



Human Movement Sciences: Sport, Exercise and Health (Research) (MSc)

Vrije Universiteit Amsterdam - Faculteit der Bewegingswetenschappen - M Human Movement Sciences (Research) - 2014-2015

The two-year (120EC) programme Human Movement Sciences: Sport, Exercise and Health (Research) aims at training for so-called “translational research”; research on the cutting edge of fundamental and clinical human movement sciences that tries to integrate fundamental knowledge and clinical questions. This requires a strongly multidisciplinary approach, but also a well developed knowledge and experience of the workings of fundamental research and clinical practice. The Research Master's offers a very broad, but human movement oriented programme, stretching from molecular biology to cognitive neuroscience and human motor behaviour. The programme intends to prepare students for a research career in the area of movement-related disorders.

Admission to the programme

The programme is open for students with a clinical, science or technical BSc diploma related to the field of Movement Sciences. The Master's programme is a so-called selective master, which implies that the programme has a maximum intake of thirty students per year and that admission is linked to strict criteria such as the average grade (for either BSc-, or premaster programme), the quality of the premaster / bachelor research project and of course, motivation and proficiency in English.

Structure of the programme

The first year of the programme is dedicated to training for research, which embraces a core programme on subjects relevant for translational, interdisciplinary research, training in general research methods and methodology and selective courses to prepare especially for the research year.

The second year is dedicated to research and is spent as either one internship (60EC), or a combination of a minor (24EC) and major internship (36EC). The department offers ample possibilities for spending (part of the) internship abroad.

The research master programme coordinator serves as the advisor for all students. Approval of all study programmes has to be obtained from the Examination Board.

Master courses are taught in English. The course material is in English.

[Overview of the programme](#)

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RM1 Optional Courses

Vakken:

Naam	Periode	Credits	Code
3D-Kinematics	Periode 4	3.0	B_3DKIN
Animal Experiments for HMS	Periode 6	6.0	B_ANIMEXP
Behavioral Concepts in Human Movement Sciences	Periode 1	3.0	B_BEHCONCEPT
Biophysical Concepts in Human Movement Sciences	Periode 1	3.0	B_BIOCONCEPT
Clinical Exercise Physiology	Periode 3	3.0	B_CLINEXERC
Coordination Dynamics: Prin. Clin. Appl.	Periode 2	6.0	B_CLINCORDYN
Electromyography	Periode 5	3.0	B_ELECTROMYO
Energy Flow Models	Periode 1	3.0	B_ENERFLOW
Entrepreneurship in Human Movement Sciences	Periode 5	6.0	B_ENTREPREN
Fatigue, Aging and Disuse	Periode 2	6.0	B_FATIGUE
Intermuscular Load Sharing	Periode 6	3.0	B_INMUSCLOAD
Introduction into the Clinic	Semester 2	6.0	B_INTROCLIN
Maximal Neuromuscular Performance	Periode 1	3.0	B_MAXNEUR
Mechanical and Adaptive Myology	Periode 5	3.0	B_MECHADMYO
Perception for Action	Periode 4	3.0	B_PERCACTION
Perceptual-motor Learning	Periode 2	6.0	B_PERCML
Psychological Factors in Sport		3.0	B_PSYFACSPRT
Rehabilitation: Restoration of Mobility	Periode 1	3.0	B_REHABMOB
Studentbegeleiding	Ac. Jaar (september)	6.0	B_STDBEG
Time Series Analysis	Periode 5	6.0	B_TIMESERANA

RM1 Obligatory Courses

Vakken:

Naam	Periode	Credits	Code
Advanced Methodology	Periode 5	6.0	B_ADVANMETH
Exercise Immunology	Periode 1	6.0	B_EXERIMMUNO
Molecular Biology	Periode 5	3.0	B_MOLECULBIO
Neurosciences	Periode 2	6.0	B_NEUROSC

Statistics for Experimental Research	Periode 4	3.0	B_STATEXPRES
Tissue Engineering and Mechanobiology	Periode 6	3.0	B_TISSUEENG
Treating Locomotor Disease	Periode 3+4	6.0	B_LOCOMOTOR

RM2 Obligatory programme

Vakken:

Naam	Periode	Credits	Code
Research Internship Research Master	Ac. Jaar (september)	60.0	B_RIRM

3D-Kinematics

Vakcode	B_3DKIN (900632)
Periode	Periode 4
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	prof. dr. H.E.J. Veeger
Examinator	prof. dr. J. Harlaar
Docent(en)	prof. dr. H.E.J. Veeger, prof. dr. J. Harlaar
Lesmethode(n)	Hoorcollege, Computerpracticum
Niveau	500

Doel vak

The student is capable to:

- Define and calculate local joint coordinate systems;
- use and understand different calibration methods and their limitations;
- translate technical motion descriptions into clinically relevant units;
- apply the above to experimental data;
- interpret and comment on methods as described in the literature.

Inhoud vak

In this course students are introduced to the fundamentals of three-dimensional kinematics, as well as the (more or less) standard application methods.

The course will comprise three separate blocks focusing on

1. the definition and use of local coordinate systems in the calculation of osteokinematics;
2. the use of technical marker sets as well as the practical implications of data processing, especially correcting for missing markers and;
3. the calculation procedures for obtaining helical axes, needed for the definition of functional axes-based coordinate systems

Onderwijsvorm

Lectures, computer practicals and tutorials

The three computer practicals are linked to in-term assessments. Each practical will contribute for 15% to the final score.

Toetsvorm

- two in-term tests on calculation skills, partially exempting for exam
- final test on calculation skills + literature
- score: 3 x 20% for calculation questions (one for each block)
40% for essay question
above 100% = 9/10
- 1/10 for professional conduct (participation assignment hand-in)

Literatuur

Relevant papers will be listed in Blackboard.

A useful source is the book by Zatsiorsky (Zatsiorsky, Valdimir M., Kinematics of Human Motion. Champaign, Illinois: Human Kinetics, 1st edition, 1998. ISBN 0-880110767-5), which will be used as reference material.

Vereiste voorkennis

This course requires proficiency in Matlab and matrix calculation. If there is a deficiency related to Matlab skills, students are strongly advised to take the TUE web-based matlab course that can be found at <http://www.imc.tue.nl/>

The BSc course "Mechanische Analyse ..." is advised.

Overige informatie

The maximum number of participants in this course is limited to 40.

Advanced Methodology

Vakcode	B_ADVANMETH (900808)
Periode	Periode 5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. B.T. Knapik
Examinator	dr. B.T. Knapik
Docent(en)	dr. B.T. Knapik, dr. E.N. Belitser
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	400

Doel vak

An introduction to statistical models for regression analysis.

Inhoud vak

Regression models try to explain or predict a dependent variable using measured "independent variables" (or "fixed effects"). Statistical methods are needed if there is random variation in the dependent variables and/or if the measured variables are a sample from a population. Dependencies in the variables (for instance by repeatedly measuring the same unit) require introduction of unmeasured "random effects".

In this course the concept of a statistical model, as given by equations involving random variables, will be central. The model reflects a design by which data is collected, allows to formulate the assumptions underlying the statistical analysis, and is basic for interpreting the results of the analysis. The analysis itself is carried out by a computer package, for which we need to know code but no formulas. Brief introduction to basic statistical concepts. Statistical model, likelihood function, maximum likelihood estimation, confidence region, likelihood ratio test, p-value.

Fixed effects regression. Multiple linear regression: estimation, testing, variable selection and diagnostics. Extension to generalized linear models.

Mixed effects regression. Linear random effects models, repeated measures, longitudinal data. Extension to nonlinear models. Introduction to R. Basics of the open source computer package R (<http://www.r-project.org/>), and its application to fixed and mixed effects regression.

Onderwijsvorm

Lectures and computer assignments.

Toetsvorm

By weekly reports on data analyses using the R package.

Literatuur

- Handouts.
- Book: Extending the Linear Model with R: Generalized Linear, Mixed Effects and Nonparametric Regression Models, by Julian J Faraway.
- R-manuals.

Vereiste voorkennis

Some previous experience with statistics. Some knowledge of ANOVA. Familiarity with matrix calculus is handy.

Intekenprocedure

Course website
blackboard

Overige informatie

Course website <http://www.math.vu.nl/~aad/ARM/>

Animal Experiments for HMS

Vakcode	B_ANIMEXP ()
Periode	Periode 6
Credits	6.0
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. H. Maas
Niveau	500

Doel vak

Aim of this course is to prepare research master students who are going to perform animal experiments for their research project in their second year. The course is focused on the respectful and responsible use of laboratory animals in Human Movement Sciences related research. Refinement of techniques, reduction in the number of animals used and replacement wherever possible by non-sentient systems will be guiding principles.

Inhoud vak

In this course, the students are educated and trained in the principles and practical skills that are essential for the humane use and care of laboratory animals and for the quality of research. The two-year Research Master program Human Movement Sciences: Foundations in Sport, Exercise & Health aims at training for research on the cutting edge of fundamental and clinical human movement sciences that tries to integrate fundamental knowledge and clinical questions. The first year is dedicated to preparation for research. The second year is fully dedicated to a research internship of your own choice. The human movement sciences cover a great variety of subjects stretching from molecular biology and muscle physiology to cognitive neuroscience and human motor behavior. This also involves several experimental approaches, ranging from in vitro work on for example cultured cells to in situ and in vivo studies using live animals, as well as experiments on human subjects. Appropriate education and training of all those engaged in the use of live vertebrate animals for scientific purposes is required. To prepare students for a research career using animal models, the course Animal Experiments for Human Movement Sciences offered to those students that are accepted for a research internship involving animal experiments.

Onderwijsvorm

This course consists of three major parts. All lectures and lab classes are obligatory.

1. Course on Laboratory Animal Science (3 ECTS) as coordinated by the Division of Animal Welfare & Laboratory Animal Science, Utrecht University.
2. Training on handling animals, fluid injections and anesthesia, as well as general microsurgical techniques (1.5 ECTS).
3. Training of project specific surgical skills (1.5 ECTS)

Toetsvorm

Part 1: written exam (grade 1-10); The student has a maximum of two opportunities to pass the written exam. There is no second chance for this course.

Part 2: practical exam (pass/fail); Assessment by Laboratory Animal Welfare Officer VU/VUmc Dr. ing. Klaas Kramer and Guus Baan.

Part 3: practical exam (pass/fail); Assessment by laboratory technician and research internship supervisor.

A student passes for this course only if all parts were graded by a mark >6 or by a pass.

Literatuur

Part 1: Course on Laboratory Animal Science

The theoretical part of the course is covered by a multi-author textbook (which has been translated into several other languages): L.F.M. van Zutphen, V. Baumans and A.C. Beynen (eds.), Principles of Laboratory Animal Science: A contribution to the humane use and care of animals and the quality of experimental results, Elsevier Science Publishers, Amsterdam, 2003 (4th ed.) Also a CD-ROM Humane Endpoints in Laboratory

Animal Experimentation is used and additional information is given with hand-outs from presentations, etc.

Part 2: Training anesthesia and fluid injections, as well as general microsurgical techniques

- Information for handling and fixing mouse and rat (Amsterdam Animal Research Center, VU University; in Dutch).
- Manual of Microsurgery on the Laboratory Rat, Part I. Remie R. et al. (1990). Chapters 3, 4, and 7.
- Chirurgische Knotentechniek. Ethicon; a Johnson & Johnson Company (2009).

Part 3: Training of project specific surgical skills

- General laboratory practice ("Algemene labvoorschriften") and those specific for the lab.
- Animal anatomy, those structures that are involved in the project specific surgery.
- Surgical protocol specific for the research project.

Vereiste voorkennis

- The student should have training which meets the legal requirements of 18 ECTS biological basic subjects (of which 7.2 ECTS anatomy/zoology and 7.2 ECTS physiology).
- The student has been accepted by a scientific staff member of the MOVE research institute for a research project that will involve animal experiments.
- Admission for this course requires proof of the above, including a short description of the involved animal experiments, sent to the course coordinator, who will decide if the course is appropriate for the internship.

Overige informatie

The dates of part 1 of the course are not in line with the curriculum schedule of the VU University.

There are a limited number of positions available for MSc students for part 1 of the course. Therefore, early registration (in the first year of the RM program) is recommended.

Behavioral Concepts in Human Movement Sciences

Vakcode	B_BEHCONCEPT (900662)
Periode	Periode 1
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	prof. dr. J.B.J. Smeets
Examinator	prof. dr. J.B.J. Smeets
Docent(en)	prof. dr. P.J. Beek
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	500

Doel vak

The student is able to describe course aims in formal format, divided in the categories:

- reporting the key behavioral concepts in contemporary Human Movement

Science;

- applying these concepts in describing research outcomes;
- judging the (dis)advantage of using a concept in a particular situation.

Inhoud vak

Human movement is a complex behavior. To interpret this complex behavior, the scientific literature uses concepts that are rather complex themselves. Examples of such concepts are information, stability, synergy, internal representation and motor programs. In this course, questions such as "What do these concepts mean exactly?" and "How do these concepts help us to understand the behavior we observe?" are to be addressed.

Onderwijsvorm

8 two-hour lectures, 33 hour self-study, 28 hour essay writing, 7 hour essay evaluation

The students prepare for the lecture by reading both papers and by writing a brief critical essay (maximum of 500 words) on one of them. Each essay will be evaluated by two randomly selected fellow-students (implying that, in the context of each lecture, each student will have to write one essay and score two essays). During the lecture the teachers then present their own evaluation of the papers in question, highlighting the theoretical background of a given concept and the manner in which it is defined and used in the study of interest. The evaluation by the teachers will assist the students in evaluating their own essay as well as their assessment of the quality of essays written by their peers. This cycle will repeat itself over the 7 concept-related lectures, allowing the students to develop their critical evaluation skills of key concepts used in the study of motor control and learning. Towards the end of the course, each student selects two of his or her own (most promising) essays to elaborate further into two final essays, which will then be scored by the teachers for final grading.

Toetsvorm

The grading of the two essays to be evaluated by the teachers will be based on the following weighted general aspects:

Language: spelling, grammar and style (20%)

Clarity of insight in the theoretical context (20%)

Clarity of insight in the concepts and their empirical elaboration (30%)

Argumentation: to-the-pointedness, logic and persuasiveness (30%)

In order for the two final essays to be considered, all 7 essays and 14 evaluations should have been completed in time

Literatuur

Various scientific publications are to be used, further information is provided during the course.

Vereiste voorkennis

No specific entry requirements.

Overige informatie

The two essays should each have a length of less than 1000 words

Biophysical Concepts in Human Movement Sciences

Vakcode	B_BIOCONCEPT (900663)
Periode	Periode 1
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	prof. dr. J.H. van Dieen
Examinator	prof. dr. J.H. van Dieen
Lesmethode(n)	Hoorcollege
Niveau	500

Doel vak

The student knows the mechanical concepts that apply to control of joint position and movement, in particular equilibrium, stability, robustness, performance, and observability.

The student understands these concepts and can explain how they are related to clinical problems and to motor control in patients with joint disorders.

The student knows the physiological concepts of relative workload in sports and clinical research and training, in particular, (sub)maximal force/power generation, (sub)maximal energy expenditure, aerobic/anaerobic metabolism, blood flow, and anaerobic threshold.

The student understands these concepts and can explain how they are related to sports and rehabilitation research and practice.

Inhoud vak

In this course the students are acquainted with biophysical concepts that underlie current debates in HMS.

One part of the course deals with biomechanical concepts in particular with (in-)stability of joints and joint movement. Instability is often used in the clinical setting to describe the state of the joint after injury or in degenerative disorders. The term is often poorly defined, which leads to confusion in the communication between disciplines, e.g. between physiotherapists and orthopedic surgeons. Mechanics and control theory provide a rigorous framework for describing joint function. The relevance of this conceptual framework for the clinical context and the implications for diagnosis and treatment will be discussed.

The other part of the course deals with physiological concepts in particular with the use of relative workload. Relative workload is often used to induce similar loading of persons in sports and clinical studies, either to measure endurance or to induce a certain training stimulus. Relative workloads as percentage of maximal force/power or energy utilization (oxygen uptake) are used in various circumstances. While the choice for a given variable is essential for the result, it will be discussed whether the proper variables are chosen for the specific goals.

Onderwijsvorm

23 contact hours, divided in:

Lectures 10 * 2 hours

Assessment 3 hours

57 hours self study

The course consists of two series of lectures dealing with biomechanical and physiological concepts respectively. In the first lecture of the two

series a general introduction will be given. In the second and third lecture of each series, the formal concepts will be introduced and explained and related to the applications in sports and health. In the fourth lecture questions by the students will be discussed.

Toetsvorm

Written test with open-ended questions, with equally weighted questions on both parts of the course content.

Literatuur

- Research articles and review papers will be made available at the start of the course

Vereiste voorkennis

The student should have a basic knowledge and understanding of the human musculoskeletal anatomy as described for example in Human Anatomy. EN Marieb, J. Mallatt, Benjamin Cummings, 3rd edition, ISBN: 0-8053-5335-6, chapters 1.1-1.16; 4.88-4.102; 4.99-4.102; 9.212-9.239; 10.244-10.253; 11.266-11.270.

The student should have a basic knowledge and understanding of biomechanics as described for example in Fundamentals of Biomechanics. Equilibrium, Motion and Deformation. M. Nordin and N. Ozkaya; Human Kinetics, ISBN 0387982833, chapters 1-5.

The student should have a basic knowledge and understanding of exercise and muscle physiology as described in for example W.D. McArdle, F.I. Katch, V.L. Katch: Exercise Physiology: energy, nutrition & human performance, 7th edition (2010) Lippincott Williams & Wilkins, ISBN 1608318591, chapters 7-11, 15-17, 21.

Clinical Exercise Physiology

Vakcode	B_CLINEXERC (900670)
Periode	Periode 3
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. J.J. de Koning
Examinator	prof. dr. C.C. Foster Jr.
Docent(en)	dr. J.J. de Koning, prof. dr. C.C. Foster Jr.
Lesmethode(n)	Hoorcollege, Practicum, Werkcollege
Niveau	400

Doel vak

To provide the student with the fundamental knowledge of clinical exercise physiology as a variant of normal exercise physiology, which will enable the student to apply this knowledge in preventive and rehabilitative exercise programs.

Inhoud vak

Basic didactic information and laboratory experiences of the effect of pathophysiological conditions on human energy metabolism and health. The focus will be on organ systems and their linkage to ATP generating pathways and on how this influences skeletal muscle performance. The

application is to the use of exercise both diagnostically and as a therapeutic tool. After this course the student will have the fundamental knowledge and skills to use exercise in patients with cardiopulmonary/metabolic disease and to work cooperatively with other health care providers.

Onderwijsvorm

Lecture
Practical laboratory exercises
Directed reading

Toetsvorm

multiple choice

Literatuur

A selection of articles and practical guide on BlackBoard

Vereiste voorkennis

Toegepaste Inspanningsfysiologie.

Coordination Dynamics: Prin. Clin. Appl.

Vakcode	B_CLINCORDYN (900666)
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. M. Roerdink
Examinator	dr. M. Roerdink
Docent(en)	dr. M. Roerdink
Lesmethode(n)	Hoorcollege, Computerpracticum, Practicum, Bijeenkomst, Deeltoets extra zaalcapaciteit
Niveau	400

Doel vak

The coordination dynamics approach is pursued to study how patterns of coordinated movement come about, persist and change as a function task constraints, expertise and pathology. The student is acquainted with the key principles, concepts and methods of coordination dynamics. The student can explain these aspects in a qualitative manner. The student is able to indicate how these aspects may contribute to assessments and interventions in the context of sports and rehabilitation. The student can interpret scientific literature in the area of coordination dynamics. The student can design new basic or applied coordination dynamics experiments.

Inhoud vak

Coordination dynamics is governed on the one hand by principles of self-organization, and on the other hand by intentionality, perceptual information and explicit knowledge. Coordination patterns exist at multiple levels: 1. dynamics within or between body segments of a moving person; 2. dynamics between moving segments of multiple persons and 3. dynamics between person and external events, as well as between persons. Coordination dynamics provides a framework to study the nature of pathological, normal and expert movements by assessing stability and

loss of stability of coordination patterns as a function of training and rehabilitation.

The first part of the course provides an overview of the key principles, concepts and methods of coordination dynamics by adopting a 3-stage empirical approach: 1. gaining background theoretical information through lectures and literature, 2. gaining hands-one experience by participating in experiments, formulating hypotheses and analyzing the so-obtained data, 3. gaining a thorough understanding of the key aspects of coordination dynamics by linking theory and practice.

The second part of the course focuses on the application of coordination dynamics in sports and rehabilitation, again by adopting a 3-stage empirical approach. In the context of rehabilitation, specific emphasis will be placed on interventions based on environmental coupling aimed at facilitating desired coordination patterns and/or stabilizing existing unstable coordination patterns. In the context of sports, the nature of interactions between two or more athletes will be the focal point, including their cooperative and competitive effects on pattern formation and coordinative stability.

Onderwijsvorm

Amount of contact hours (36 hrs), divided in:

Lectures: 10 * 1.75 hrs

Laboratories: 2 * 2.00 hrs

Computer Practicals: 5 * 2.00 hrs

Midterm Exam: 1 * 1.75 hrs

Exam: 2.75 hrs

Self study: 132 hrs

Toetsvorm

Written closed-book exams with open-ended questions. The final grade is determined by both the Midterm Exam (25%) and the Final Exam (75%). However, in case the grade of the Midterm Exam is lower than that of the Final Exam, the final grade is fully determined by the Final Exam grade (i.e., Midterm Exam [0%], Final Exam [100%]).

Literatuur

A selection of relevant book chapters and articles.

Vereiste voorkennis

Basic understanding of statistics (What is a standard deviation?), sine waves (What is the amplitude, offset, frequency and phase?), integral and differential calculus (What is the derivative of a sine wave?) and Matlab (Can you run a script?). Please note that Matlab scripts and functions are provided and so programming skills are not required for the computer practicals. Computer practicals are included to become acquainted with the handling and interpretation of the experimental data and associated coordination dynamics outcome measures).

Overige informatie

Note that Laboratory 2 will be held at the Duyvensz-Nagel Research Laboratory of Reade Center for Rehabilitation and Rheumatology (DNO, Reade, Overtoom 283). Students can subscribe for Laboratories and Computer Practicals on BlackBoard.

Electromyography

Vakcode	B_ELECTROMYO (900815)
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Periode	Periode 5
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	prof. dr. J.H. van Dieen
Examinator	prof. dr. J.H. van Dieen
Docent(en)	prof. dr. J.H. van Dieen
Lesmethode(n)	Hoorcollege, Practicum, Computerpracticum
Niveau	400

Doel vak

- The student has a basic knowledge of electrophysiology and the background of electromyographical; signals;
- the student has a basic knowledge of the different ways; of collecting electromyographical data in various fields of application;
- the student can analyze EMG data for kinesiological use;
- the student can choose the appropriate method for collecting and analyzing EMG data in a kinesiological study;
- the student knows the possibilities and limitations of EMG data;
- the student can interpret EMG data in relation to motor control, force and fatigue;
- the student can identify contamination in EMG data and can apply methods to reduce its effects;
- the student knows the standards for reporting EMG data.

Inhoud vak

In this course, the students are introduced to the electrophysical background of electromyography (EMG). Subsequently, the course focuses on methodological aspects of EMG acquisition and analysis, addressing the potential of this method as well as its pitfalls.

Onderwijsvorm

lectures 6 x 2 hours

practical 2 x 3 hours

The lectures introduce the following topics:

- electrophysiology;
- motor control (motor unit recruitment and firing);
- instrumentation and electrodes;
- HD- EMG and spatio- temporal information;
- onset determination;
- amplitude estimation;
- force estimation;
- cocontraction and cross- talk;
- motor unit firing and decomposition;
- frequency content, conduction velocity and fatigue.

Practicals concern analyzing EMG data.

Toetsvorm

2 hours; written test with equally weighted open- ended questions

Literatuur

Research articles and lecture handouts to be made available before the course

Vereiste voorkennis

- knowledge of and skills in programming in MATLAB at the level described for example in 'Verwerken van digitale signalen'.
- basic knowledge and understanding of the physiology of muscles and their control.

Overige informatie

Maximum number of students: 40

Energy Flow Models

Vakcode	B_ENERFLOW (900675)
Periode	Periode 1
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. J.J. de Koning
Examinator	dr. J.J. de Koning
Docent(en)	dr. J.J. de Koning
Lesmethode(n)	Hoorcollege, Computerpracticum
Niveau	500

Doel vak

To provide the student with knowledge about energy flow models, and so to enable the student to apply this knowledge in the modelling of human endurance performance.

Inhoud vak

Research in which exercise physiology and biomechanics are combined as a 'toolbox' is apparently unique and successful. This course familiarizes the student with one branch of this approach. Energy flow models, based on power equations, will be used to study performance determining factors in endurance sports. This course explains the technique of modelling, how parameter values are obtained from experiments and how simulations with the model can be done. The student will construct a model of an endurance athlete to study the effect of parameter values on performance in cycling, speed skating and running. The models will be made in MATLAB. Knowledge of MATLAB is necessary to be successful in this course.

Onderwijsvorm

Lectures and guided practical;
84 hours (from which 28 practical, 6 lecture, 2 exam and 48 self study).

Toetsvorm

Written examination and practical report (30%/70%).

Literatuur

A selection of articles and practical guide on Blackboard.

Vereiste voorkennis

900104: Biomechanica (Students are expected to have sufficient knowledge of this subject);

Entrepreneurship in Human Movement Sciences

Vakcode	B_ENTREPREN (65412020)
Periode	Periode 5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	prof. dr. E. Masurel
Examinator	prof. dr. E. Masurel
Docent(en)	prof. dr. E. Masurel
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	500

Doel vak

Students obtain knowledge about and insight in the relevance of entrepreneurship and innovation for their own discipline. Students learn about the processes which are involved in the recognition and exploitation of opportunities, about creating economic and social value and about the nature and role of networks. In addition students gain knowledge of different entrepreneurial processes and the importance of valorization of findings and business ideas for a knowledge-based economy.

Inhoud vak

This course consists of two tracks: a theoretical track and a practical track. These two tracks run simultaneously.

In the first track you learn about entrepreneurship. Answers are found on questions such as: what is entrepreneurship? What defines an entrepreneur? What are entrepreneurial opportunities? What is the role of innovation in entrepreneurship? What is corporate social responsibility (CSR)? How can we judge the feasibility of entrepreneurial ambitions?

Simultaneously you work on an assignment (second track). In the first week of this course you search for an innovation in your own discipline (product, service, process etc.). Your choice must be approved by the lecturers. The first part of the assignment consists of a description of the innovation which you have chosen. Subsequently, you make a SWOT analysis and a network analysis of the innovation. Also a paragraph of CSR should be added. The final part of the assignment is your own feasibility study: how would you valorize the innovation to the market.

Onderwijsvorm

Lectures and workshops. Each week scientific lectures or practical workshops are given. These lectures are both the basis for the exam and for the assignment.

Toetsvorm

You conduct a written exam and an assignment. Both the exam and the assignment will determine 50% of the grade. The exam and the assignment must be of sufficient quality.

Literatuur

The course manual contains a list of online available articles.

Overige informatie

Optional course for Master students 'Human Movement Sciences' 'Sport, Exercise & Health', 'Fundamental and Clinical Movement Sciences'.

Exercise Immunology

Vakcode	B_EXERIMMUNO (900807)
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	prof. dr. G. Kraal
Examinator	prof. dr. G. Kraal
Docent(en)	prof. dr. G. Kraal
Lesmethode(n)	Hoorcollege, Werkcollege, Practicum, Bijeenkomst
Niveau	400

Doel vak

The student:

- is capable to understand the principles of the functioning of the immune system and understand its importance for the homeostasis of the body;
- has a good knowledge of the various cell types and organs that cooperate in the body's defense is acquired;
- will learn in addition to an in depth knowledge of the function of the immune system, how the immune system can attack our own body and how immunological diseases can affect joint functions and neural innervation in normal situations.

Inhoud vak

In a series of lectures the immune system will be explained. In two practicals the structure of the lymphoid organs and immunological techniques are taught. In two tutorials several aspects of the immune system will be discussed in depth. In addition students present literature to study the role of exercise clinical immunology. The assessment consists of a written examination.

Onderwijsvorm

lecture
practical
tutorial

- Lectures based on the textbook "The Immune System" by P. Parham, the lectures will follow the various chapters. Emphasizing the highlights and by giving additional examples the functioning of the immune system are explained;
- Tutorials: in the tutorial the role of antibodies in disease and vaccination will be discussed. Attention will be given to the therapeutic use of antibodies in various diseases;
- Practical I: Microscopy of the lymphoid organs;
- Practical II: Immunological techniques;

- Assessment: written examination.

Toetsvorm

The assessment consists of multiple choice questions

Literatuur

Peter Parham, The immune system, 3rd edition, Garland Science

Vereiste voorkennis

A general knowledge of cell biology is required.

Fatigue, Aging and Disuse

Vakcode	B_FATIGUE (900648)
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. R.T. Jaspers
Examinator	dr. R.T. Jaspers
Docent(en)	dr. R.T. Jaspers
Lesmethode(n)	Werkcollege, Hoorcollege
Niveau	400

Doel vak

At the end of this course the student has knowledge of the short term changes in the physiology of the neuromuscular system, as induced by fatigue and long term adaptations as a result of disuse and aging, and the underlying (molecular) mechanisms. The student can apply this knowledge to questions regarding human movement in various situations (e. g. sports, aging, illness, injury, disorders).

Inhoud vak

Neuromuscular performance in terms of muscle peak power and maximal steady state power is impaired during aging and with a chronic decrease in usage, such as during bed rest, diseases, injuries, neuromuscular disorders and (most extreme) after a spinal cord injury. During the course, a critical overview is given of the current knowledge of short and long term adaptations of the neuromuscular system in response to training, aging, disuse and chronic disease how these relate to impaired muscle function. Underlying (molecular) processes leading to atrophy and reduced force generating capacity as well as a reduced endurance performance of the neuromuscular system are discussed. To obtain indications for how training or other interventions could effectively prevent these adverse effects and improve muscle function, a detailed overview is given of training induced changes in muscle phenotype and how these are related to molecular regulators of protein synthesis and degradation and mitochondrial biosynthesis. The content is mostly based on recent own research.

Onderwijsvorm

The course will consist of a series of lectures during which relevant questions are addressed and discussed. In additional meetings relevant items are addressed in group discussions based on prepared questions/statements.

Toetsvorm

Assessment

Written test with open- ended questions.

Literatuur

Book chapters, research articles and review papers to be made available before the course.

Vereiste voorkennis

The student should have a basic knowledge and understanding of molecular, biology, exercise and muscle physiology.

Intermuscular Load Sharing

Vakcode	B_INMUSCLOAD (900809)
Periode	Periode 6
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	prof. dr. J.H. van Dieen
Examinator	prof. dr. J.H. van Dieen
Docent(en)	prof. dr. J.H. van Dieen, dr. H. Maas
Lesmethode(n)	Hoorcollege, Computerpracticum
Niveau	500

Doel vak

- The student is able to explain the most common methods for inverse mechanical analysis of muscle-joint systems and is able to apply these.
- The student is able to describe the possibilities and limitations of these methods.
- The student is able to describe recent insights on mechanical and neural connectivity between muscles and can integrate these insights into the inverse mechanical analysis.
- The student is able to assess the validity and sensitivity of such methods and can interpret and report results in a scientific format.

Inhoud vak

In this course, the students are introduced to methods to estimate the mechanical load on structures in a muscle-joint system through inverse mechanical analysis. Since muscle-joint systems are mechanically indeterminate, estimating the distribution of the net moment over moment-producing structures (mainly muscles) is the main challenge. The course consists of three major subjects. First, after a general introduction on modeling and model validation, EMG driven and optimization models for estimating the distribution of the net moment over muscles will be dealt with and data on load sharing as measured in animal experiments will be discussed in the context of such models. During a computer lab students will modify and use a simple model of a muscle-joint system driven by optimization. Second, the mechanical and neural connectivity between muscles will be introduced in a lecture. In

the subsequent computer lab, the model will be adapted to study the effects of intermuscular force transmission and neural overflow. Third, a formal analysis of joint stability will be introduced and the effects of stability requirements on load sharing between muscles will be discussed. In the following computer lab, students will apply stability constraints in the model to further study these effects. Based on sensitivity analyses for specified inputs, parameters, or model assumptions with the model, students will prepare a written report with respect to a self-selected question related to one of the three parts of the course.

Onderwijsvorm

Lectures 11 hours
Reading articles 8 hours
Article assignment 4 hours
Computer labs 6 hours
Preparing presentation 3 hours
Final assignment 52 hours

Toetsvorm

Students, in groups of two, write a written report based on the topic of one of the three computer labs (optimization criteria, intermuscle connectivity, stability constraints). They phrase a research question and hypothesis with respect to this topic and perform the analyses needed to answer the question. First a proposal is written and submitted for feedback. The report should have the format of a research paper. However, the introduction section should be limited to a minimum (i.e., one paragraph; ~200-300 words), including the research question and hypothesis. The report should describe in detail which analyses were performed using which models (methods) and provide the results of the analyses. The discussion should incorporate relevant methodological literature and literature concerning the question at hand. The total number of pages should not exceed 20 excluding references.

Literatuur

A series of papers will be made available at the start of the course.

Vereiste voorkennis

- The student should have a basic knowledge and understanding of the human musculoskeletal anatomy as described for example in Human Anatomy. E.N. Marieb & J. Mallatt (Eds.), Benjamin-Cummings Publishing Company, 3rd edition, ISBN: 0-8053-5335-6, chapters 1.1-1.16; 4.88-4.102; 4.99-4.102; 9.212-9.239; 10.244-10.253; 11.266-11.270.
- The student should have knowledge and understanding of biomechanics (at the level described for example in Kinetics of Human Motion. V. M. Zatsiorsky (Ed.), Human Kinetics, 1st ed. 2002, Chapters 1-5.
- The student should have a basic knowledge and understanding of the physiology of muscles and their control at the level described for example in Physiology of Sport and Exercise, J.H. Willmore & D.L. Costill (Eds.), Human Kinetics, ISBN 0-87322-693-3, chapters 2-3.
- The student should have knowledge of and skill in programming in matlab at the level described for example in: Signalen in beweging - het verwerken van digitale signalen met MATLAB. T. de Haan (Ed.), Faculteit der Bewegingswetenschappen Vrije Universiteit Amsterdam, zevende druk, zomer 2011 or the English translation (both available on blackboard sites of the VU University, Faculty of Human Movement Sciences) or as described in Engineering problem solving with MATLAB, D. M. Etter (Ed.), Prentice-Hall, International, Inc. ISBN 0-13-520891-2, chapters 2 – 4.

Aanbevolen voorkennis

- The student is able to explain the most common methods for inverse mechanical analysis of muscle-joint systems and is able to apply these.
- The student is able to describe the possibilities and limitations of these methods.
- The student is able to describe recent insights on mechanical and neural connectivity between muscles and can integrate these insights into the inverse mechanical analysis.
- The student is able to assess the validity and sensitivity of such methods and can interpret and report results in a scientific format.

Overige informatie

Max Students : 30

Introduction into the Clinic

Vakcode	B_INTROCLIN (900803)
Periode	Semester 2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. O.G. Meijer
Docent(en)	dr. O.G. Meijer
Lesmethode(n)	Hoorcollege

Doel vak

To understand the impact of locomotor pathology on the lives of patients, to know how clinical decision making for such patients unfolds itself, to understand what kind(s) of research we can do to understand locomotor pathology and to help the patients in question, to communicate with others about these topics.

Inhoud vak

Pairs of students will attend consultations of two medical specialists (about 8 hours each), then select, together with the specialist, a patient to evaluate, provided this patient agrees with the procedures. Students will then interview the patient, introduce the patient to the course coordinator, and follow the patient's road through the medical system (for about 2 months). Students produce a paper a) presenting the impact of the pathology on the patient's life, b) capturing the kind(s) of research students of Fundamental and Clinical Human Movement Sciences can do (see: aim). These papers are presented, in such a way that each student presents at least once, and that the whole group comes to know about each patient. In principle, the coordinator and the specialist in question will attend this presentation.

Learning activities:

1. Attending consultation. Students select a medical specialization from, e. g., Internal Medicine, the Outpatient Clinic for Pain, Orthopaedic Surgery, Rheumatology, Neurology, Rehabilitation, etc. This choice is made in consultation with the course coordinator.
2. Following patients. It is important that students present the patient as soon as possible to the course coordinator, and that relatively frequent interaction between the students, the patient and

the coordinator is maintained until the paper is produced.

3. The relevant literature. The paper will summarize relevant literature on: Current understanding of the pathology, current treatment options, the evidence for those options, and current priorities for research. Students are advised to consult the coordinator to locate relevant papers. For the main content of the paper, see Content.

4. Presentation. The course coordinator and the medical specialist receive the first draft of the paper, and give recommendations to improve it. As soon as the improved version is ready, a meeting is scheduled, in which the paper is presented and discussed. The student's mark is determined by the coordinator and the medical specialist, on the basis of the quality of the written product, the presentation, and, if any, feedback from the host(s) as well as the patient.

Onderwijsvorm

active participation

Toetsvorm

presentation

see content.

Literatuur

Students are required to select their own literature.

Maximal Neuromuscular Performance

Vakcode	B_MAXNEUR ()
Periode	Periode 1
Credits	3.0
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. C.J. de Ruiter
Examinator	dr. C.J. de Ruiter
Docent(en)	dr. C.J. de Ruiter
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The student has knowledge of the role of muscle activation and (changing) muscle properties on maximal human neuromuscular performance during high intensity exercise and the student has knowledge of the relevant research methods.

The student can apply this knowledge to questions regarding testing and improving of maximal neuromuscular performance in sports (and rehabilitation).

The student is able to evaluate the validity and relevance of basic scientific literature for neuromuscular performance in a sport (rehabilitation) related context.

The students will learn to critically read scientific papers on neuromuscular performance published in international journals. The student will be able to communicate ("translate") the implications of basic scientific knowledge of neuromuscular performance to practical issues raised by coaches and therapists in the field of sports (and rehabilitation).

Students will not learn how to do research, or how to test athletes, or

how to design exercise programs in sports or rehabilitation etc.
Students will learn what underlying factors/mechanisms they should be aware of while designing muscle function tests and exercise programs.

Inhoud vak

During the course, a critical overview will be given of the current knowledge of maximal neuromuscular performance during relatively high intensity exercise of short duration (40 ms up to 5 min). Most examples will be provided from own research. The emphasis will be on the coupling between basic knowledge of muscle activation and (changing) muscle properties during human movement and their consequences for testing and training. This is a fundamental sports related muscle physiology course, not an applied sports course.

The following subjects will be addressed:

- Voluntary activation;
- Explosive force/power;
- Influence of temperature (incl. warm-up);
- Potentiation;
- (Low frequency) fatigue;
- Shortening deficit and lengthening force enhancement;
- Recruitment of motor units.
- Muscle oxygenation

Onderwijsvorm

The course will consist of a series of nine lectures during which relevant practical questions will be used as a starting point. Subsequently the focus will be on fundamental neuromuscular properties as studied in a series of accompanying scientific papers.

Toetsvorm

2.5-hour exam with open-ended questions in the week immediately following the three week lecture period.

Literatuur

The course will mainly use research papers. Basic background information is derived from Chapters 1-10 of: Skeletal muscle: from molecules to movement. A textbook of muscle physiology for sport, exercise, physiotherapy and medicine. Jones, D.A., Round, J. and A. de Haan, Edinburgh: Churchill Livingstone, Elsevier Science Limited, 2004. ISBN 0 443 07427 5

Vereiste voorkennis

Sufficient knowledge of the basics of Muscle Physiology is absolutely necessary. In order to successfully participate, the students have to understand the following concepts: anatomy of skeletal muscle, sarcomere function, twitch, tetanus, length-force, force- and power-velocity, and stimulation frequency-force relations, the size principle of motor unit recruitment, rate coding, EMG, electrical stimulation, fibre type related differences in contractile properties, cross-bridge kinetics, excitation contraction coupling, the basic metabolic changes during exercise (changes in ATP and CrP, glycolysis, oxidative phosphorylation)

Mechanical and Adaptive Myology

Vakcode	B_MECHADMYO (900813)
Periode	Periode 5

Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. R.T. Jaspers
Examinator	dr. R.T. Jaspers
Docent(en)	dr. R.T. Jaspers
Lesmethode(n)	Hoorcollege, Werkcollege, Practicum
Niveau	500

Doel vak

At the end of this course, the student has detailed knowledge and understanding of the principles of functional morphology and physiology of the muscular system embedded within a connective tissue context as well as of the mechanical load induced adaptations thereof. The student is able to apply and discuss this knowledge with respect to problems and questions related to locomotion, movement, training induced muscle adaptation and orthopedic interventions.

Inhoud vak

During the course, a critical evaluation is made of the current knowledge of how muscle structure and function are related and how these properties adapt in response to mechanical loading.

This involves the subjects indicated below:

- force exertion by sarcomeres, muscle fibers, muscle and muscle tendon- complexes;
- elasticity;
- functional morphology and determinants of the muscle length- force-velocity characteristics;
- heterogeneity in mechanical properties and functional consequences;
- force transmission between muscle fiber, tendon and fascia;
- adaptation of muscle due to growth, immobilization, training and surgical interventions;
- mechanotransduction and cellular signaling in the regulation of adaptation of muscle size.

Onderwijsvorm

lecture
practical
tutorial

The course consists of a series of lectures and tutorials. In this combination, the relevant topics will be addressed, explored and discussed. One practical is included in which the analysis of gene expression in muscle in response to mechanical loading will be introduced.

Toetsvorm

Exam

The assessment consists of:

- written examination (essay questions including calculations) - 90%;
- practical report - 10%.

Literatuur

Lecture notes, book chapters, research articles and review papers which will be made available before the course.

Vereiste voorkennis

The student should have basic knowledge and understanding of the muscle anatomy and physiology as well as molecular biology.

Molecular Biology

Vakcode	B_MOLECULBIO (900801)
Periode	Periode 5
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. ir. T.J. de Vries
Examinator	dr. ir. T.J. de Vries
Docent(en)	dr. ir. T.J. de Vries
Lesmethode(n)	Hoorcollege, Practicum
Niveau	400

Doel vak

1.General overview of molecular biology and its relevance for movement, faculty: prof.dr. V. Everts, format: lecture;
2.Omics and molecular biology, faculty: dr. B.P. Krom and dr. B.W. Brandt, format: lecture and workgroup;
3.Technical approaches in molecular biology, faculty: dr.ir. T.J. de Vries, A.M. Schoenmaker, format: lecture, workings groups, practical course.

Inhoud vak

This course provides an overview and insight into (1) general aspects of molecular biology, (2) molecular biology in relation to movement (muscles, nerves, bone, tendon), and (3) use of modern molecular biological techniques.

A general overview of molecular biology will be presented. Topics will be discussed like structure and function of DNA, RNA, siRNA, transcription and translation. In addition interference with gene expression will be discussed (e.g., gene transfection, deletion).

Molecular aspects of movement will be discussed with an emphasis on the

functioning of muscles, nerves, bones and tendon, as well as other tissues in relation to movement and non-movement. A central issue will be the question how movement or the lack of movement affects the activity and protein expression of the cells associated with these tissues.

Finally an in-depth insight in modern biological strategies for the analyses of (defects in) the above mentioned molecular aspects of movement and the tissues involved will be presented.

The following techniques and their applications in cell biology will be highlighted:

- 1.mutation detection, important for understanding effects of genomic mutations on cellular functioning;
- 2.RT-PCR, a breakthrough technique developed in the 1980's, which enables the study of gene expression and its relevance for physiological or pathological processes in minute biological samples;
- 3.DNA-sequencing, DNA-microarrays, transcriptomics and proteomics, elegant and valuable tools for studying gene-variations and gene-

expression of a large number of genes in one biological sample;
 4. RNA interference, a technique of the last decade with which you can inhibit the expression of specific RNA's, used to study the function of different genes;
 5. Bioinformatics, the development, validation and application of computational techniques to the management, analyses and understanding of biological information.
 Ultimate learning objective is to know more about molecular biology and its role in answering movement related research projects.

Onderwijsvorm

The course will include:

1. Tutorials/lectures for 4 hours on general aspects of Molecular Biology and transcription and translation (V. Everts);
2. Tutorials/lectures for 8 hours on molecular biological strategies, bioinformatics, next-generation sequencing, DNA-microarrays, genomics and proteomics (B. Krom and B. Brandt);
3. Practicals for 3 days on qPCR (T. de Vries, T. Schoenmaker).
4. 1 hour question time

Toetsvorm

Open-ended questions (2/3 of the final grade) and written report of the practicals (1/3 of the final grade)

Literatuur

Molecular Biology. Principles and Practice by Michael.M. Cox, Jennifer A. Doudna and Michael O'Donnell Publisher: W.H. Freeman and Company. ISBN-13: 978-0-7167-7998-8. ISBN-10: 0-7167-7998-6. Edition of 2012.

Teun de Vries: Chapters 2.4; 11,12; 15-19.

Bastiaan Krom: Chapters 7-8.

Bernd Brandt: Sequence tagged sites (STSs), 261

Expressed sequence tags (ESTs), 261

Ensembl & NCBI website, paralogs, orthologs, Comparative genomics 264, 266

Genome sequencing, 260-263

BLAST (annotation), 263

databases for, 266-271

genome annotation, 263-266

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Single nucleotide polymorphisms (SNPs), 271,272

Comparative genomics phylogenetic profiling (computational approaches), 281-282

Biological Literature Mining, 282

Sectie 12.1: Types of DNA mutation, 410-416

Appendix Model Organisms, A1-A2

Vereiste voorkennis

No entry requirements.

Neurosciences

Vakcode	B_NEUROSC (900804)
Periode	Periode 2

Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	prof. dr. A. Daffertshofer
Examinator	prof. dr. A. Daffertshofer
Docent(en)	prof. dr. A. Daffertshofer
Lesmethode(n)	Hoorcollege, Computerpracticum, Practicum, Werkcollege
Niveau	400

Doel vak

- The student understands the basic structure and function of the neuromuscular system as a model for neuronal communication and interaction
- The student understands the relation between the electric activity at nerve and muscle cell level and macroscopic electrophysiological non-invasive EEG, MEG, and EMG measurements.
- The student understands the interpretation of the brain as a dynamic network and can use basic computer simulation techniques to interpret mechanisms.
- The student knows how to collect encephalographic data and to interpret such data also in relation with external events.
- The student knows the important mechanisms behind central nervous diseases and how these are reflected in abnormal brain activity.
- The student is confronted with neuromuscular disease states and the diagnostic tools to do basic differential diagnostics.
- The student knows principles and applications of the most often used techniques for (functional) brain imaging like (f)MRI, PET, TMS.

Inhoud vak

This course will approach the function of the human nervous system from different angles. Students will be familiarized with basic approaches to neural communication and interaction. We then will deal with the functional background of mass activity in the central nervous system. The student will become familiar with the general principles of electrophysiology and other neurophysiological imaging techniques. The possible roles of oscillatory neuronal dynamics will be explained. The use of relevant methods in the diagnostic process of central nervous disorders and in the recent developments around brain-computer interfaces will then be considered.

Onderwijsvorm

Lectures 17'2 hours, computer practical 3'4 hours, excursion (practical Nijmegen) 1'4 hours. The course is build around three main themes: (i) Neurons and neural network behavior, (ii) Signals from the brain and their interpretation and (iii) Peripheral neuromuscular systems

Toetsvorm

2.75 hours (including dyslexia time); written exam with open questions

Literatuur

Research articles and lecture handouts will be provided before the course.

Vereiste voorkennis

Basic knowledge and understanding of the neurophysiology of brain processes and neuromuscular control concerning membrane potential, ion channels, ion pumps, between neuron communication, function of different brain structures, movement control, spinal cord circuits and motor units.

Knowledge of and skills in programming in Matlab at the level used in, e.g., the FBW bachelor course 'Meten van Fysische Grootheden'.

Perception for Action

Vakcode	B_PERCACTION (900810)
Periode	Periode 4
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	prof. dr. J.B.J. Smeets
Examinator	prof. dr. J.B.J. Smeets
Docent(en)	prof. dr. J.B.J. Smeets
Lesmethode(n)	Hoorcollege, Computerpracticum
Niveau	500

Doel vak

The student is able to:

- describe the functioning of the sensory systems relevant for motor control;
- interpret scientific literature in the area of perception and apply it to the field of motor control.

Inhoud vak

The topic of this course is the question: how is sensory information processed to guide ones action? More specific: how do we know where a target and (a part of) our body is? The answers to these questions require knowledge about the sensory organs, their signals, and how these signals are processed and combined in order to be used to control our actions. Each topic (e.g. proprioception, binocular vision) is introduced by a lecture, but the focus of the course is on the discussion of papers of the last decade. The discussion will be about both the phenomenology and the mechanisms.

Onderwijsvorm

Amount of contact hours:

Lectures (' hoorcolleges') 7

Tutorials (' werkcolleges') 7

Assignments & self study 68

Practicals 2

Each meeting will be a combination of tutorial consisting of a discussion of the previous assignment (1 hour), and a lecture introducing to the topic of the next assignment (1 hour)

In the practical, the students will compare two psychophysical techniques and discuss their effectiveness in answering the question

what perceptual information is available.

Toetsvorm

After each lecture, students receive an assignment. Six of them have to be handed in before the next meeting. These assignments are graded, and count for 10 % of the final grade. The assignment after the final lecture will contribute 35 %: the remaining 5% on completion of the practical.

Literatuur

Literature needed for the course will be distributed during the course.

Vereiste voorkennis

No entry requirements. Basic knowledge of the nervous system is expected (e. g. function of various brain areas).

Overige informatie

- The maximum number of participants in this course is limited to 40

Perceptual-motor Learning

Vakcode	B_PERCML (900682)
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. G.J. van der Kamp
Examinator	dr. G.J. van der Kamp
Docent(en)	dr. G.J. van der Kamp
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	500

Doel vak

- The student is capable to describe, summarize and compare the key concepts, experimental methods, and empirical evidence for contemporary theories of perceptual- motor learning;
- The student is capable to apply knowledge from contemporary theories of perceptual- motor; learning to provide insight; into concrete problems and common habits in the practice of sport and rehabilitation with respect to perceptual- motor learning;
- The student is capable to critically assess and evaluate the underlying assumptions and empirical evidence for the contemporary theories of perceptual- motor learning. The student is able to evaluate the applied value of the contemporary theories for the practice of perceptual- motor learning in sports and rehabilitation;
- The student is capable to orally present a concise summary of the main contributions of contemporary theories of perceptual- motor learning for applications in practice of sports and rehabilitation. The student is capable to contribute to discussions regarding the applied value of the contemporary theories for the practice of sports and rehabilitation.

Inhoud vak

The course provides a capita selecta of contemporary theories of perceptual- motor learning, such as the ecological approach, common-

coding approach and neuropsychological approaches to perceptual-motor learning. Among others, the following topics will be addressed; variability of practice, video-feedback, self-controlled feedback, gaze-training, education of attention, anticipation, internal & external focus of attention, motor familiarity, observational learning, implicit & explicit learning, analogy learning, errorless learning, re-investment. Besides a concise overview of the key concepts, hypothesis and experimental methods and empirical support for these theories, the course addresses the significance and (possible) applications of these theories for the practice of sports and rehabilitation.

Onderwijsvorm

lecture
tutorial

Three lectures provide the student with an introduction into the three contemporary approaches to perceptual- motor learning. The lectures give a short background to the theories and provide a critical discussion of the key concepts and empirical evidence. During the tutorials the student applies the contemporary theories to the practice of perceptual- motor learning in sports and rehabilitation by proposing theory- derived solutions to 'problems from practice'. Assessment 40 hours and for preparation tutorials 20 hours.

Toetsvorm

The lectures provide the student with an introduction into each of the contemporary approaches to perceptual- motor learning. The lectures give a short background to the theories and provide a critical discussion of the key concepts and empirical evidence. During the tutorials the student applies the contemporary theories to the practice of perceptual- motor learning in sports and rehabilitation by proposing theory- derived solutions to 'problems from practice'. (Assessment 80 hours and for preparation lectures and tutorials 60 hours)

Literatuur

A collection of recent theoretical and experimental papers from the scientific literature (details to be announced).

Vereiste voorkennis

The student is familiar with the type of problems and questions that are addressed in theories and research of perceptual- motor coordination, control and learning. The student is able to independently search for, acquire and report knowledge from contemporary scientific papers.

Overige informatie

Maximum number of students: 50

Psychological Factors in Sport

Vakcode	B_PSYFACSPRT (900676)
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. R.R.D. Oudejans

Examinator	dr. R.R.D. Oudejans
Docent(en)	dr. R.R.D. Oudejans
Lesmethode(n)	Hoorcollege, Werkcollege, Bijeenkomst
Niveau	400

Doel vak

The student is able to:

- give an overview of several psychological factors that play a role in sport, the assumed working mechanisms as well as ways of influencing these factors with mental training;
- critically assess (recent) literature about psychological factors in sport and sport psychology on its thesis, content, empirical rigor and applicability;
- critically discuss (recent) literature about psychological factors in sport and sport psychology in a written report, culminating in the evaluation of the literature and a discussion of implications for sport (psychology) practice;
- critically assess and discuss papers of fellow students on contents, structure, writing and originality.

Inhoud vak

In this course several psychological factors that determine performance in sports will be discussed with special focus on the topics that are crucial in sports practice and have a prominent place in research at the Faculty of Human Movement Sciences. These are anxiety, choking under pressure, training under pressure, attentional control, and visual attention training. Other than that the content is for a large part determined individually as each student writes a paper on a key topic in sport psychology.

Onderwijsvorm

lecture 5 times 2 hours

discussion tutorial 1 meeting 4 hours

There are several lectures on topics in sport psychology. Other than that students will produce an individual paper on a topic in sport psychology and reviews of the papers of their fellow students.

Toetsvorm

Students produce a paper (80%) and reviews about papers of other students (20% of the final grade). The paper and reviews must at least be of sufficient quality to pass the course.

Literatuur

- Course manual (available on Blackboard);
- Recent articles and book chapters on psychological factors in sport and sport psychology.

Background literature:

- Cox, R.H., Sport Psychology: Concepts and Applications, 6th edition. Boston: McGraw-Hill, 2007.

or

- Bakker, F.C. & Oudejans, R.R.D. (2012). Sportpsychologie. Nieuwegein: Arko Sports Media.

Vereiste voorkennis

Students should have basic knowledge and understanding of sport psychology as is available in textbooks such as Cox, R.H. (2007). Sport Psychology: Concepts and Applications, 6th edition. Boston: McGraw-Hill, or Bakker, F.C. & Oudejans, R.R.D. (2012). Sportpsychologie. Nieuwegein: Arko Sports Media.

Rehabilitation: Restoration of Mobility

Vakcode	B_REHABMOB (900657)
Periode	Periode 1
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. J.H.P. Houdijk
Examinator	dr. J.H.P. Houdijk
Docent(en)	dr. J.H.P. Houdijk
Lesmethode(n)	Hoorcollege, Practicum
Niveau	500

Doel vak

The student is capable to:

- understand the relevant issues, terms, concepts, and models in the restoration of mobility within the context of rehabilitation,
- understand and knowledge of the practical aspects of patient-related – biophysical - research into restoration of mobility in rehabilitation,
- Develop knowledge, understanding and skills in (clinical) human movement research results, methods and techniques of measurement of 'function & structure, activity, participation and functionality,
- Appreciate and understand various aspects of adaptation, compensation, training and learning of function and activities in the framework of restoration of mobility in persons with lower limb impairments,
- understand the contexts, and the practical process of scientific research and communication in the combined fields of rehabilitation and human movement sciences.

Inhoud vak

Being the key-issue in rehabilitation, this course concentrates on the 'restoration of mobility' – and its underlying mechanisms - at the different levels of the International Classification of Functioning, Disability and Health (WHO 2001). Primarily a biophysical approach is taken: biomechanical and exercise physiological principles, techniques and research findings will be discussed in specific patient-related experiments and studies. Aspects of adaptation, compensation as well as concepts of learning and training mechanisms will be addressed. Research in this field will be presented and discussed in the format of 'Capita Selecta'.

Onderwijsvorm

Brief description of Lectures (' hoorcolleges'): 6 lectures in which the current issues and state-of-the-art research different patientpopulations is discussed.

Practicals: two visits to rehabilitation centers(Reade Amsterdam,

Heliomare Wijk aan Zee)

Assessment: a written assignment (16 hours), a written examination (41 hours self study and 3 hours examination).

Toetsvorm

Specific description of the assessment form, such as:

- written test: written examination covering lectures and reading material; short essay questions. (80%)
- assignment(s): essay on restoration of mobility conform format popular scientific magazine. (20%).

Literatuur

A selection of scientific papers.

Vereiste voorkennis

None.

Research Internship Research Master

Vakcode	B_RIRM (900800)
Periode	Ac. Jaar (september)
Credits	60.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Niveau	600

Doel vak

During the research internship, students conduct scientific research in a 'master - pupil relationship'.

The research project must be:

- aimed at a suitably challenging research question;
- conducted in a methodologically correct way;
- related to and based on the theory.

The aim the internship is to learn to perform under supervision the components of the research process (formulating a research question, creating a hypothesis, planning and conducting experiments, processing the data, interpretation of the results and reporting) and to gain insight in the connection between these components.

Onderwijsvorm

The student conducts the research internship within one of the research programs of MOVE, under the supervision of one of more MOVE members within the programme. The subject of the internship is chosen in consultation with the coordinator. Students are advised to participate in the meetings of at least one of the MOVE research programs (www.move.vu.nl) during the first year of the MSc program, to prepare the choice of a research topic. Once the subject and the internship supervisor(s) have been established, the student writes a proposal, comprising research question, hypothesis(es), methods statistics and planning. In addition to a time schedule, the latter should include choices for equipment and indications for organization of the work. After the proposal has been approved by the supervisor(s), it is presented during a meeting of the research group. The time available for supervision is in the order of 80 hrs.

The student can opt to divide the internship in two parts, a major internship (36 EC) to which the above applies and a second internship in another research institute, preferably abroad (24 EC). For these minor internships a MOVE member will be appointed as supervisor (by the coordinator). The main responsibilities for supervision will be delegated to the external supervisor.

Toetsvorm

The evaluation of the research internship is performed using a standardized form (available on the course blackboard site) and is based on the following elements:

- the research proposal (originality, relevance and methodological quality);
- actual performance of the study, quality of data collection and processing;
- the report (this should contain a description of the work preferably in the format of a journal paper and a detailed description data acquisition, data analysis and data storage);
- The oral presentation of the report during the work group meeting.

The proposal and overall performance of the student during the internship are judged by the internship supervisor(s). The report and the oral presentation are judged by both the internship supervisor(s) and a second assessor from the same research program but not directly involved in the project. The quality of the proposal and the performance of the study make up 40 % of the mark, the report makes up 50 % and the oral presentation makes up the final 10 %.

For minor internships performed outside MOVE, the role of the internal supervisor can be limited to that of assessor of the report. In all cases, the external supervisor advises the MOVE supervisor with respect to the mark on all elements mentioned above, but the MOVE supervisor decides on the final mark.

Statistics for Experimental Research

Vakcode	B_STATEXPRES (900683)
Periode	Periode 4
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. M.J.M. Hoozemans
Examinator	dr. M.J.M. Hoozemans
Docent(en)	dr. M.J.M. Hoozemans
Lesmethode(n)	Hoorcollege, Werkcollege, Computerpracticum
Niveau	400

Doel vak

On the basis of case descriptions and raw data the student is capable to:

- determine the research designs and choose, justify and perform the appropriate statistical analyses (t-tests or ANOVAs or their non-parametric counterparts) using SPSS.
- report the analyses and the results in the same way as is commonly

done in methods and results sections of scientific journal articles.

Inhoud vak

Students will learn ins and outs of applying and interpreting statistical techniques that are common or are becoming common in experimental research. The topics covered in this course are:

- Research design
- Basic statistical principles (e.g. data exploration)
- Estimating a population mean from a sample
- Independent and paired t-tests and their associated confidence intervals
- Non-parametric difference tests
- Linear regression
- One-way ANOVA (between subjects and repeated measures)
- Factorial ANOVA (two-way between subjects, two-way repeated measures, two-way mixed design)
- Effect size
- Data transformations

There will be lectures and SPSS practical sessions for all the topics covered in the course.

Onderwijsvorm

Lectures (20 hours / 10 lectures)

Computer practicals (32 hours / 8 practicals)

Toetsvorm

The students have to take an examination. It will focus on t-tests, non-parametric difference tests, one-way ANOVA and factorial ANOVA.

Literatuur

Andy Field – Discovering Statistics using SPSS

Studentbegeleiding

Vakcode	B_STDBEG ()
Periode	Ac. Jaar (september)
Credits	6.0
Voertaal	Nederlands
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	drs. M.G.J. Buijtenweg
Examinator	drs. M.G.J. Buijtenweg

Time Series Analysis

Vakcode	B_TIMESERANA (900814)
Periode	Periode 5
Credits	6.0
Voertaal	Engels

Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	prof. dr. A. Daffertshofer
Examinator	prof. dr. A. Daffertshofer
Docent(en)	prof. dr. A. Daffertshofer
Lesmethode(n)	Hoorcollege, Werkcollege, Computerpracticum
Niveau	500

Doel vak

Students will learn various techniques for the analysis of time series. A brief sketch of the mathematical background will enable students to select and apply proper methods for the study of signals typically found in the movement sciences. As examples range from kinematic and (neuro-) physiological signals students will get well-equipped to analyze and interpret their own experimental recordings.

Inhoud vak

Recent advances in recording techniques and increasing data storage capacity render time series analysis a challenge. In this course various uni-, bi-, and multivariate methods for the study of experimental data will be outlined and critically discussed. Statistical time-domain approaches go hand in hand with Fourier analysis, Hilbert and Gabor transforms, wavelet decomposition, et cetera. For the multivariate extension primary focus will be on principal and independent component analysis and on investigating recordings of whole-body kinematics and electromyographic signals. All techniques will be discussed based on current research articles and implemented by means of numerical exercises (Matlab).

Onderwijsvorm

36 contact hours (14 seminars, 12 practicals, 10 lectures); 124 hours self-study

A mixture of lectures, seminars, and computer practicals. At the computer students will analyze typical examples of movement-related, temporal data like kinematic or electromyographic signals. During the seminars, research articles on the analysis of movement dynamics will be discussed on the basis of brief summaries written by the students (writing assignment).

Toetsvorm

60% of the grade is determined by the written exam (essay questions). 20% is determined by the quality of the written summaries and/or oral presentations (depends on the number of participating students but will be announced in time via BlackBlack), and 20% by the quality of solution of the computer practicals.

Literatuur

- C. Chatfield, The analysis of time series. An introduction, Chapman & Hall, London, 1987 (or newer edition); advised

- Several research articles that will be provided

Vereiste voorkennis

Basic knowledge of Matlab is mandatory.

Aanbevolen voorkennis

Basic knowledge of Matlab is mandatory

Overige informatie

Basic knowledge of Matlab is mandatory

none

Tissue Engineering and Mechanobiology

Vakcode	B_TISSUEENG (900806)
Periode	Periode 6
Credits	3.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	dr. M.N. Helder
Examinator	dr. M.N. Helder
Docent(en)	dr. M.N. Helder
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	400

Doel vak

At the end of the course, the student is able to:

- Describe and understand the principles of tissue engineering and regenerative medicine
- Describe and understand the clues derived from embryogenesis, and how these may be implemented in tissue engineering and regenerative medicine
- use the knowledge provided in this course to formulate strategies to translate and clinically implement the principles of tissue engineering (“from bench to bedside”)

Inhoud vak

This course addresses regenerative medicine, also referred to as reparative medicine or tissue engineering, which is the regeneration and remodeling of tissue in vivo in order to repair, replace, maintain or enhance organ function, as well as to engineer and grow functional tissue substitutes in vitro for implantation in vivo as biological substitutes for damaged or diseased tissues and organs. Regenerative medicine is a multidisciplinary field involving biology, medicine, and engineering. Regenerative medicine will revolutionize surgical disciplines, and is expected to become the surgical golden standard of the upcoming decade by supporting and activating the body’s natural healing.

The course will address:

- the general build-up of organisms (organs, tissues, and their basic building blocks: the cells and the matrices surrounding them) and the various modes/levels of communication and organization.
- lessons to be learned from embryogenesis and epimorphic regeneration

- (regeneration of entire tissues and organs, e.g. observed in amphibians)
- basics of cell biology and mechanobiology
 - the main regenerative medicine building blocks: biomaterials, biologics (inductive stimuli) and (stem) cells.
 - how to “translate” basic regenerative medicine/tissue engineering principles from fundamental research via translational research towards clinical implementation (“from bench to bedside”)
 - examples of tissue engineering research on the VU campus

Onderwijsvorm

lectures: 18h

tutorials/presentations/discussions: 14h

Exam: 2.5h

Toetsvorm

Written exam (multiple choice + open questions)

Literatuur

Research articles, lectures (including notes) uploaded on blackboard

Treating Locomotor Disease

Vakcode	B_LOCOMOTOR (900818)
Periode	Periode 3+4
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Bewegingswetenschappen
Coördinator	prof. dr. J. Harlaar
Examinator	prof. dr. J. Harlaar
Docent(en)	dr. E.E.H. van Wegen
Lesmethode(n)	Hoorcollege
Niveau	500

Doel vak

1. Knowledge and Understanding:

- A general knowledge of and insight into the main clinical issues (epidemiology, pathophysiology, consequences and treatment modalities) with regard to diseases that affect the locomotor system.
- Knowledge of current research questions and translational research projects at VUmc/MOVE

2. Applying knowledge and Understanding:

- The ability to integrate knowledge from human movement sciences and medicine
- The ability to frame tentative research questions relevant to a specific locomotor disease, by applying knowledge from human movement science.

3. Making Judgments:

- The ability to reflect on ethical and practical issues that constrain the feasibility to perform applied studies in the area of locomotor diseases.
- The ability to formulate relevant hypotheses regarding research questions on translational research in locomotor diseases.
- The ability to reflect on the scientific relevance and societal value of achievements in translational research on locomotor diseases.

4. Communication:

- The ability to communicate with fellow researchers as well as clinicians, and finding ways to bridge gaps between different conceptual frameworks that are current in human movement science and medicine

5. Learning skills:

- The ability to write a research proposal that could serve as starting point for a research master thesis (i.e. a scientific report in the form of a scientific (peer-reviewed) paper).

Inhoud vak

This course provides an overview of leading innovative research and medical treatments in the field locomotor disease, rehabilitation and movement science. Each topic of this module is designed around a clinical theme, i.e. a specific disease. A general introduction will include a discussion on the main clinical problems, related to the design of possible new treatments. This discussion will be focused on how methods and techniques from the several medical disciplines as well as the movement sciences are being applied to study and treat locomotor disease. Both neurological diseases (progressive as well as non progressive) as degenerative diseases of the skeletal system will be discussed. Also general principles of clinical movement analysis and outcome measurements are part of this module.

Onderwijsvorm

Topics:

Joint Replacement
Hand Surgery
Parkinson's Disease
Cerebral Palsy
Cerebro Vascular Accident
Clinical Movement Analysis
Rheumatoid Arthritis
Osteoarthritis
Endocrinology/Osteoporosis
Clinimetrics in Neurorehabilitation
Multiple Sclerosis
Ankylosing Spondylitis
Obstetric Plexus Brachialis Lesion
Amputation/ prosthetics
Spinal Cord Injury

Toetsvorm

paper: research proposal 100%

Literatuur

- literature to be studied: will be provided through blackboard
- additional literature: will be provided through blackboard

Vereiste voorkennis

Not applicable