilosophy and Ethics	Periode 3	3.0	AM_1018
Neuropsychiatric Genetics	Periode 2	6.0	AM_1195
Psychophysiology	Periode 1	6.0	AM_470736
Rhythms of the Brain	Periode 2	6.0	AM_1003
Statistical Genetics for Gene Finding	Periode 1	6.0	AM_1040
Systems Neuroscience	Periode 2	6.0	AM_470712

Advanced Clinical Neurosciences

Vakcode	AM_1014 ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. L. Douw
Examinator	dr. L. Douw
Docent(en)	dr. L. Douw
Lesmethode(n)	Hoorcollege, Werkgroep, Werkcollege
Niveau	600

Doel vak
The overall aim of the Advanced Clinical Neuroscience course is to learn how to design, perform and critically evaluate clinical neuroscience.
Specific learning goals are as follows:
1. The student is able to design clinical neuroscientific research
1.1 The student is able to list the most important clinical features of the five brain disorders that are central to this course (Alzheimer's disease, Parkinson's disease, multiple sclerosis, neuro-oncology, obsessive compulsive disorder)
1.2 The student is able to identify relevant diagnostic problems within these disorders
1.3 The student is able to construct hypotheses directed at solving these diagnostic problems
1.4 The student can present a newly designed study about a clinical neuroscientific topic
2. The student can perform clinical neuroscientific research
2.1 The student can recite techniques and methods used within neuroscience
2.2 The student is able to apply and administer these methods within the five main diseases
2.3 The student can choose the correct statistics to test his/her own study hypotheses
3. The student is able to critically evaluate clinical neuroscientific research
3.1 The student is able to formulate pros and cons of a clinical scientific grant proposal
3.2 The student is able to apply their knowledge to review the scientific quality of clinical neuroscientific papers

Inhoud vak
This course will involve lectures, workshops, and a clinical internship to familiarize students further with clinical neuroscience. They are expected to design and present a neuroscientific study of their own interest. They will integrate the current scientific state of the art with clinical patient presentation in a written case report. They will also gain experience in the process of peer review.

Onderwijsvorm
Lectures (10 contact hours)
For each of the five main disorders, a clinical lecture will focus on a stringent/current problem that needs solving. We assume basic knowledge on each disorder, so that we can discuss the problem in depth. These lectures will mostly be taught by the coordinators, or an expert in the field. This clinical lecture is paired with a research lecture, in which an (innovative) approach towards solving a (perhaps not the same) problem. These lectures will be given by researchers in the field. The students are expected to prepare a single paper for each lecture and may be quizzed on their preparation during the lecture.

Clinical internship (4-8 contact hours)
For further familiarization with the clinical aspects of neuroscience, students will be able to do an internship in the outpatient clinic at the VUmc. They will shadow an MD, attend research meetings and/or multidisciplinary clinical meetings. For non-Dutch speaking students, these meetings will be in English. Furthermore, students have the opportunity to do an internship with a clinical neuroscientist.

Clinical neuroscience methods workshops (8 contact hours)
In order to further provide students with the tools necessary to conduct clinical neuroscience, a series of hands-on workshops will be taught (mostly by coordinators, in addition to experts). Topics include brain stimulation, animal studies, neuropsychological testing, scientific writing and presenting, epidemiology and trial design, and others. Participation during these workshops is essential.

Toetsvorm
• Scientific abstract presentation (30%)
• Peer review (20%)
• Written case report (30%)
• Pop quizzes and class participation (20%)

Literatuur
A number of recent relevant reviews and peer-reviewed articles will be posted.

Vereiste voorkennis
Principles of Neuroscience (470701), Clinical Neuroscience (470757)

Doelgroep
Neuroscience students with an interest in clinical neuroscience.

Intekenprocedure
Registration via VUnet, please inform us (advancedclinicalneuroscience@vumc.nl) if you switch!

Overige informatie

There is a maximum of 24 students. For further information and application, please contact the course coordinators: dr. L. Douw or dr. Hanneke Hulst (advancedclinicalneuroscience@vumc.nl).

Advanced Neurogenomics

Vakcode	AM_470717 ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. M. Verhage
Examinator	prof. dr. M. Verhage
Lesmethode(n)	Practicum
Niveau	600

Doel vak
This course aims to introduce modern techniques in the integrated Neurosciences via hands-on experience. The course illustrates experimental approaches to seek causal relationship between molecular events, such as changes in gene-expression, gene-mutations, protein-protein interactions, and effects of such events on the functioning of cells, networks and the whole organism. The use of these techniques is embedded in short research projects and typically covers a number of steps: first clone a construct (a mutant protein, an over-expression construct), than culture and tranfect a cell with this construct and finally analyze a functional consequences of this modification using functional assays. Alternatively, research projects may also start with the intact brain and then work down to the molecular networks of proteins and genes, for instance using proteomics and mRNA expression profiling. Although centered around genomics, many functional assays are offered, from electronmicroscopy and protein chemistry to life cell imaging, electrophysiology and behavioural analyses. Various tools and technologies will be explained in supporting lectures and used in order to answer questions related to the function of genes in the nervous system and how they contribute to higher order processes important for functioning of circuitry or behavior.

End terms:
Profound insight and experience with neurogenomic techniques that are used during the course
Adequate design, execution, and interpretation of neurogenomics experiments and conceptualisation of new working models (empirical cycle)
Adequate oral presentation (2 oral presentations)

Inhoud vak
This is a practical course. You will be executing a small research project aimed at illustrating today's research into gene-function relations and finding causal relationships between molecular events and functional consequences at the cellular/network level. The experiments involve gene expression analysis (transcripts, proteins), and genotypic and phenotypic analysis (genotyping, cell biology, behavior). Theoretical underpinning of concepts and methods will be achieved by

using examples from recent literature.

Onderwijsvorm
Lectures, discussion of papers, demonstrations, practicals
16x8h practicals, presentations and discussion
4x8h self study

Toetsvorm
Examination and presentations of the work performed. Evaluation on the basis of 2 oral presentations by the students and their performance during the practical work and during (plenary) discussions.

Literatuur
Articles form journals that published in the last couple of months (2-4 per student)
Purves Neuroscience (5th edition) as reference book
Literature can be studied during the course and will be provided at the start of the course.

Vereiste voorkennis
The Neurogenomics course (MN 1st year) is obligatory for this course.

This course uses advanced equipment at the FGA and MCN departments for hands-on experiments by the participants. Therefore, the course HAS A LIMITED CAPACITY AND THE MAXIMAL NUMBER OF PARTICIPANTS IS 20. In case of over-subscription, priority will be given to students in the Fundamental Neuroscience track of the MA Neuroscience and, if required, selection on the basis of past performance in this track.

Overige informatie
E-mail: matthijs@cncr.vu.nl

Behavioral Genetics

Vakcode	AM_1006 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	R.S.L. Ligthart
Examinator	R.S.L. Ligthart
Docent(en)	dr. C.M. Middeldorp, R.S.L. Ligthart
Lesmethode(n)	Hoorcollege, Computerpracticum
Niveau	400

Doel vak
To provide the Master of Neuroscience students with a solid basis in human behavioral genetic research. This entails:
- A good understanding of the most commonly used methods in behavioral genetics (including twin studies, genetic linkage and genome-wide association studies)
- The ability to critically read and understand behavioral genetic research articles
- Familiarity with the most important research findings in the field

- Familiarity with the most common software programs used in this field of research.

Inhoud vak
Behavior genetics focuses on the inheritance of individual differences in complex traits. Such traits are most likely influenced by multiple genetic and environmental factors. The effects of genetic and environmental factors may be additive or interactive and lead to individual differences in complex traits and diseases that are quantitative rather than qualitative. In this course theory and principles from population genetics and biometrical genetics will be introduced, including genetic and cultural inheritance of complex phenotypes. Designs of family, adoption and twin studies and their applications to variation in cognitive abilities, personality and psychiatric disease will be discussed. The advances in molecular genetics have generated substantial progress in identifying the genetic basis of heritable traits using linkage and genome-wide association approaches. Both approaches will be reviewed and illustrated using recent studies aiming to identify genes genes underlying the vulnerability for psychiatric disorders, such as schizophrenia and mood disorders. Practical exercises will guide the student through some of the available online tools that facilitate the interpretation of gene-finding studies.

Onderwijsvorm
Lectures (6, 2 hours each) and computer practicals (6, 3 hours each).

Toetsvorm
Written exam consisting of open-end questions (60%) + writing assignment (40%).
To obtain a final grade of 6 or higher, students have to pass both the exam and the writing assignment.

Literatuur
Research articles, exact reading list to be announced on Canvas 2 weeks before the course.

Vereiste voorkennis
Students from disciplines other than neuroscience should contact the course coordinator to discuss the possibility of entry in this course.

Doelgroep
First year students of the master neuroscience and students interested in behavioral genetic research (e.g. twin studies or gene-finding methods, with a focus on behavioral phenotypes).

Overige informatie
Attending the practicals is compulsory

Clinical Neurosciences

Vakcode	AM_1005 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen

Coördinator	M.M. Schoonheim
Examinator	M.M. Schoonheim
Docent(en)	M.M. Schoonheim, dr. D.P. Bakker
Lesmethode(n)	Hoorcollege, Practicum, Deeltoets extra zaalcapaciteit
Niveau	400

Doel vak
The aim of this course is twofold: 1. Provide knowledge on neurological disease, and 2. Initiate a translational way of thinking as a neuroscientist.
To do this, we will provide knowledge on common neurological disorders: Multiple sclerosis, childhood white matter disorders, dementia, movement disorders, neuropsychiatric
disorders and neuro-oncology. Translational thinking will be stimulated by continuously investigating the (histo)pathology, clinical and imaging abnormalities for diagnosis and prognosis and therapeutic options. Teachers are a combination of clinicans and researchers, to promote translational thinking.

Inhoud vak
Multiple sclerosis:
Description of the clinical phenotypes of the disease. Introduction of neuroimaging specifically adapted for MS. The use of neuropathology to understand disease mechanisms in MS.

Childhood white matter disorders:
Introduction in MRI pattern recognition in childhood white matter disorders. Demonstration of translational research: from patient to gene, protein and treatment.

Dementias:
Description of the main clinical manifestations of dementia.
Introduction of cognitive assessment in dementias. Demonstration of the neuropathological features of dementias.

Movement disorders:
Description of the motor and cognitive manifestations of movements disorders. During this course the focus will be on Parkinson’s disease.

Neuropsychiatric disorders:
Description of the clinical manifestation of the main neuropsychiatric disorders in a broad translational way; from molecule to mind.
Introduction of the underlying neuroanatomy and pathophysiology and discussion on what the use is of neuroimaging in neuropsychiatry.

Neuro-oncology:
Description of the clinical/cognitive manifestations of brain tumors, mainly glioma. The effects of these tumors on brain networks is the main focus.

Onderwijsvorm
Lectures, student presentations, practical
The course runs for eight weeks, on Mondays and Thursdays

Toetsvorm
Group presentation (10% of grade)
Written essay, in the form of an introduction of a research paper (30%)

Written exam with open questions (60%)
Sufficient grades for the presentation, the essay, as well as the exam are required in order to pass the course.

Literatuur
Research papers and course slides provided on Canvas

Vereiste voorkennis
All students following the masters program in Neurosciences at the VU are required to take this course.
External candidates are also allowed, if accepted by the course coordinator.

Aanbevolen voorkennis
For external candidates, some (basic) knowledge on the brain and neuroanatomy is highly recommended.

Doelgroep
Students interested in clinical neuroscience

Intekenprocedure
Enrolment in vu-net.

Overige informatie
Questions: clinicalneuroscience@vumc.nl
This course is coördinated by: dr. M.M. Schoonheim (Menno) and dr. D.P.Bakker (Dewi)

Complex Trait Genetics

Vakcode	AM_470733 ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. D.I. Boomsma
Examinator	prof. dr. D.I. Boomsma
Docent(en)	prof. dr. D.I. Boomsma
Lesmethode(n)	Hoorcollege
Niveau	500

Doel vak
Provide the theoretical background into population and biometrical genetics so that students gain an understanding of the way the genome contributes to human variation in behavior, health and disease.

Inhoud vak
Quantitative genetics is concerned with the inheritance of those differences between individuals that are of degree rather than of kind (quantitative rather than qualitative). Such differences are seen for most complex human traits (e.g. depression, cognitive abilities or attention problems).
This course aims to provide an understanding of the inheritance of quantitative differences in behavior, psychiatric disorders, endophenotypes (e.g. blood pressure or brain volumes) underlying disease

traits (e.g. hypertension or schizophrenia).
Quantitative differences, as far as they are inherited, depend on genes with on average small effects and are usually influenced by gene differences at many loci. Consequently these genes cannot be identified by Mendelian segregation ratios (though they are subject to the laws of Mendelian transmission).
The methods of quantitative genetics differ in from those employed in Mendelian genetics and have in the past few years undergone a revolution, because we can now assess millions of gene variants and associate those with human traits.
The extension of Mendelian genetics into quantitative genetics will be made in two stages: the genetic properties of populations (population genetics) and the inheritance of measurements (biometrical genetics).
Quantitative genetics is now merging with molecular genetics and the last part of this course will be devoted to methods for the localization and characterization of genes causing quantitative variation, focusing on recent developments using genome wide association (GWA) analysis.

Onderwijsvorm
Combined lectures and work groups, twice 4 hours per week.

Toetsvorm
Course grades will be based on 3 assignments; for ~40%, 20% and 40% of grades:
1) Read papers (references provided in class) and write a short essay about current issues / state-of-the-art in human genetics (focus on genetic association studies). Select one empricial paper; (try to) read it.
Indicate what is unclear to you. At the end of this course you will asked to review your own essay and then indicate what you now understand better than before.
2) Problems from the book to be assigned after each lecture (about 4 or 5) as home work before the next class. Students will be asked to present the solutions to the problems in class and part of grading depends on how well solutions are presented.
3) Final assignment: oral presentations on a research topic; topics can be chosen from a list of papers or book chapters.

Literatuur
Book: Falconer & Mackay: Introduction to Quantitative Genetics (1996) and a series of papers, the final list of papers will change as new papers come out, the list below serves as an indication.

4 papers / commentaries from the New England J of Medicine 23 april, 2009:
J. Hardy and A. Singleton: Current Concepts: Genomewide Association Studies and Human Disease
D. B. Goldstein: Common Genetic Variation and Human Traits
J. N. Hirschhorn: Genomewide Association Studies — Illuminating Biologic Pathways
P. Kraft and D. J. Hunter: Genetic Risk Prediction — Are We There Yet?

Recent review papers
Visscher PM, Brown MA, McCarthy MI, Yang J. Five years of GWAS discovery. Am J Hum Genet. 2012 ;90(1):7-24.
Hirschhorn JN, Gajdos ZK. Genome-wide association studies: results from the first few years and potential implications for clinical medicine. Annu Rev Med. 2011 18;62:11-24.

Recent gene finding papers
*Davies G, et al. Genome-wide association studies establish that human intelligence is highly heritable and polygenic. Mol Psychiatry, 16 (10):996-1005, 2011
* Teslovich TM, et al. Biological, clinical and population relevance of 95 loci for blood lipids. Nature. 466(7307): 707-13, 2010
* Lango Allen H, et al.. Hundreds of variants clustered in genomic loci and biological pathways affect human height. Nature. 467(7317):832-8, 2010
* Scott RA,. Large-scale association analyses identify new loci influencing glycemic traits and provide insight into the underlying biological pathways. Nat Genet. 44(9):991-1005, 2012

Vereiste voorkennis
General knowledge of human and quantitative genetics. When in doubt, ask the course coordinator.

Aanbevolen voorkennis
General knowledge of human and quantitative genetics. When in doubt, contact the course coordinator (Dorret Boomsma: di.boomsma@vu.nl).

Doelgroep
MA Students, PhD-students, postdocs who are interested in the theoratical basis of research on the genetic origin of complex features of man.

Overige informatie
There will be guest lectures on topics that have emerged after the last edition of the book was published; on fields like epegenetics. Furthermore, it is expected from students that they will join a couple of high-level meetings in the Netherlands, such as from BBRMI-NL.

Data Analysis and Visualisation

Vakcode	AM_1191 ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. C.C. Minica
Examinator	dr. L.E.J. de Zeeuw
Docent(en)	dr. L.E.J. de Zeeuw, dr. C.C. Minica, dr. C.V. Dolan
Lesmethode(n)	Hoorcollege, Computerpracticum
Niveau	400

Doel vak
The objectives of the course are
• for the student to acquire a basic knowledge of statistical thinking, about the stochastic nature of variables, about samples drawn from populations, distributions of both data and estimators, and the inferences that can be drawn from these.
• for the student to conceive the correct hypothesis, to be able to select the appropriate statistical analysis for a particular experiment or research design.
• for the student to be able to understand scientific articles

statistically and to be able to evaluate and critically think about the methods used.
• for the student to actually perform statistical tests in SPSS, explore and test the underlying assumptions, and report the results in both graphic and textual format.

Inhoud vak
Data analysis is the process of inspecting, cleaning, transforming and modeling data to be able to test scientific hypotheses and answer research questions. The lectures of this course will provide an overview of the basics of quantitative methods. This includes independent t-test, (partial) correlation, regression, multilevel modelling, ANOVA, ANCOVA, factorial ANOVA, paired samples t-test, repeated measures ANOVA and power. Each lecture will provide the theoretical background. The practicals will guide you through a statistical software package, SPSS. You will receive hands-on experience in the main steps involved in statistical analysis, from the formulation of hypotheses, selecting the right analysis types, running the analyses, to reporting the obtained results. This hands-on experience will be invaluable for your internships later that year and the second year of the Master of Neuroscience.

Onderwijsvorm
8 lectures, 8 computer practicals and 2 presentation sessions

Toetsvorm
The final score will be determined by the presentation (20%) and multiple choice + open ended questions exam (80%). 5 assignments have to be handed in that do not count towards the final grade. To pass the course, students need to pass the assignments, presentation and exam.

Literatuur
The literature consists of chapters from a book and several scientific papers. You will be required to know lecture material, practical material, as well as the scientific papers and book chapters.
• Andy Field Discovering Statistics using SPSS, 4rd edition, Sage. - Chapters 1-9, 11-14, 20 (20.1-20.6)
• Button et al. 2013 Nature Reviews Neuroscience; doi:10.1038/nrn3475
• Krzywinski & Altman, 2013 Nat Methods; doi:10.1038/nmeth.2738
• Ioannidis 2005 PLoS Medicine; doi: 10.1371/journal.pmed.0020124
• Tsilidis et al 2013 PLoS Biology; doi:10.1371/journal.pbio.1001609

Vereiste voorkennis
It is assumed that you are familiar with chapters 1-5 of the book before entering the course. The first lecture and practical will provide a short review of these five chapters, but cannot aim to fit all that reading material into two hours of lecture. The first lecture will include an entry test just to give you (and us) an insight into your own knowledge of statistics.

Developmental Neurobiology of the Vertebrate Brain

Vakcode	AM_470713 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen

Coördinator	dr. R.F.G. Toonen
Examinator	dr. R.F.G. Toonen
Docent(en)	dr. R.F.G. Toonen
Lesmethode(n)	Hoorcollege
Niveau	500

Doel vak
Many brain disorders originate from defects during early brain development. Therefore it is of vital importance that future neuroscience researchers obtain in depth knowledge of brain development.

This course will provide insights in the developmental mechanisms of neural circuits and their plasticity during early and late brain development.
The following issues will be covered: Molecular mechanisms of brain development from neurogenesis, neuronal migration, neuronal differentiation, axonal growth to synapse formation. We will address critical periods of development and experience dependent plasticity during embryonic and adult life in relation to normal brain function and brain disorders.
These topics are discussed while considering the adequate research technology and will be addressed during hands-on lab work using cultured neurons.

Inhoud vak
Lectures, seminars, master classes. The first two weeks will consist of lectures covering the developmental neurobiology topics discussed above and master classes from experts in the field of developmental neurobiology. The last two weeks will focus on and hands-on training on early development of mouse neurons in culture. In the last week, students will present on specific topics in developmental neurobiology.

Onderwijsvorm
This is a full time course.
Week 1&2: Lectures and seminars. These 2 weeks will be examined during a mid-term exam.
Week 3&4: Master classes, Journal Clubs and hands-on practicals focused on early development of neuronal networks, Human iPS cells and neuro-glia interactions.
In week 4, students will present on specific topics in developmental neurobiology.

Theory (30%)
A. Lectures
- 8 sessions of ± 3 hrs: 24 hrs
B. Masterclasses
- 3 classes of ± 3 hrs: 9 hrs
C. Individual Journal Club task
- 1 high-impact paper presentation 6 sessions of 2 hrs: 12 hrs
Hands-on lab work (30%)
- neuron development in vitro (polarization, neurite outgrowth, synapse formation): 10 sessions of ± 4 hrs: 40 hrs
- Presentation of results lab work: 1 session of 5 hrs
Self study (40%)
- 60 hrs

Toetsvorm
Written mid-term exam (40%). Oral presentation of seminar task (30%).
Presentation of labwork (30%)
Students need to pass all parts (grade > 5.5) to obtain final grade.

Literatuur
Handouts will be distributed at the beginning of the course.
PDFs of all lectures will be made available via BB

Vereiste voorkennis
1st year Master of Neurocience or equivalent.
Course is also open to non-VU students with neuroscience background or a strong interest in neuroscience. Please send email to course coordinator Ruud Toonen (r.f.g.toonen@vu.nl)
with study program details for eligibility and availability check.

Doelgroep
2nd year Master of Neuroscience or equivalent.
Please mind: this course is for 2nd year master students only.

Intekenprocedure
Maximum number of students is 20. Students from the Master of Neuroscience will have first choice. If more than 20 students apply, selection will be based on grades obtained during first year of the Master.
For further information and application, please contact: Dr. R. Toonen (r.f.g.toonen@vu.nl)

Experimental and Clinical Neuroendocrinology

Vakcode	AM_470700 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. C.B. Lambalk
Examinator	dr. C.B. Lambalk
Docent(en)	dr. J.B. Deijen, B.P.C. Kreukels BSc, dr. J. Rotteveel, dr. C.B. Lambalk, dr. M.M. van Weissenbruch, prof. dr. M. den Heijer
Lesmethode(n)	Hoorcollege, Practicum
Niveau	500

Doel vak
The aim of the course is to provide the students not only with a solid basis in the fundamentals of neuroendocrinology, but also with knowledge of recent developments and current research in this field of clinical neurosciences.

Inhoud vak
The course includes an understanding of structure and function of the hypothalamo- pituitary axis in relation to growth, stress, reproduction as well as to autonomic- endocrine and immune- endocrine interactions. Diseases of the hypothalamus and pituitary will be discussed, with special emphasis on central regulation of growth, puberty,

reproduction, obesity and stress, sexual orientation and gender identity, taking both an experimental and clinical point of view.

Onderwijsvorm
Lectures 24 hrs (appr)
Outpatient clinics 6 hrs
Research tutorials 10 hrs (appr)

Toetsvorm
Lectures 24 hrs (appr)
Outpatient clinics 12 hrs
Research tutorials 10 hrs (appr)

Literatuur
Kandel ER, Schwartz JH, Jessell TM Principles of Neural Science, 2012, 5th edition, McGraw Hill, ISBN 0071390111. (Ch 47) Selected papers to be handed out during the course.

Vereiste voorkennis
BSc Biology, BSc Medical Biology, BA Biological Psychology, BA Neuropsychology

Overige informatie
For further information, please contact mw. M. Evers (M.Evers@vumc.nl)

Maximum nr. of participants 25.

From Molecule to Mind

Vakcode	AM_1190 ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. G.J. Schenk
Examinator	dr. G.J. Schenk
Docent(en)	prof. dr. M. Verhage, prof. dr. H.D. Mansvelder, prof. dr. A.B. Smit, dr. G.J. Schenk, dr. L. Diergaarde, prof. dr. J.J.G. Geurts
Lesmethode(n)	Deeltoets extra zaalcapaciteit, Hoorcollege, Practicum
Niveau	400

Doel vak
Providing master students, independent of primary training, with a solid basis in molecular and cell biology, neurophysiology and functional neuroanatomy.

Inhoud vak
The course will be used to brush up your knowledge of neurophysiology, molecular and cellular neurobiology and neuroanatomy. During the first day of the course (September 4th 2017) an entry test will be given to get an impression of your cell and molecular neurobiology knowledge level. This test cannot be failed. It is a diagnostic exam that is strictly meant to elucidate in which areas you are proficient and in which you need to improve. Keynote lectures by

established researchers on exciting and cutting-edge topics as well as a keynote symposium related to the different research programs on campus will be held to give you an impression of the research we do and to prepare you for your search for an internship position (which will start in February 2018).
The exam will consist of three parts: cell biology, neurophysiology and neuroanatomy.

Onderwijsvorm
Lectures, study groups, assignments, practical sessions, presentations, demonstrations.

Toetsvorm
You will have to prepare presentations based on neurophysiology and neuroanatomy related assignments and are expected to participate actively during practical sessions. A written examination with open end questions will consist of three parts: cell biology, neurophysiology and neuroanatomy,
each accounting for a third of your final grade.

Literatuur
B. Alberts et al., 2013. Essential Cell Biology. Fourth Ed. ISBN 9780815344544.

D. Purves et al., 2012. Neuroscience. Fifth Ed. ISBN 9780878936953.
Practical guide : Human Neuroanatomy.
Macroscopic dissection of the
brain, to be handed out during the first practical session.

Recent scientific papers/reviews, to be handed out during the course.

Vereiste voorkennis
A bachelor in Biology, Biomedical Sciences, Psychology with profile Biological Psychology or Neuropsychology, or similar pre-training.

Doelgroep
The vast majority (>70%) of graduates of the Master's programme in Neurosciences go on to join a PhD programme either at VU University Amsterdam or at another academic institute in the Netherlands or abroad. This course will provide you with a firm base in molecular biology, cell biology, neurophysiology and functional neuroanatomy, from which you will benefit for the rest of your scientific career.

Intekenprocedure
Please visit:
http://www.vu.nl/nl/opleidingen/masteropleidingen/opleidingenoverzicht/m-o/neurosciences/admission-and-application/index.aspx
For further information, please contact dr. Geert Schenk (g.schenk@vumc.nl)

Overige informatie
Past evaluations of the course have shown that the first weeks are very useful, but also very busy. Therefore, if you have some time to spare during the summer and you want to create some breathing room for yourself during the first weeks of the course, we suggest to read up before the start of the course. If you want to receive an overview of compulsory reading material or if you want any further information, please contact dr. Geert J. Schenk (g.schenk@vumc.nl)

Functional Brain Imaging

Vakcode	AM_470715 ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. P.J.W. Pouwels
Examinator	dr. P.J.W. Pouwels
Lesmethode(n)	Computerpracticum, Hoorcollege
Niveau	500

Doel vak
The student will learn about the most important brain imaging techniques, the principles on which they are based and practical applications in research and patient care.
Quite some emphasis on physics and mathematics will be given during the lectures. However, the goal is not to examine the students on this knowledge, but to provide sufficient background to develop a critical and scientific attitude towards imaging techniques.
The main focus for the students will be to translate this knowledge into the potential use of techniques in neuroscience.

Inhoud vak
In this course the student will learn about techniques to study structure and function of the brain that are used in clinical studies and in neuroscientific research.
Three main approaches can be distinguished: neurophysiological techniques (EEG, MEG), magnetic resonance techniques (MRI, fMRI, MRS) and techniques which
involve the use of radio active ligands (SPECT, PET). In addition, network approaches to describe brain structure and function will be discussed.
The background, possibilities and limitations of these techniques will be discussed in relation to ongoing research at the VU University Medical Centre and Amsterdam Neuroscience, including Brain imaging (methodological innovation), Brain mechanisms (childhood white matter disorders), Neurodegeneration (Alzheimer's disease, Parkinson's disease), Neuroinfection & neuroinflammation (Multiple Sclerosis), Compulsivity, impulsivity & attention (obsessive compulsive disorder).

Onderwijsvorm
The basic principles and several applications of all techniques will be presented in a series of lectures scheduled during the first 6 weeks (typically two or three days a week - the other days are available for either Advanced Clinical Neuroscience or Psychophysiology).
Attendance at the lectures is required. Small groups will discuss particular aspects in more detail.
During the course, visits to the departments involved in imaging will be arranged.
Hands-on experience of analysis methods is provided in computer practicals.

Toetsvorm
Individual written opinion paper / essay (50% of final mark).
Team presentation about a functional brain imaging experiment about a neurological disorder / neuroscientific problem. (50% of final mark).
For each of these items a minimum score of 5.0 is required.

Literatuur
- Bullmore E, Sporns O: Complex brain networks: graph theoretical analysis of structural and functional systems. Nat Rev Neurosci. 2009 Mar;10(3):186-98.
- Gong G, He Y, Evans AC: Brain connectivity: gender makes a difference. Neuroscientist. 2011 Oct;17(5):575-91
- Stam CJ: Characterization of anatomical and functional connectivity in the brain: a complex networks perspective. Int J Psychophysiol. 2010 Sep;77(3):186-94.
- Varela F et al: The brainweb: phase synchronization and large-scale integration. Nat Rev Neurosci. 2001 Apr;2(4):229-39.
- Devlin H et al: Introduction to fMRI.
http://www.fmrib.ox.ac.uk/education/fmri/fmri/introduction-to-fmri
- Matthews PM et al: Applications of fMRI in translational medicine and clinical practice. Nat Rev Neurosci. 2006 Sep;7(9):732-44.
- Lazar M: Mapping brain anatomical connectivity using white matter tractography. NMR Biomed. 2010 Aug;23(7):821-35.
- Beaulieu C. The basis of anisotropic water diffusion in the nervous system - a technical review. NMR Biomed. 2002 Nov-Dec;15(7-8):435-55
- Blokland JA et al: Positron emission tomography: a technical introduction for clinicians. Eur J Radiol. 2002 Oct;44(1):70-5.
- Klunk WE et al: Imaging brain amyloid in Alzheimer's disease with Pittsburgh Compound-B. Ann Neurol. 2004 Mar;55(3):306-19.
- Lammertsma AA: Radioligand studies: imaging and quantitative analysis. Eur Neuropsychopharmacol. 2002 Dec;12(6):513-6.
- Phelps ME: Positron emission tomography provides molecular imaging of biological processes. Proc Natl Acad Sci U S A. 2000 Aug 1;97 (16):9226-33.
- Baillet S et al: Electromagnetic brain mapping. IEEE Signal Processing Magazine 2001 Nov;18(6):14-30.
- Hari R, Salmelin R: Human cortical oscillations: a neuromagnetic view through the skull. Trends Neurosci. 1997 Jan;20(1):44-9.
- Hillebrand A et al: A new approach to neuroimaging with magnetoencephalography. Hum Brain Mapp. 2005 Jun;25(2):199-211.

Vereiste voorkennis
Finished 1st year Master of Neurosciences or finished 1st year Master of Biomedical Sciences.

Doelgroep
Students following 2nd year master-tracks Clinical Neurosciences or Psychophysiology.
Students with other background, please first contact coordinator.

Overige informatie
There is a maximum number of students.
This means that students other than the target group should first contact the coordinator.
Taught in English.
For further information, please contact dr. P.J.W. Pouwels - (Petra) - (pjw.pouwels@vumc.nl)

Genomic Data Analysis

Vakcode	AM_1008 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. P. van Nierop
Examinator	dr. P. van Nierop
Docent(en)	dr. P. van Nierop, dr. Z. Bochdanovits
Lesmethode(n)	Hoorcollege, Computerpracticum
Niveau	500

Doel vak
To provide students with basic knowledge and skills to independently design, execute and explain the results of data analysis in the context of a genomics/proteomics experiment.

FINAL ATTAINMENT LEVELS :
(i) Graduated students have acquired the necessary research skills to plan, execute, and reflect on elementary steps in data processing, statistical evaluation, and representation of results of a genomics experiment;
(ii) students have knowledge of the principles behind analysis of protein and DNA sequence information;
(iii) students have basic programming skills in the R programming language

Inhoud vak
The course will address various aspects of bioinformatics analysis of the genome and will address the following topics:
- Gene expression analysis: this section of the course deals with stages in data analysis that are associated with large scale transcriptomics data (microarray experiment). Consecutive stages of data analysis, i.e., experimental design (as far as relevant for data analysis), data preprocessing, normalization, statistical evaluation, and the identification of relevant gene groups, are discussed. At each stage specific characteristics of large scale genomics experiments that impair a straightforward interpretation of results are highlighted and alternative analysis strategies are discussed. The lectures are accompanied by computer practicals where theory is put into practice and the basic practical skills are acquired for genomics data analysis and representation in the R programming language. The theoretical and practical skills are applicable to any 'omics' (genomics, proteomics, metabolomics) experiment.
- Analysis of biological sequences: this section of the course teaches the fundamentals of mining of information on DNA and protein sequences relevant for molecular biology research. Special attention is given to the principle of molecular evolution and the translation thereof into algorithms for sequence analysis. Topics of sequence alignment, sequence database searching, and phylogenetic analysis will be discussed, and are accompanied by computer practicals that provide insight into sequence analysis algorithms as well as familiarize students with popular sequence analysis tools such as BLAST and ClustalW.

Onderwijsvorm

Lectures (20 hr), practicals (15 hr)

Toetsvorm
Written exam(60%), microarray data analysis assignment (20%), sequence analysis assignment (20%)

Literatuur
Dov Stelkel, Microarray bioinformatics, 2003, Cambridge University Press, ISBN 052152587X

David W Mount, Bioinformatics: sequence and genome analysis, 2004, 2nd edition, Cold Spring Harbor Laboratory Press, ISBN 0879697121

Vereiste voorkennis
Bachelor Biology, Biomedical Sciences, Psychology with profile Biological Psychology or Neuropsychology, Neurogenomics course.

Doelgroep
The course provides essential body of knowledge and skills to students that pursue a career in Life Sciences at the molecular level (genomics, proteomics, metabolomics).

Overige informatie
For further information, please contact dr. P. van Nierop (p.van.nierop@vu.nl)

Internship Neurosciences I

Vakcode	AM_471108 ()
Periode	Ac. Jaar (september)
Credits	27.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. L. Diergaarde
Docent(en)	dr. L. Diergaarde
Lesmethode(n)	Werkcollege
Niveau	600

Doel vak
The aim of a Master's Neurosciences internship is to learn to independently conduct neuroscientific research. At the end of an internship the student
• is able to independently find scientific information and knows how to analyse, summarize and critically evaluate this for the benefit of his or her own research question.
• is able to use the principles from different disciplines in the design of research plans, the execution of research, and the analysis of the results.
• has command of the relevant research techniques and laboratory procedures, including safety procedures and the ability to solve emerging problems.
• has command of the use of computer software relevant for the field.
• is able to communicate experimental results in a scientific article in English, and by means of an oral presentation.

• can analyse and evaluate planning, execution and results of research independently and critically.
• is able to collaborate with researchers of various disciplines.
• can contribute to scientific discussions about plans, results and consequences of research.
• can reflect on ethical aspects of research and applications of research.
• can evaluate his or her own functioning in the internship, both by reflection and in discussions with others.
• has obtained a good impression of a potential future field of career.

Inhoud vak
Writing research proposal and report (scientific article in English), conducting experiments and analyses, presenting and discussing data.

Onderwijsvorm
The day-to-day supervisor teaches the student the necessary neuroscientific research techniques/tools and analysis tools and regularly provides feedback on the performance of the student.

The day-to-day supervisor and/or first assessor also aid in the student's development of the following skills, by means of formative assessment
- academic skills (incl. insight and creative thinking)
- scientific writing skills
- presenting skills
- attitude

Toetsvorm
Written research proposal (GO/NO-Go decision after 6 weeks: decision on whether the project and the student both have enough potential to continue)
Final grade: attitude & execution (25%), oral presentation (25%), written report (assessor 1: 25%; assessor 2: 25%)

Literatuur
Starting literature is provided by the supervisor.

Vereiste voorkennis
Student has to have obtained at least 18 ECTS from the MSc Neurosciences program before the internship can commence.

Doelgroep
First year MSc Neurosciences students

Intekenprocedure
Via the master coordinator (Application and agreements form).
The student e-mails the master coordinator a signed Application and Agreement form incl. a research proposal at least four weeks before the start of the internship. The internship can commence as soon as the master coordinator has approved the project.

Internship Neurosciences II

Vakcode	AM_471109 ()
Periode	Ac. Jaar (september)

Credits	25.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. L. Diergaarde
Niveau	600

Doel vak
The aim of a Master's Neurosciences internship is to learn to independently conduct neuroscientific research. At the end of an internship the student
• is able to independently find scientific information and knows how to analyse, summarize and critically evaluate this for the benefit of his or her own research question.
• is able to use the principles from different disciplines in the design of research plans, the execution of research, and the analysis of the results.
• has command of the relevant research techniques and laboratory procedures, including safety procedures and the ability to solve emerging problems.
• has command of the use of computer software relevant for the field.
• is able to communicate experimental results in a scientific article in English, and by means of an oral presentation.
• can analyse and evaluate planning, execution and results of research independently and critically.
• is able to collaborate with researchers of various disciplines.
• can contribute to scientific discussions about plans, results and consequences of research.
• can reflect on ethical aspects of research and applications of research.
• can evaluate his or her own functioning in the internship, both by reflection and in discussions with others.
• has obtained a good impression of a potential future field of career.

Inhoud vak
Writing research proposal and report (scientific article in English), conducting experiments and analyses, presenting and discussing data.

Onderwijsvorm
The day-to-day supervisor teaches the student the necessary neuroscientific research techniques/tools and analysis tools and regularly provides feedback on the performance of the student.

The day-to-day supervisor and/or first assessor also aid in the student's development of the following skills, by means of formative assessment
- academic skills (incl. insight and creative thinking)
- scientific writing skills
- presenting skills
- attitude

Toetsvorm
Written research proposal (GO/NO-Go decision after 6 weeks: decision on whether the project and the student both have enough potential to continue).
Final grade: attitude & execution (25%), oral presentation (25%),

written report (assessor 1: 25%; assessor 2: 25%).

Literatuur
Starting literature is provided by the supervisor.

Vereiste voorkennis
The student needs to have successfully completed Internship Neurosciences I, before
Internship Neurosciences II can commence.

Doelgroep
Second year Master's Neurosciences students.

Intekenprocedure
Enrollment in the course via vu-net.
NB the project needs prior approval of the master coordinator: The student sends the master coordinator a signed Application and Agreement form incl. a research proposal at least four weeks before the start of the internship. The internship can commence as soon as the master coordinator has approved the project.

Literature Survey Neurosciences

Vakcode	AM_471110 ()
Periode	Ac. Jaar (september)
Credits	8.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. L. Diergaarde
Niveau	600

Doel vak
The students writes a review paper that meets the author guidelines of a pre-selected neuroscientific journal, and gives an oral presentation on this topic.

The student is able to
[this applies to both review paper and oral presentation]
- plan and complete tasks involved in writing the review paper in an efficient and independent manner
- select relevant literature
- generate ideas and concepts on own
- provide a well-structured overview of the literature (including: concise summary; coherent theoretical framework; clear hypothesis; fully, systematically and accurately presented findings)
- analyse and evaluate findings in a critical manner
- draw appropriate conclusions and formulate implications of the findings for further theoretical development

[this applies to the review paper only]
- write a review paper with virtually no language or spelling errors
- use a clear writing style

[this applies to the oral presentation only]
- present in an enthusiastic and convincing manner
- use clear and effective visual aids

- listen to questions, answer questions in a respectful manner
- devote enough time to each key point
- respect the time allotted for the presentation

Inhoud vak
- Writing of a neuroscientific review paper in English, thereby providing an overview of the literature
- Oral presentation of this review paper, including discussion

Onderwijsvorm
Assessor 1 provides formative feedback on the writing process and on the review paper itself.

Toetsvorm
Assessor 1: 50% (writing process + review paper + oral presentation), assessor 2: 50% (review paper)
The review paper is independently assessed by the 2 assessors.

Literatuur
The student is responsible for collecting scientific articles. The supervisor can aid the student in this process, if necessary.

Vereiste voorkennis
The student has to have succesfully completed Internship Neurosciences I before the Literature survey can commence.

Doelgroep
Second year Master's Neurosciences students

Intekenprocedure
Enrolment via vu-net. NB the master coordinator has to provide prior approval of the project .
The student sends the master coordinator a signed Application and Agreement form incl. a short description of the literature survey at least four weeks before the start of actual writing process. The course can commence as soon as the master coordinator has approved the proposal and the agreements.

Live Cell Imaging

Vakcode	AM_470726 ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. R.F.G. Toonen
Examinator	dr. R.F.G. Toonen
Docent(en)	dr. R.F.G. Toonen, dr. R.M. Meredith
Lesmethode(n)	Hoorcollege
Niveau	500

Doel vak
This course will provide the student with theoretical and practical knowledge to utilize emerging cellular and sub-cellular imaging technologies in neuroscience.

Inhoud vak
Advances in light microscopy, digital image processing, and the development of a variety of powerful fluorescent probes present expanding opportunities for investigating the nervous system, from synaptic terminals to networks in the brain. This intensive theoretical and practical course will provide participants in-depth knowledge to utilize emerging imaging technologies. The primary emphasis of the course will be on vital light microscopy. Students will learn the principles of light microscopy, as well as use of different types of electronic cameras, laser scanning systems, functional fluorophores, delivery techniques, and digital image-processing software. In addition to transmitted light microscopy for viewing cellular motility, the course will examine a variety of molecular probes of cell function, including calcium-sensitive dyes, voltage-sensitive dyes, photoactivated ("caged") compounds, and exocytosis and vesicle trafficking tracers. Issues arising in the combination of imaging with electrophysiological methods will be covered. Particular weight will be given to single- and multi-photon laser scanning microscopy, photo-stimulation techniques and to newly available biological fluorophores, especially Green-Fluorescent Protein (GFP) and its variants.

Onderwijsvorm
This is a full time course. In the first two weeks we will address all major live cell imaging techniques and their applications in a series of lectures and Masterclass meetings with experts in the field. A mid-term exam will test the obtained knowledge. The last 2 weeks will be devoted to hands-on experiments in the lab in small groups. Students will perform 2 imaging experiments under guidance of an experienced PhD-student or Postdoc.

Toetsvorm
Oral group presentations of results experiments (50%) and Mid-term Exam (50%). Students need to pass both parts (grade > 5.5) to obtain final grade.

Literatuur
Course coordinators will provide selected chapters from Live Cell Imaging. A laboratory Manual. Editors: Goldman and Spector and a selection of primary scientific papers at start of the course.

Vereiste voorkennis
1st year Master of Neurocience or equivalent. Course is also open to 2nd year Master students from other courses and to non-VU neuroscience students but ONLY if course is not filled-up by VU Master students. Non-neuroscience master students need to contact course coordinators with study program details for eligibility check prior to self enrolment.

Doelgroep
2nd year Master of Neuroscience students.

Intekenprocedure
Standard VU enrolment. Non-neuroscience master students need to contact course coordinators with study program details for eligibility check prior to self enrolment.

Overige informatie

Maximum number of students is 20. Master of Neuroscience students will have priority. In case more than 20 Master students apply, selection will be based on grades obtained in year 1 of the Master. Vacant positions (if any) will be filled on basis of first come first serve but only after eligibility check.
For further information and application, please contact: Dr. R. Toonen (r.f.g.toonen@vu.nl) or Dr. R. Meredith (r.m.meredith@vu.nl).

Methods in Behavioral Neurosciences

Vakcode	AM_470728 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. S. Spijker
Examinator	prof. dr. S. Spijker
Docent(en)	prof. dr. S. Spijker
Lesmethode(n)	Werkcollege
Niveau	500

Doel vak
The course will give an overview of methods, the behavior tests and its measures (used in a number of different research areas in behavioral neuroscience), and the interpretation of these data. By means of expert knowledge from those who are actively involved in the newest techniques and topics, we will provide you with a critical overview of how you are able to integrate behavioral phenotyping with molecular and cellular studies to find causal relations in biomedical research using models for human disorders/diseases. The course aims to develop critical thinking in behavioral research.

Inhoud vak
In behavioral and molecular neuroscience we study how different brain areas are involved in the control and execution of behavior.
Importantly, the methods used have to capture important aspects of the normal behavior of the animal, and the interference used for studying causal aspects of cells/molecules in that behavior should not confound this type of normal behavior. In order to obtain results that are both reproducible and reliable it is important to that the methods used are standardized and that there is agreement on what the measures actually mean (its interpretation).

The following topics will be covered to better understand and judge the behavior test spectrum and its use in behavioral phenotyping:
- Standardized tests of learning and memory
- Home cage-based phenotyping
- Attention and impulsivity
- Anhedonic and cognitive aspects of depression models
- Autonomic functions in behavior as index of emotion
- Animal welfare under dutch law

In addition, for evaluation of the molecular and cellular mechanisms that drive these behaviors the following topics are covered
- Animal models for tagging neuronal activity

- Optogenetics and chemogenetics in behavioral neuroscience

Onderwijsvorm
Lectures and discussion based on primary research papers / unpublished data will be mainly in week 1. Demonstrations will be given when compatible with the current experiments. Individual or pairs will interact on a 1 to 1 basis with a supervisor of choice in preparation of a mini-literature review (mainly week 2-4).

Toetsvorm
1) Student presentation on mini-review (21%)
2) Written mini-review for the jointly prepared manuscript (49%)
3) Written examination with open-ended questions (30%)
In all three assessment forms the minimal grade has to be 5.5 to pass the course.
Redoing the exam is possible in the summer period. Redoing the mini-review and/or presentation might be possible after consultation with the course coordinator; otherwise this can be redone the next year.

Literatuur
Primary literature (papers) generally provided through digital Canvas.

Vereiste voorkennis
Basic knowledge of animal behavior.

Doelgroep
MSc. Biology and MSc. Neuroscience students.

Intekenprocedure
There is a minimum of 6 participants in the course, and a maximum of 15 participants.
Mind to mail to the coordinator in case you did subscribe, but you are not going to follow the course.

Overige informatie
There is a minimum of 6 participants in the course, and a maximum of 15 participants. Mind to mail to the coordinator in case you did subscribe, but you are not going to follow the course.

Neuro- and Psychopharmacology

Vakcode	AM_470718 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. M.M.M. Wilhelmus
Examinator	dr. M.M.M. Wilhelmus
Docent(en)	dr. M.M.M. Wilhelmus
Lesmethode(n)	Hoorcollege
Niveau	600

Doel vak
Principal aim of the course is to provide the student with sufficient insight into the basic principles of Neuro- and Psychopharmacology, in

order to enable the student to independently formulate ideas and concepts which may lead to the development of innovative drug therapies. The subjects of the course are largely drawn from research themes of the Neuroscience Campus Amsterdam of the Vrije Universiteit and VU University Medical Center.
Specific aims:
A) Students are able to describe the pathology of the disease and know which biological mechanisms are the driving forces underlying the pathology.
B) Students are capable of pinpointing possible therapeutic entries of the disease, and can argue whether and how the therapy will affect these therapeutic entries.
C) Students are able to defend and motivate their therapeutic strategy in front of fellow students and teachers.

Inhoud vak
Current pharmacotherapy of well known neurologic- and psychiatric disorders is based on the use of drugs of which the development has been guided by, often unproven, hypotheses concerning the pathophysiology of these diseases. As a result, despite a few "success stories", in most cases this has led to the introduction of suboptimally effective compounds. Moreover, these "therapeutics" do not cure the disease, but merely act to ameliorate the symptoms. However, in light of the increasing knowledge concerning the pathogenesis of brain disorders, it now seems highly feasible that in the near future drugs will be developed which will target the core of the disease process.
During the course, a small number of lectures will provide the student with detailed knowledge and insight into the hypotheses that have guided the development of the current generation of neuro- and psychopharmaceuticals. Subsequently, the student will be expected to 1) independently identify the strong points and weaknesses of these hypotheses, and 2) use the conclusions of this evaluation, in combination with recent developments in the field, to formulate a well-based proposal for the development of a new pharmacotherapy for a specific brain disease.

Onderwijsvorm
Lectures (approximately 19h), progression meeting with supervisor (3h) and writing a thesis and preparing presentation (approximately 96h). In total, the students are expected to invest a workload of 40 hour each week during this course.

Toetsvorm
Pharmacology exam (1/4 of mark, in writing), writing (1/2 of mark) and public presentation (1/4 of mark) of thesis.

Literatuur
- Relevant chapters from "Medical Pharmacology at a Glance"; M.J. Neal, Seventh Edition
(John Wiley & Sons, Ltd 2012), ISBN 978-0-470- 65789-8
- Relevant chapters from "Rang and Dale’s Pharmacology"; H.P. Rang, J.M. Ritter, R.J. Flower, G. Henderson. Eight Edition (Elsevier
2015), ISBN 978-0-7020-5363-4.
- Additional texts provided during the course

Vereiste voorkennis
Medical Pharmacology course or equivalent.

Overige informatie
A maximum of 24 students can be accommodated in the course. Preference is given to students who participate in the Master of Neuroscience program of the VU University Amsterdam. Course is taught in English. For further information please contact dr. M. Wilhelmus (m.wilhelmus@vumc.nl).

Neurogenomics

Vakcode	AM_1007 ()
Periode	Periode 3
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. A.B. Smit
Examinator	prof. dr. A.B. Smit
Lesmethode(n)	Hoorcollege, Werkgroep, Computerpracticum
Niveau	500

Doel vak
To provide the Master of Neuroscience students with a solid basis in understanding the genome and working mechanisms and function of genes in relation to the development and functioning of the nervous system.

Inhoud vak
The course will address the various aspects of functional analysis of the genome, by addressing the following topics:

• The search for genes and gene variants which are underlying neuronal physiology and pathology, including forward genetics an gene-hunting strategies
• Functional analysis of genes through reverse genetics
• Gene expression analysis of neuronal cells and brain areas (gene expression profiling)
• The analysis of proteins (proteomics) and complexes thereof.
• Simulation of genetic and protein networks
• The introduction of various model organisms relevant for neurogenomics research, such as, man, mouse, Drosophilla, C. elegans, and zebrafish.

Onderwijsvorm
Lectures, experiments, workshops, student presentations, computer practicals

Toetsvorm
Written examination, open end questions. Practical task, presentation and literature evaluation.

Literatuur
To be announced on Canvas

Vereiste voorkennis
Bachelor Biology, Biomedical Sciences, Psychology with profile Biological Psychology or Neurophysiology

Intekenprocedure
Students need to enroll via VUnet
Students not enrolled in the VU master's in Neurosciences, need to contact the course coordinator prior to enrollment

Overige informatie
Language: tuition in English

Neuronal Networks in Vivo

Vakcode	AM_1001 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. C.P.J. de Kock
Examinator	dr. C.P.J. de Kock
Docent(en)	dr. C.P.J. de Kock
Lesmethode(n)	Werkgroep, Practicum
Niveau	600

Doel vak
The aim of this exciting course is to provide insight into the most intricate neuronal network of the brain – the cortical microcircuit. You will learn the basic floor plan of the cortex and find out the function of
different layers and multiple cell types. As the course title suggests, all topics will
be addressed from the in vivo perspective which aims to combine cortical function with animal behaviour. You will get hands-on experience in in vivo experiments, data analysis and how to identify different types of cortical neurons.

Inhoud vak
The course starts with plenary lectures on cortical circuitry and on recent advances to study the properties of cortical networks. These advances involve in vivo imaging and electrophysiological techniques that are applied in anaesthetized and awake animals. The lectures will gradually merge into a master class setting where you will work on a methods-thesis and a mini-thesis. In the methods thesis (individual ppt) you will highlight a recently developed (in vivo) technique and discuss the advantages and disadvantages. In the mini-thesis (duo-setting, pdf and ppt) you will review two experimental papers (from a pre-selected or self-chosen set) and write a critical evaluation. In addition, the course will feature demonstrations of in vivo experiments, practical (histological) work and will be concluded with a workshop where you learn how to discriminate and recognize different cortical cell types using real rat, mouse and human brain slices.

Onderwijsvorm
Lectures 16 hours 31% 1.9 ECTS
Demo’s in vivo experiments 16 hours 31% 1.9 ECTS
Histology workshop 8 hours 15% 0.9 ECTS
Cell identific. workshop 2 hours 4% 0.2 ECTS

Final presentations 10 hours 19% 1.1 ECTS

Total 52 hours 100% 6.0 ECTS

Toetsvorm
1) Written Examination

2) Presentation on an in vivo methods.

3) Written thesis (Report, 5 pages) on an in vivo topic, accompanied by a Topic Presentation. The topic can fall into three catagories: 1) a "hot"
current topic in the field. 2) the topic covers a set of papers with conflicting outcomes or 3) the topic covers similar outcomes with different in vivo approaches.

Final grading depends on Examination (pass/fail), Methods Presentation (33%),
Report (33%), and Topic Presentation (33%). All components have to be passed.

Literatuur
Oberlaender et al, Cereb Ctx 2012
Harris and Shepherd, Nat Neurosci 2015
Tremblay et al, Neuron 2016
Mohan et al, Cereb Ctx 2015
Markram et al, Cell 2015
Kasthuri et al, Cell 2016

Doelgroep
Master of Neurosciences students of VU University Amsterdam or students from other universities participating in a comparable (Neuroscience) master program. Students not in the target group should contact the course coordinator prior to enrolment and discuss eligibility requirements.

Overige informatie
Guest Lecturers:
Roel de Haan, MSc, FALW
Anton Pieneman, FALW
Sarah Hunt, Dr. FALW
Suman Das, Dr. FALW

Neurophilosophy and Ethics

Vakcode	AM_1018 ()
Periode	Periode 3
Credits	3.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. G. Glas
Examinator	prof. dr. G. Glas
Docent(en)	prof. dr. G. Glas, H.E. Hulst
Lesmethode(n)	Hoorcollege
Niveau	500

Doel vak
This course gives an introduction into philosophical and ethical issues that are part of neuroscientific research and of the application of neuroscientific insights in professional practices and in the communication with the general public.
Final attainment level: at the end of the course the student is able
- To identify logical errors in scientific papers
- To understand and reproduce four positions in the debate about the relation between brain and mind
- Point out the differences between the concepts of cause, explanation,law, correlation
- To identify ‘reification’ and scientistic reasoning
- To give an ethically informed account of the relation between scientific research and the industry
- To provide a summary statement about the role of the scientist in educating the general public.

Inhoud vak
Part 1. Philosophy of science and methodology (6 hours)
This part of the course addresses questions like
- what is science?
- what do concepts like cause, explanation, and law mean?
- what is the difference between correlation and causation? how can one discern different types of relation: lawlike relations, statistical relations; covariations
- when do statistical relations say anything about reality?
- hypothesis-driven research versus bottom-up ‘data-driven’ research
- explanation of terms: inference to the best explanation, post hoc explanation, validation (different types of validation)

Part 2. Basic concepts(6 hours)
This part of the course addresses questions like
- what is mind?(including the notion of ‘extended mind’)
- what is relation between mind and brain? (with an introduction into the conceptual history of this relationship)
- what is embodiment?
- what is a gene (the gene as ‘fuzzy’ concept)?
- conceptualizations of complexity (system theory; neurophilosophy)

Part 3. Ethical issues (4 hours)
This part of the course gives an introduction to basic concepts and to current approaches of ethics. Special attention to issues like
- informed consent, especially in neurological and psychiatric patients
- intertwinement between science and industry
- neurosurgery (in OCD and Parkinson’s disease)
- brain implants

Part 4. Educating the public (4 hours)
This part of the course is devoted to the position of the scientist who is asked to inform the general public. What can be said on the basis of neuroscience research and what not? Is it for example legitimate for a scientist to say
- that God does not exist
- that we have no free will
- that morality is nothing but a product brain wiring
Another question would, what to say as scientist about the status of evolutionary explanations in the public sphere.

Onderwijsvorm
20 hours interactive Interactive lectures (in English), video, discussion of the literature, ‘Lagerhuys debate’, pitching

Toetsvorm
Each student gives a brief presentation about his or her research project and discusses one or two philosophical issues with respect to his project (the grade for this presentation forms 1/4 of the final grade; only for those who present). The other 3/4 of the grade is based on a final paper, which provides a brief summary of the main issues that are discussed (max 2 pages per lecture) and a three page account of a particular philosophical or ethical problem (question, possible answers, discussion of philosophical/ethical resources to answer the question, conclusion).
The three page paper may also consist of an in-depth analysis of the conceptual strengths and weaknesses of metaphors that are used in the translation of neuroscientific findings to the broader public.

Literatuur
Will be provided two months before the beginning of the course.

Aanbevolen voorkennis
Students are adviced to read an introduction into philosophy beforehand

Doelgroep
Research master students Neuroscience

Neuropsychiatric Genetics

Vakcode	AM_1195 ()
Periode	Periode 2
Credits	6.0
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. D. Posthuma
Examinator	prof. dr. D. Posthuma
Docent(en)	prof. dr. D. Posthuma
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	500

Doel vak
The main aim of this course is to provide a comprehensive overview of the current state-of-the-art of the field of Neuropsychiatric Genetics, and to teach how novel findings in this field can be translated for use in clinical practice.
Specific learning objectives:
- To be able to interpret outcomes from gene-finding studies for neuropsychiatric disorders
- To understand the difference between common variants and rare variants
- To have good insight into the current state of the art in Neurosychiatric Genetics
- To have insight into the predictive power of outcomes of genome-wide association studies (common variants/rare variants - structural variant, sequencing) and the utility of these for clinical practice
- To generate hypotheses about biological disease mechanisms based on

genome wide approaches
- To translate outcomes of gene finding studies to actionable targets for functional follow-up
and design a functional research design to test the role of these targets in

Inhoud vak
Neuropsychiatric disorders are a major economic, societal and personal burden. Major scientific efforts have therefore focused on identifying causal genetic variants to increase insight into disease mechanisms and improve risk prediction. After a century of limited etiological progress, the past decade has seen unprecedented advances in our understanding of the fundamental genetic architectures of mental disorders. Unlike single gene disorders, mental disorders are influenced by thousands of genetic risk variants of small effect, that combine to increase risk for disease. This highly polygenic nature poses major challenges and raises many questions. For example, how can we generate hypotheses about disease mechanisms based on thousands of risk variants each of small effect? And, how can we use such variants to diagnose and predict disease? To benefit from the wealth of genetic findings, use them to screen for and predict disease, and translate them into clear therapeutic targets we need to provide the next generation of medical practitioners with knowledge and understanding of the state-of-the-art techniques available in complex trait genetics.
The course will bridge the gap between human genetics and functional genomics, and will provide students with clear target-routes of how these fields are interconnected, and how their combined contribution aids in understanding psychiatric disorders. In the course students will discuss and critically evaluate the value of classic and modern techniques from functional genomics in uncovering disease mechanisms of psychiatric disorders. The use of induced pluripotent stem cells for functional follow-up studies in psychiatry will be extensively discussed.
The course will provide an overview of the current state of affairs in neuropsychiatric genetics and future directions of the field.

Onderwijsvorm
The course will exist of general lectures by the Course Coordinator, keynote lectures by specialized experts, and smaller working/discussion/reading groups, led by PhD students/Postdocs.

Toetsvorm
Format of examination: Presentation (40%), Written exam (60%)

Literatuur
The course material will consist of selected published scientific papers.

Vereiste voorkennis
The course Behavior Genetics (1st year Master Neurosciences) or equivalent

Doelgroep
2nd year Master of Neuroscience students. Minimum of 8 participants!

Overige informatie
main: Prof D Posthuma
Keynotes from: Prof Philipp Koellinger, dr Vivi Heine, dr Sophie van der Sluis. Minimum of 8 participants.

Psychophysiology

Vakcode	AM_470736 ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. J.C.N. de Geus
Examinator	prof. dr. J.C.N. de Geus
Lesmethode(n)	Werkgroep, Practicum, Hoorcollege
Niveau	400

Doel vak
1) Insight in the link between emotional state and peripheral nervous system activity and the most recent experimental approaches and research designs in the field of autonomic and cardiovascular psychophysiology.

2) Practical skills in the measurement of autonomic nervous system and cardiovascular stress-reactivity.

Inhoud vak
In plenary lectures we will outline the organisation of the autonomic nervous system and the cardiovascular system and how their activity is reflected in peripheral physiological signals. The lectures are interspersed with a series of practicals, where the students apply a broad arsenal of instruments and techniques (ElectroCardioGram, ImpedanceCardioGram, Skin-conductance, Respiration, Finger Blood Pressure, Hormones) to record these signals and to extract parameters that can be used to index psychological processes (e.g. mental load, emotion and stress). This will be done in a standardized laboratory setting using the Biopac system as well as in naturalistic open-field settings using the Vrije Universiteit Ambulatory Monitoring System (VU-AMS). Amongst others, students will measure (on each other): skin-conductance responses to emotion, cardiorespiratory coupling, baroreflex regulation, and sympathetic and parasympathetic reactivity to mental and physical stress. The main principles and strategies for data analysis will be covered in the lectures and applied in the practicals to the self-recorded data-sets.

Onderwijsvorm
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mental and physical stress. The main principles and strategies for data analysis will be covered in the lectures and applied in the practicals to the self-recorded data-sets.

Number of contact hours:
Lectures: 20h
practicals & practical preparation: 70h
Examination: 2h
self-study: 70h

Toetsvorm
Written examination (50% of grade) and independent performance of a short experiment (20%) and analysis and presentation of the data collected (30%).

Literatuur
1) Psychophysiology reader with selected open access papers (published on Canvas, end of August)

AND

2a) Vander, A., Sherman, J. & Luciano, D. Human physiology, the mechanisms of body function. Boston: WCB-McGraw-Hill: blz 373-463 (Circulation), blz 463-504(Respiration).
OR
2b) Stanfield J, Principles of Human Physiology (4th Ed). Pearson Education Inc: chapters 13,14 (Circulation), and 16 (Respiration)

AND

3) 7 short practical manuals

Vereiste voorkennis
If followed as part of the Master Biomedical Sciences, students must have completed the 1st year.

Aanbevolen voorkennis
General knowledge of cardiovascular physiology, SPSS usage, and biomedical experimentation.

Doelgroep
Future employees of biomedical R&D departments in public institutions (e.g. University) or private (e.g. biotech)companies

Intekenprocedure
Due to the large amount of practicals, it is essential to know timely how many students will enroll. Students are advised to email the course coordinator (j.c.n.de.geus@vu.nl) that they aim to enroll, and to do so well before August 1.

Overige informatie
Due to the large amount of practicals, it is essential to know timely how many students will enroll. Students are advised to email the course coordinator (j.c.n.de.geus@vu.nl) that they aim to enroll, and to do so well before August 1.

Rhythms of the Brain

Vakcode	AM_1003 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. K. Linkenkaer Hansen
Examinator	dr. K. Linkenkaer Hansen
Docent(en)	dr. K. Linkenkaer Hansen
Lesmethode(n)	Hoorcollege, Werkgroep, Computerpracticum, Practicum
Niveau	600

Doel vak
The course "Rhythms of the Brain" is focused on measuring, analyzing and interpreting the functional role of neuronal
oscillations in humans.

At the end of the course the student should be able to:
1. Explain how the human brain generates scalp electroencephalographic (EEG) signals, both ongoing oscillations and event-related potentials (ERPs).
2. Acquire practical experience with EEG (i.e., measure EEG, perform quantitative and statistical analysis to draw conclusions about the relation between brain activity and cognition/behavior, and present the results on a poster).
3. Explain key concepts of complex-systems science that have gained acceptance in the cognitive and behavioral neurosciences.
4. Apply state-of-the-art complexity-analysis techniques to EEG data and perceptual/behavioral time series, and
5. …understand how these techniques can be applied in fundamental science and applied medical fields, e.g., for clinical trials and personalized medicine.
6. Explain the advanced techniques that estimate brain sources from the EEG signals, and outline the possibilities and limitations based on own experiences.
7. Explain the rationale of so-called "integrated biomarkers", use specialized toolboxes to compute them and critically reflect on the pros and cons of this approach to functionally assess the state of a human brain based on the rhythms that it generates.

Inhoud vak
Understanding the complexity of the human brain and mind is one of the greatest scientific challenges of the 21st century. To address these challenges, researchers increasingly adopt theories and methods used to study complexity in other natural systems. In this course, we give you a solid conceptual understanding of "complexity" and tools to study the complexity of the human brain through quantitative analysis of the brain rhythms that it generates and the variability in cognitive and behavioral tasks.
We consider it critical that students gain an in-depth understanding of the analytical tools in order to properly use and interpret the outcome of the different analysis techniques. This is achieved by covering the theory in the lectures followed by tutorials in the computer rooms. The concepts of "critical dynamics" and power-law scaling behavior are carefully explained in the context of time-series analysis tools, generating mechanisms, and functional implications. Key

concepts of complex networks and analytical tools to characterize them based on M/EEG data are also covered.
Another important component of the course is to teach you how to perform high-density EEG recordings of spontaneous brain activity during resting-state conditions and cognitive tasks and to analyze these signals with classical as well as modern complexity algorithms. You will work in small groups to record, analyze and present both data on EEG and its cognitive/behavioral correlates at the end of the course.
Finally, the importance of non-stimulus driven brain activity and cognition for brain-related disorders such as depression, dementia, insomnia or attention deficit and hyperarousal disorder is discussed in the context of normal variation in biomarkers and the associated challenges in objective diagnosis, prognosis, and treatment selection. We explain how data-mining and -classification techniques from artificial intelligence can be used to integrate information from multiple biomarker algorithms to increase the accuracy of clinically relevant functional assessments. While the course is focused on understanding variability in human cognition and behavior in health and disease, the concepts and tools equally apply to research on common animal models.

Onderwijsvorm
The study credits amount to 168 hours of study, which are divided approximately as follows:

Activity Hours of study
Lectures (l) 20
Self study (literature and lecture sheets) 38
Practicals in EEG lab (Prac) 8
Computer practicals and project assignment (A) 36
Journal club (Pres) 8
Poster preparation (A) 18
Preparation for exams (poster and written) 40
Total 168

Toetsvorm
Analysis and making research poster (R, 15%)
Presentation of research poster (Pres, 25%)
Written examination (E: 60%)
Compensation is not possible for any of these assessments.

Literatuur
Nikulin VV, Linkenkaer-Hansen K, Nolte G, Lemm S, Müller KR, Ilmoniemi RJ, Curio G. A novel mechanism for evoked responses in the human brain. Eur J Neurosci. 2007;25:3146–54.

Mazaheri A, Jensen O. Asymmetric amplitude modulations of brain oscillations generate slow evoked responses. J Neurosci 2008;28:7781–7.

Jensen O, van Dijk H, Mazaheri A. Amplitude asymmetry as a mechanism for the generation of slow evoked responses. Clin Neurophysiol 2010.

Nikulin VV, Linkenkaer-Hansen K, Nolte G, Curio G. Non-zero mean and asymmetry of neuronal oscillations have different implications for evoked responses. Clin Neurophysiol 2010;121:186–93.

Hardstone R, Poil S-S, Schiavone G, Jansen R, Nikulin VV, Mansvelder HD, Linkenkaer-Hansen K. Detrended fluctuation analysis: A scale-free view on neuronal oscillations. Frontiers in Physiology. 3:450.

doi:10.3389/fphys.2012.00450. 2012.

Annotated sheets from lectures

Doelgroep
Masters and PhD students with interest in human brain function in general and EEG methodology in particular.

Overige informatie
dr. K. Linkenkaer Hansen with guest lectures of dr. D.J.A. Smit

Statistical Genetics for Gene Finding

Vakcode	AM_1040 ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	dr. J.J. Hottenga
Examinator	dr. J.J. Hottenga
Docent(en)	dr. J.J. Hottenga
Lesmethode(n)	Hoorcollege, Computerpracticum
Niveau	500

Doel vak
Provide practical skills for genetic linkage and association studies to analyse neurological disorders.

Inhoud vak
The first part of the course will concentrate on genome-wide association studies (GWAS). With the advent of SNP microarray-chips that can map an essential part of the common genetic variance, GWAS have been playing a crucial role in the field of genetics for the last couple of years. With a higher resolution than the classical linkage studies, GWAS studies have been able to uncover many variants with small effects on complex traits. Methods that have been developed to subsequently estimate the phenotypic variance explained by the detected variants will also be discussed. The second part of the course does however also focus on the parametric - and non-parametric linkage analysis, because in current and future research - and clinical genetics genetics, linkage analysis remains an essential tool to identify genes in large families where a (complex) phenotype is showing a clear Mendelian inheritance pattern. The required knowledge for linkage analysis is an essential background for any geneticist.

Besides teaching the main theoretical concepts underlying GWAS and linkage analysis, this course also includes the hands on training needed to handle the large amounts of data and statistical tests. In the practical you will prepare your data, run GWAS and linkage analyses, learn how to visualize and interpret the output and distinguish real signal from noise. The practicals include the use of Merlin, Qtdt, Plink, haploview, WGA-viewer, Galaxy, GCTA, SPSS.

Onderwijsvorm

Lectures, practical hands-on computer training. The lectures will be essential to answer most of the examined knowledge.
Contact hours: 6x2 hours lecture + 6x4 hours practicals.
First three weeks: GWAS. Second three weeks: GWAS. One week exam preparation and assignments.

Toetsvorm
There will be a written homework assignment on GWAS, which counts for 25% of the grade. And there will be a written exam about the full course, which counts for 75% of the grade. The exam needs to be passed independent of the homework assignment. The written exam will contain 12 open questions, where 8 will be about linkage and general background knowledge and 4 questions will be about GWAS and it's involved statistics.

Literatuur
Statistical Genetics: Gene Mapping Through Linkage and Association. Neale BM, Ferreira MAR, Medland SE, & Posthuma D (Eds.) Taylor and Francis, London (2007). (ISBN 9780415410403)

Abecasis GR, Cardon LR and Cookson WO. A General Test of Association for Quantitative Traits in Nuclear Families. Am J Hum Genet (2000) 66:279-292.

Abecasis GR, Cherny SS, Cookson WO and Cardon LR. Merlin-rapid analysis of dense genetic maps using sparse gene flow trees. Nat Genet (2002) 30:97-101.

Fulker DW, Cherny SS, Sham PC, Hewitt JK. Combined linkage and association sib-pair analysis for quantitative traits. Am J Hum Genet. 1999 Jan;64(1):259-67.

Purcell S, Neale B, Todd-Brown K, Thomas L, Ferreira MAR, Bender D, Maller J, Sklar P, de Bakker PIW, Daly MJ & Sham PC (2007) PLINK: a toolset for whole-genome association and population-based linkage analysis. American Journal of Human Genetics, 81.

David J. Balding. A tutorial on statistical methods for population association studies. Nature Reviews Genetics. (2006) 7:781-791

Thomas A. Pearson; Teri A. Manolio. How to Interpret a Genome-wide Association Study. JAMA. 2008;299(11):1335-1344

Joel N.Hirschhorn and Mark J.Daly. Genome-Wide Association Studies for Common Diseases and Complex Traits. Nature Reviews Genetics. (2005) 6:95-108.

Treva K. Rice, Nicholas J. Schork, and D. C. Rao. Methods for Handling Multiple Testing. Advances in Genetics, Vol. 60, chapter 12.

Robert Plomin, Claire M. A. Haworth and Oliver S. P. Davis. Common disorders are quantitative traits. Nature Reviews Genetics, published online 27 october 2009.

John P. A. Ioannidis, Gilles Thomas and Mark J. Daly. Validating, augmenting and refining genome-wide association signals. (2009). Nature Reviews Genetics. 10:318-329.

Peter M. Visscher, Matthew A. Brown, Mark I. McCarthy, and Jian Yang.

Five Years of GWAS Discovery. The American Journal of Human Genetics 90, 7–24, January 13, 2012

Additional literature involving recent techniques will be announced on Canvas two weeks in advance of the course.

Vereiste voorkennis
Basic knowledge of statistics, variance component analysis (Anova), regression analysis, and Mendelian genetics.

Aanbevolen voorkennis
Behavioral Genetics (AM_470732) & Complex Trait Genetics (AM_470733).

Doelgroep
Any person interested in analyzing human DNA in relation to heritable (complex) traits: e.g., geneticists, molecular biologists.

Intekenprocedure
Please sign up as a master student following the standard VU procedures, or contact the course coordinator in case you are from outside the VU or a PhD student.

Overige informatie
Additional useful information can be obtain from the following website links:
http://zzz.bwh.harvard.edu/plink/
http://csg.sph.umich.edu/abecasis/Merlin/index.html
http://csg.sph.umich.edu/abecasis/QTDT/
http://cnsgenomics.com/software/gcta/

Systems Neuroscience

Vakcode	AM_470712 ()
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. T.J. de Vries
Examinator	prof. dr. T.J. de Vries
Niveau	500

Doel vak
- Understanding of approaches to study the central nervous system in an integrated and multidisciplinary way with a strong focus on how the complexity of the brain is required for complex behaviour.
- The ability to write a research proposal from a system neuroscience perspective

Inhoud vak
Systems Neurosciences is a "way of life": approaching the study of the central nervous system in an integrated and multidisciplinary way. Once learned in an exemplar system, the systems approach can be applied to essentially any functional system in the CNS. In this course we will restudy the organization of essential systems, such as the sensory and motor systems, associational systems, autonomic nervous system and

hypothalamus, etc. This will to a large extent consist of textbook-based homework assignments with short presentations and discussion. The core of the course will take examples of systems involved in learning and memory, in particular those involved in declarative learning and memory. Based on selected review- type papers/chapters we will a) follow the development of concepts over time; b) discuss the relationship between technology-development and experimental approaches c) study and discuss different approaches and d) integrate those into a concept of systems neurosciences.

Onderwijsvorm
Lectures, homework assignments, presentations, and tutored discussions.
Contact hours: 24
Selfstudy 48

Toetsvorm
Self-study with evaluations by way of presentations and discussions; final thesis on a self-selected topic.

Literatuur
Kandel ER, Schwartz JH, Jessell TM Principles of Neural Science, 2000, 4th edition, McGraw Hill, ISBN 0-07-112000-9. All chapters
This book will be used in the course as background literature and for a large part of self study assignments. Other literature will be provided during the course or will be self-selected.

Vereiste voorkennis
Principles of Neuroscience or similar advanced neuroscience course

Aanbevolen voorkennis
Basic neuroscience

Overige informatie
Lecturor's:
prof dr Taco de Vries; Dr P Voorn

Guest lecturers: dr Menno Schoonheim, dr Tommy Pattij, dr Ysbrand van der Werf, dr Ingo Willuhn, dr Matthew Self

Writing a Research Proposal

Vakcode	AM_1123 ()
Periode	Periode 2
Credits	3.0
Voertaal	Engels
Faculteit	Fac. der Aard- en Levenswetenschappen
Coördinator	prof. dr. M. Hannay
Examinator	prof. dr. M. Hannay
Lesmethode(n)	Werkgroep
Niveau	400

Doel vak
On successful completion of this course you will be a confident writer of an academic text in English which is
• coherent

• convincing
• compact
• linguistically correct

Inhoud vak
After an initial introductory session in which we agree a fine-tuned version of the schedule, the course will essentially concentrate on aspects of coherent and compact text, introducing basic principles and giving you the opportunity to analyse and reformulate defective text segments. These aspects will play a central role in weeks 2, 3, 4 and 5. The need for convincing text, in which the relevance of the research comes strongly to the fore, will be addressed at various points as well, and at least in week 5, where you will give peer review of each other's draft summaries/introductions. The treatment of linguistic accuracy [lexical, grammatical and punctuational features] in week 6 will be in the main determined by your own perceived needs and by the feedback given on individual draft texts.

The topic of the research proposal you work on during the course should be finalized by the end of week 2 [see Canvas document detailing the options]. No more than 15 students will be allowed to work on any one of the given topics. For the peer review session in week 5 [possibly continued in week 6] you will work in groups of 4, which will have to be agreed beforehand, so that each person in a group offers comments on three other texts.

Toetsvorm
The final product is a research proposal of approx. 1000 words, composed following agreed structural requirements. At the end of the course you will have some time to complete the final version of your research proposal. We will arrange the precise date together. Your proposal will receive a pass/fail assessment. If you fail, you will be given feedback to help you prepare a reworked version.

Literatuur
There is no obligatory reading for this course, but for language support you can study the feedback categories in ELS-Online.

Overige informatie
The materials for this course will be made available on the course's Canvas site. You will also be asked to submit your mid-course assignment and final assignment via Canvas. Please organize your Canvas account so that you receive course announcements additionally via your e-mail [see under notifications].