Master Human Movement Sciences

Find another programme

Students must choose one of two specialisations within the master's in Human Movement Sciences:

Health and Rehabilitation
Sports and Nutrition

There is also a third specialisation - Physiotherapy - which is only available for students with a bachelor's diploma from SOMT University of Physiotherapy in the Neherlands.

Interested in the Master's Open Day? Sign up now!

Health and Rehabilitation

Physical activity - whether the result of therapy, exercise training or a change in lifestyle - appears to be a simple yet effective means of improving cardiovascular, metabolic and even mental health. Furthermore, the ability to move in itself is a fundamental characteristic of human life, which may be hampered by illness, accidents or ageing.
As such, understanding and improving human movement is an important objective of rehabilitation. Both aspects, i.e. human movement as a **means** to improve health and human movement as a **goal** in rehabilitation, are covered in this specialisation.

Is this specialisation right for me?

This specialisation is primarily intended for those who are interested in performing and understanding research on the interaction between physical activity, mobility and health. Specific examples are: non-invasive ways to determine muscle health; use of wearable technology for health monitoring; use of motion analysis for evaluation and diagnostics of movement disorders; clinical biomechanics and neuro-rehabilitation.

What are my career prospects?

This specialisation prepares you for a research-oriented future in the field of physical activity and health or rehabilitation in academia, hospitals, rehabilitation centres, life style centres, biomedical companies, et cetera (e.g. PhD, embedded scientists, R&D).

Those who are already in a job, will be able to better embed evidence-based handling in their

practical profession.

Programme

During the first 16 weeks, you follow courses specific to this specialisation:
Imaging Muscle Health
Physical Activity and Health
Analysis and Restoration of Human Locomotion
Movement Disorders and Rehabilitation

After these courses, you have a course on designing research, followed by a systematic review course and the research placement leading towards your master's thesis.

Imaging Muscle Health
This course focuses on muscle function, muscle mass, strength and endurance/fatigue, using short and interactive lectures.

You will also get acquainted with the various methods that are available to measure muscle function (MRI/MRS, functional testing such as strength and endurance measurements by EMG and biodex). The acquired knowledge will be applied to situations of changed muscle function (training/detraining, ageing and metabolic disease). In addition, you will make an instruction movie in which you explain one of the muscle health investigation techniques and its value/application.

Physical Activity and Health
Movement involves and affects major components of our biological system, and therefore it has influence on metabolic health, cardiovascular health and also cognitive health.

The themes of physical activity and cardiovascular, cognitive and metabolic health are offered via short, interactive work lectures that are closely intertwined with a research project.

The specific movement sensors that are used in this course are tri-axial accelerometers that measure accelerations in the vertical, anteroposterior and mediolateral direction of the body to capture total physical activity as well as activity patterns. These accelerometers can also be used to assess a specific aspect of physical activity such as walking speed.

Analysis and Restoration of Human Locomotion
You will learn about the current thinking in motion analysis and the novel approaches for 3D clinical motion analysis and treatment of impaired human locomotion (e.g. virtual reality as a treatment option). You will work with real anonymised patient data to solve their clinical question.

Movement Disorders and Rehabilitation
Treatment of movement disorders does not always result in full recovery; the remaining consequences of the disorders, i.e. the impairments, result in disabilities in daily life functioning and lower quality of life. In rehabilitation, patients learn to participate in their daily life despite their impairment.

During this course you work in little groups of about four on three cases. Together you'll interpret which methodological approach is needed to measure this issue. And you consider, formulate and evaluate solutions. In addition, you will write your individual essay, in which you argue (pro or con) for the use of innovative technologies used in the domain of rehabilitation (sensor technology and robotics).

What about the academic part?

To be able to apply evidence-based practice in your professional setting, it is essential that you learn to adequately design, conduct, analyse and (orally) present scientific research, in collaboration with peers. In addition, you will need to develop your critical reading and thinking. Therefore, an academic skills training programme is integrated into the various courses. The set of skills that is being trained is identical for both specialisations.

This video gives you an impression of the specialisation *Health and Rehabilitation*. It is a show and tell by three people who are in one way or another involved in this specialisation: dr. Kenneth Meijer, student Anniina Blomster and clinical operator/researcher at MUMC+ Rachel Senden.

Master Human Movement Sciences: specialisation Health and Rehabilitation

Sports and Nutrition

This specialisation covers themes such as performance testing in athletes, dietary requirements based on type, intensity and volume of exercise, and efficacy of nutritional strategies to optimise sports performance.

Is this specialisation right for me?

This specialisation is developed for students aiming to gain scientific understanding of the interaction between exercise and nutrition. Specific examples are: use of performance testing to study efficacy of sport supplements and/or nutritional interventions in sports practice; advising sports teams and coaches on nutritional programmes to optimise training efficiency; designing and conducting scientific studies to further academic developments in the field of sports and nutrition.

What are my career prospects?

After graduation, you are a sports nutritionist with a scientific understanding of the interaction between nutrition and sports. You are prepared for a research-oriented future in the field of sports and nutrition in academia, applied sciences, sports organisations, sports nutrition companies, et cetera (e.g. PhD, embedded scientists, R&D).

Those who are already in a job will be able to better embed evidence-based handling in their practical profession.

Programme

During the first 16 weeks, you follow courses specific to this specialisation:
Nutrition to Fuel Sports Performance
Sport Supplements and Ergogenic Aids
Nutrition to Support Training Adaptations

Sports and Nutrition: Putting Science into Practice

After these courses, you have a course on designing research, followed by a systematic review course and the research placement leading towards your master's thesis.

Nutrition to Fuel Sports Performance
This course focusses on the role of nutrition to meet the energy demands of exercise.

The main topics are being discussed on the basis of three cases:
The different energy systems in the human body, which substrates are used during exercise, and how these energy systems are limiting for sports performance.
The role of exogenous substrates to support endogenous energy stores before, during, and after exercise. You will determine which actual food products can be used in practice.
The importance of the intake of large amounts of carbohydrates versus other nutritional strategies to stimulate exercise performance in the light of training intensity and efficacy.

Sport Supplements and Ergogenic Aids
This course focusses on sport supplements and their proposed mechanisms of action. What is available, what is the evidence, what works, how and when, and - not trivial - what does not work? The course contains three cases which will discuss various supplements: caffeine, creatine, buffers (sodium bicarbonate), nitrate, carnitine, fish oil, vitamins, minerals, anti-oxidants and ketones.

Nutrition to Support Training Adaptations
This course focusses on how nutrition after exercise - or even on non-training days - can improve recovery and improve training adaptations.
The course contains three cases in which it will be discussed how the body (with skeletal muscle as main tissue) adapts to different sports/training programmes and how nutrition is more than just a performance fuel; i.e. how can nutrition be used to augment the adaptive response to exercise training, with a focus on protein nutrition.

Furthermore, different recovery strategies are being discussed and a practical experiment on cooling strategies is performed.

Sports and Nutrition: Putting Science into Practice
The focus of this course is on translating scientific knowledge to practical recommendations (practical guidelines tailored for athletes). The course contains three cases in which a nutritional plan will be designed for athletes from different sports, taking into account their training practices. In addition, the course also evolves around individualisation or personalised nutrition depending on factors that go beyond the specific sport discipline, i.e. gender, ethnic background, culture, et cetera.

Topics that are being addressed are popular diets, how dietary needs differ between persons/sports/training phases, dietary assessment and how to communicate with athletes and be part of a larger coaching team.

To get you familiar with the 'practical environment', you'll go on work visits to sports organisations / institutes where you can experience actual examples of how proper sport nutrition is being facilitated in practice (e.g. Topsport restaurant and sports centre Papendal).

What about the academic part?

To be able to apply evidence-based practice in your professional setting, it is essential that you learn

to adequately design, conduct, analyse and (orally) present scientific research, in collaboration with peers. In addition, you will need to develop your critical reading and thinking. Therefore, an academic skills training programme is integrated into the various courses. The set of skills that is being trained is identical for both specialisations.

This video gives you an impression of the specialisation *Sports and Nutrition*. It is a show and tell by three people who are in one way or another involved in this specialisation: dr Lex Verdijk, student Hannes Quandel and researcher at FHML Jorn Trommelen.

Master Human Movement Sciences: specialisation Sports and Nutrition

Master's Programme

Specialisation Health and Rehabilitation

Fac. Health, Medicine and Life Sciences

Imaging Muscle Health

Full course description

Muscle health can be defined in many ways, but muscle function, muscle mass, strength, and endurance/fatigue are all aspects that are highly important for muscle health.

This course will focus on these aspects of muscle health using short, interactive lectures. Furthermore, since different tests are available to assess each aspect of muscle function, the course contains four practical training sessions. Furthermore, three problem-based learning (PBL) cases will cover (clinically) relevant situations of changing muscle function, where students will need to apply their knowledge to the specific problem. Lastly, a project will be performed in small groups, in which students will make a presentation, including an instruction movie, addressing a technique of choice to evaluate muscle function.

Course objectives

Knowledge and understanding:

- Read and evaluate a scientific manuscript (critical reading)
- Write a scientific report (scientific writing, searching literature)
- Review and comment on a scientific report written by a peer (reviewing)
- Search for relevant information and report to a group (PBL in tutorial groups)
- Knowledge about design of experiments/testing (research methods and design)

Learning academic skills:

- Explain a technique to investigate muscle health in a clear and comprehensive way by making an instruction video

Communication:

- Evaluating the applicability (advantages and disadvantages) of various methods of determining muscle health for a given question

Making judgements:

- Apply the acquired knowledge to situations of changing muscle health, like ageing or disease

Applying knowledge and understanding:

- Understand how muscle mass and muscle metabolism are influencing muscle health in terms of strength, endurance, power, and fatigue
- Understand how these factors of muscle health can be determined (by imaging-based and functional assessments)
- Know the basic principles of imaging techniques such as MRI and MRS

Recommended reading

- McArdle WD, Katch FI, Katch VL. Exercise physiology: energy, nutrition and human performance. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins, 2015. - Kenney WL, Wilmore JH, Costill DL. Physiology of sport and exercise. Champaign, IL: Human Kinetics, 2015. - Poortmans J. Principles of exercise biochemistry. New York: Karger, 2004. - Maughan RJ. Sports nutrition (first edition). John Wiley & Sons, Ltd, 2014. - Frayn KN. Metabolic regulation: a human perspective (third edition). Malden: Wiley-Blackwell Pub, 2010. - van Loon LJ, Jeukendrup AE, Saris WH, Wagenmakers AJ. Effect of training status on fuel selection during submaximal exercise with glucose ingestion. J Appl Physiol (1985) 1999;87(4):1413-20. - And others...

HMS4501
Period 1
1 Sep 2021
22 Oct 2021
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- B.C. Bongers

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations, Skills, Training(s), Working visit(s)
Assessment methods:
Assignment, Attendance, Final paper, Portfolio, Presentation, Written exam
Keywords:
- Muscle function - Muscle mass - Exercise physiology - Biodex - MRI/MRS
Fac. Health, Medicine and Life Sciences

Physical Activity and Health

Full course description

This course will address two major themes that are highly related to each other. The first theme covers the beneficial effects of physical activity on health. Several keynote lectures (1 h) are delivered covering the different health aspects of physical activity including metabolic, cardiovascular and cognitive health and sit-less for health. The second major theme of the course is how physical activity can be accurately measured in daily life. For that, wearable sensors will be used and students will learn about different sensors that are available, how these sensors function and how data from these sensors can be analysed. For this, students will get to design their own research project where they can answer their research question using a tri-axial accelerometer (the MOX).

The course keynote lectures will mainly cover theoretical bases about how physical activity benefits health and how physical activity can be measured. The tutorial/project group meetings will be used to design the research projects, perform measurements, analyse the data and present the project results.

Course objectives

Knowledge and understanding

At the end of this course, students have gained knowledge and understanding of the following topics:

- Metabolic, cardiovascular and cognitive health effects of different aspects of physical activity
- Basic principles of accelerometry-based motion analysis and activity monitoring
- Underlying principles of signal analysis and basic signal processing methods (filtering, differentiation and integration)
- Experimental design and analysis aspects of research related to physical activity monitoring.

Applying knowledge

- Formulate a relevant research question related to physical activity and design an appropriate research protocol to answer this question
- Gathering and post-processing of physical activity data

Making judgements

- Choosing the appropriate technique to quantify relevant aspects of physical activity
- Judging the methodological quality of studies that use motion sensors
- Analysing and interpreting results from a physical activity experiment

Communication

- Oral presentation of obtained research data
- Writing a scientific report
- Collaborating effectively with fellow students and experts

Learning skills

- Knowledge about design of experiments/testing (research methods and design)
- To test reproducibility and validity of physical activity data
- To test sensitivity and specificity of physical activity classification

HMS4502
Period 1
1 Sep 2021
22 Oct 2021
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- G. Plasqui

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations, Research
Assessment methods:
Attendance, Final paper, Presentation, Written exam
Keywords:
physical activity assessment wearable sensors health
Fac. Health, Medicine and Life Sciences

Analysis and Restoration of Human Locomotion

Full course description

The aim of this course is to educate students on the basics of 3D motion analysis and its clinical applications for the analysis and restoration of human locomotion. From a clinical perspective walking ability has been identified as a vital sign for health. The course uses a combination of classic PBL for knowledge and understanding of the principles and project education in the form of a clinical case to understand the potential application s of the field. These are supported by lectures on the basic concepts and practicals to acquire skills in the methods and approaches of the field. The focus of the course will be on human locomotion. The students will work with real anonymized patient data to solve their clinical question and they will report their findings to a multi-disciplinary team of experts. They will also gain experience in novel approaches for clinical motion analysis and treatment.

Course objectives

Knowledge and understanding

- Biomechanical principles of human locomotion: kinematics, kinetics, muscle function
- Current concepts in gait restoration: Virtual Reality training, Assistive devices/Exoskeletons, Rehabilitation robotics & Prosthetics
- Basics of signal processing in 3D Motion Capture; filtering, differentiation/integration
- Statistical approaches to analyse complex biomechanical data

Master Human Movement Sciences

- Basic research skills; e.g. formulating hypothesis

Applying knowledge and understanding

- Choosing and adapting the appropriate technique to measure relevant aspects of human locomotion
- Performing post-processing of motion analysis data •Report gait data in a comprehensive manner
- Develop a testable hypothesis

Making judgements

- Interpret the results of a gait analysis trial to assess functional deficits
- Advice (clinical) experts on results of the analysis

Communication

- Write a scientifically sound report for a clinical case
- Orally present and communicate to/with (clinical) experts

Learning skills

- Critically analyse and report gait data
- Critically review research studies and the methodology applied

Recommended reading

R. Baker Gait analysis methods in rehabilitation Journal of NeuroEngineering and Rehabilitation 2006, 3:4 doi:10.1186/1743-0003-3-4• J.R. Gage et al The identification and treatment of gait problems in cerebral palsy 2009 Mac Keith Press Kuo AD. The six determinants of gait and the inverted pendulum analogy: A dynamic walking perspective. Hum Mov Sci.2007 Aug;26(4):617-56.• Kuo AD, Donelan JM. Dynamic principles of gait and their clinical implications. Phys Ther. 2010 Feb;90(2):157-74. doi: 10.2522/ptj.20090125.

HMS4503
Period 2
25 Oct 2021
17 Dec 2021
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- K. Meijer

Teaching methods:
Lecture(s), Work in subgroups, Paper(s), PBL, Presentation(s), Research, Skills
Assessment methods:
Final paper, Presentation, Written exam
Keywords:
3D motion analysis, Movement disorders

Movement Disorders and Rehabilitation

Full course description

Knowledge transfer during this course will include classic Problem Based Learning (PBL), short lectures, project work and practicals. In addition, students will participate in interactive lectures and will participate in a House of Commons debate. Next to gathering knowledge, in this course the main focus is on logical reasoning and applying knowledge. Students are challenged to argue, discuss and interpret relevant topics in the field of rehabilitation.
During this course students write a research proposal in teams and an individual, substantiated essay with an assigned position (pro or con) in favor or against a highly relevant topic in the field of rehabilitation medicine.
The PBL cases will be centered around:

- analyze the complex relationship and discrepancy between functioning, activity, and participation in a (seemingly simple) gait-related neurological case
- analyzing association between pain and functioning and getting insight in biopsychosocial factors influencing pain and the negative consequences for the patient and society
- technology-supported training in complex upper extremity pathology: “(non-) sense of robotics and sensor technology in rehabilitation”.

Course objectives

The aim of this course is threefold:

1. From a Bio-Psycho-Social perspective, in collaboration with multidisciplinary teams, students are able to critically analyze and describe complex health-related issues with negative impact on the musculoskeletal system and interpret within broader context which methodological approach is needed to quantify/measure this issue.
2. Students are able to consider, formulate and evaluate solutions for the above-mentioned impact of complex health-related issues regarding the musculoskeletal system.
3. Students will be acquainted with innovative technologies used in the domain of rehabilitation and are able to critically evaluate the usefulness of the deployment of such technologies in rehabilitation contexts.

Recommended reading

1. Gatchel, R.J., et al., The biopsychosocial approach to chronic pain: scientific advances and future directions. Psychol Bull, 2007. 133(4): p. 581-624. 2. Heerkens Y, Hirs W, de Kleijn-de Vrankrijker M, Ravenberg D, TenNapel H. Nederlandse vertaling van de International Classification of Functioning, Disability and Health (ICF): Compilatie. Houten, Bohn Stafleu Van Loghum, 2002. 3. Lemmens RJM, Timmermans AAA, Janssen-Potten YJM, Smeets RJEM, Seelen HAM. Valid and reliable instruments for arm-hand assessment at ICF activity level in persons with hemiplegia: a systematic review. BMC Neurology 2012,12:21. 4. Main CJ and Spanswick CC (2000). Pain Management: An Interdisciplinary Approach 5. Perry J, Burnfield J. (2010) Gait analysis: normal and pathological function. Second edition. Thorofare, Slack.

HMS4504

Master Human Movement Sciences

Period 2
25 Oct 2021
17 Dec 2021
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- E.A.A. Rameckers

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), Patient contact, Paper(s), PBL, Research, Skills, Working visit(s)
Assessment methods:
Assignment, Attendance, Final paper, Participation, Written exam
Keywords:
multidisciplinary, rehabilitation, innovative technology, ICF, rehabilitation research designs
Fac. Health, Medicine and Life Sciences

Designing Intervention Research

Full course description

The important aspects of physical activity as a means to promote mental and physical well-being have been well described in the Bachelor “Movement Sciences”. In our Western society the development of chronic metabolic diseases, like obesity and type 2 diabetes, is reaching epidemic proportions. Though part of this epidemic can be ascribed to the aging of the population, an alarming increase in the incidence of chronic metabolic disorders (particularly type 2 diabetes) has been reported among children and adolescents. The current epidemic is clearly associated with our sedentary lifestyle combined with an excessive energy intake. Therefore, combined exercise and nutritional interventions need to be designed on a scientific basis to improve health and/or functional performance. For such intervention programs to be effective it is essential to set well-defined goals specific for each target population. In this course we will integrate the different aspects of exercise and nutritional interventions to define the most effective interventions to improve health and/or (sports)performance in various populations. The permissive role of nutritional intervention to allow biological adaptation and improved functional capacity to an exercise stimulus will be addressed from the athletes’ perspective towards the clinical patient. Students will write a research grant application in which they will describe a self-designed (exercise and/or nutritional) intervention in an appropriate study population. Such an intervention can be both acute (i.e. studying mechanisms and/or potential strategies for more long-term application), short-term, or long-term (i.e. studying both mechanisms and actual outcome). The research hypotheses set in these grant applications are to be integrated in the field of sport and exercise sciences, rehabilitation, chronic metabolic disorders (diabetes, obesity, CVD, but also cancer, COPD, RA, etc) and/or general health promotion (including healthy aging, prevention, etc).

Course objectives

Students who have successfully finished this course will be able to:

1. design effective physical activity and/or nutritional interventions on a scientific basis
2. integrate the knowledge concerning the functional and/or biological adaptation to exercise and nutrition
3. select the most appropriate intervention for the desired effect: from athlete to patient
4. select the appropriate research proposal to test the efficacy of specific nutrition and/or research to large scale population studies in vivo exercise interventions: from invasive
5. define the relevant outcome parameters
6. write, present and defend a research grant proposal within this field of research

Recommended reading

- Guyton & Hall: Textbook of medical physiology. 10th ed. Saunders co. 2000, ISBN 0-8089-2187-8 - Maughan, Gleeson & Greenhaff; Biochemistry of exercise and training; Oxford university press, ISBN 0-19 262741-4 - McArdle WD, Katch FI, Katch VL: Exercise physiology, 5th ed. Lippincott Williams & Wilkins, 2001, ISBN 0-7817-2544-5 - McGinnis, P.M. Biomechanics of sport and exercise. Champaign, Ill, Human Kinetic Publishers, 1999 - Wasserman K. Principles of exercise testing and interpretation. Philadelphia: Lea & Febiger, 1994 - Passmore R, Eastwood MA. Davidson and Passmore, human nutrition and dietitics. Edinburgh: Churchill Livingstone, 1986 - Ellenberg M, Rifkin H and Porte D. Ellenberg & Rifkin’s diabetes mellitus, 5th edition, Stamford: Appleton &Lange, 1997. - Shils ME, Young VR, Olson JA, Shike M. Modern nutrition in health and disease. Philadelphia: Lea and Febiger, 1994. - Ziegler EE, Flier LJ (eds). Present knowledge in nutrition. Washington: ILSI press/International Life Sciences Institute, 1996.

HMS4001
Period 3
3 Jan 2022
28 Jan 2022
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- T. Snijders

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations
Assessment methods:
Assignment, Attendance, Final paper, Participation, Presentation
Keywords:
Intervention research Exercise intervention Methodology Presentation Research proposal
Fac. Health, Medicine and Life Sciences

Reviews

Full course description

The aim of this course is for you to formulate a sound research question regarding a topic in human movement science and to find, select, read and evaluate scientific literature critically. You will also learn how to acquire skills in reporting on the results of this process and in providing and receiving

peer feedback. The final end product will be the writing of an actual systematic review, following the PRISMA and Cochrane guidelines.

This is a fully online course, delivered via the Canvas environment. The course is broken down into Modules based on the different stages of conducting a systematic review. These are roughly arranged into the different weeks of the course, but you will also be able to look one or two sections ahead throughout the course. This will offer you the opportunity to look and work a little ahead of schedule if desired. Each of the Modules holds several Learning Activities. No presence at UM is required, enabling students to simultaneously start with their placement independent of whether this will be at UM or external (e.g. abroad). However, weekly deadlines and some virtual meetings take place on Fridays.

Course objectives

Knowledge and understanding

After following this course, you are able to:

- describe and show understanding of what a systematic review is and how to conduct a systematic review;
- define and evaluate scientific research questions for systematic reviews;
- summarize observational, diagnostic or intervention studies within the field of human movement science;
- critically evaluate systematic reviews;
- describe methodological decisions which are necessary in conducting a systematic review.

Application of knowledge and understanding

You can:

- search, find, select and read critically and evaluate relevant literature and answer a research question;
- apply criteria of the quality of studies and the strength of the evidence that can be derived from the studies;
- provide conclusions about the evidence regarding observational, diagnostic or intervention studies.
- apply the findings from your systematic review to advice for research and practice.

Making judgements

You are able to:

- demonstrate that you can apply criteria for the quality of the studies and the strength of the evidence that can be derived from the studies;
- recognize gaps in the knowledge and describe topics that need further study based on the systematic review.

Communication

You are able to:

- write a systematic review in the field of human movement science;

- present the progress of your systematic review and the methodological choices you made to other students;
- provide clear and constructive feedback on the work of other students in oral and written form.

Learning skills

You can:

- search, find, select, read critically and evaluate relevant literature to define and answer a self-defined research question;
- develop a critical attitude towards the evidence of empirical studies in human movement science settings;
- respond adequately on oral and written peer feedback received from fellow student;
- apply the content of this module in given situations and in professional life.

Recommended reading

For conducting the systematic review, we recommend that you read the following references: - Higgins JPT, Green S (editors). Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from http://handbook-5-1.cochrane.org/. - Liberati, A., Altman, D.G., Tetzlaff, J., Mulrow, C., Gøtzsche, P.C., Ioannidis, J.P.A., Clarke, M.,Devereaux, P.J., Kleijnen, J., Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. British Medical Journal, 39, b2700 doi: 10.1136/bmj.b2700. - Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., for the PRISMA Group (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRIsMa statement. British Medical Journal, 339, b2535 doi: 10.1136/bmj.b2535. - Zaza, S., Wright-De Agu¨ero, L.K., Briss, P.A.,Truman, B.I. Hopkins, D.P., Hennessy, M.H., Sosin, D.M., Anderson, L. Carande-Kulis, V.G., S.M. Teutsch, Pappaioanou, M. (2000). Data Collection Instrument and Procedure for Systematic Reviews in the Guide to Community Preventive Services. American Journal of Preventive Medicine, 18, 1S, 44–74. - Egger, M., Smith, G. D., Altman, D. G. (2001). Systematic reviews in Health Care. Meta-analysis in context. BMJ books.

HMS4707
Period 4
1 Feb 2022
1 Apr 2022
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- C. McCrum

Teaching methods:
Assignment(s), Lecture(s), Paper(s)
Assessment methods:
Final paper, Participation
Keywords:

systematic review, literature search, PRISMA, PICOS
Fac. Health, Medicine and Life Sciences

Placement and Thesis

Full course description

During the second semester of the master's year students will perform a research project. The aim of this project is to provide students with experience in various aspects of scientific research. The students select a research project themselves. This project can be carried out at different departments within Maastricht University or Maastricht University Medical Centre, but also at other national or international universities, hospitals, or (research) institutes, or research-driven (sports or health) organisations. The opportunity to go abroad for the placement provides students with a great way of gaining international experience, broadening their academic as well as their 'life' perspectives, and (based on experiences from many previous students) helps them prepare for an international career. The experimental work for the placement is generally done on an individual basis (under supervision), but can also be accomplished in 'teams' of 2 or (occasionally) more students. However the final thesis, which will be the report of this study, will have to be an individual product. To allow proper and timely preparation for the research project, students will select a research topic and supervisor during the first period of the master year (september/november). To this end, various running projects that can place an intern will be advertised, but students can also look for other options themselves.

In close consultancy with their supervisor, students write and agree upon a specific research question, select adequate methods to perform the experiments and chose appropriate techniques for analysing the data, including statistical analyses. The thesis will have the layout of a scientific paper from a specific Journal. Specific guidelines for the research placement and thesis are available.

The placement and thesis period provides 24 ECTS (i.e., 16 full time weeks), which is divided over an 8 week start-up period in which a part-time course is also performed, followed by a 12 week full time period.

Course objectives

Students who have successfully finished this part of the master programme are able to:

- Derive hypotheses for a study from current knowledge
- Design and perform a research project
- Analyse and interpret results of an experiment
- Present results in an organized and structured way
- Discuss the data and relate results and conclusions to initial hypotheses
- Write a scientific paper

HMS4003
Year
1 Sep 2021
31 Aug 2022
Print course description
ECTS credits:
24.0

Master Human Movement Sciences

Instruction language:
English
Coordinators:

- L.B. Verdijk
- T. Snijders

Teaching methods:
Paper(s), Research
Assessment methods:
Final paper, Participation
Keywords:
placement, internship, Thesis, research

Specialisation Sports and Nutrition

Fac. Health, Medicine and Life Sciences

Nutrition to Fuel Sports Performance

Full course description

One of the main themes in exercise physiology and sports nutrition is the energy utilization of the body (mainly skeletal muscle) to sustain a certain type of physical activity. This course will focus on the energy systems involved in sport performance and how exogenous and endogenous energy sources can be used to modulate substrate utilization and performance. The course contains three cases in which it will be discussed how endogenous energy sources can limit performance, how exogenous energy sources can support performance, and whether high endogenous stores or exogenous energy provision may limit training adaptations. Topics that will be addressed are the energy systems, the role of carbohydrates in exercise performance and recovery, the role of fat in exercise performance, the role of energy intake and hydration, and how to measure substrate utilization during exercise.

Course objectives

Knowledge and comprehension

At the end of the course the student should understand:

- The endogenous energy systems and the limiting energy system in relation to different sports and training adaptation.
- How nutrition can impact substrate utilization.
- The use of carbohydrates before, during, and after exercise.
- How nutrition can be used to improve performance.
- Methodology commonly used in relation to substrate utilization and endurance type activities, including VO2max, indirect calorimetry, and (glucose) tracer methodology.

Applying knowledge and understanding

At the end of the course students should be capable of applying the above-mentioned knowledge:

- Conduct measurements of substrate utilization and process data.
- Translate scientific literature into practical recommendations.
- Apply academic skills like: critical reading, reviewing, and writing; argumentation.

Making judgements

At the end of the course the student should be capable of:

- Critically evaluate nutritional intervention programs to improve sports performance and judge the quality of measurements and instruments used.
- Summarize and critically review literature (critical reading).
- Identify opportunities to improve sports performance through optimal balance between training and nutrition, with a focus on nutrition as a fuel.

Communication

At the end of the course the student should be able to:

- Write scientific reports.
- Effectively and professionally communicate in project and tutorial groups.

Learning skills

At the end of the course the student should be capable of:

- Collaborate and discuss knowledge in a project team.
- Independently study international literature related to human movement performance and (sports) nutrition.
- Searching and referencing scientific literature.
- Review and comment on a scientific report written by a peer.

Recommended reading

Basic literature: - McArdle, exercise physiology, fifth edition, Chapter 1, 6, 7 and 18 - Guyton, textbook of medical physiology, chapter 67 and 68

HMS4601
Period 1
1 Sep 2021
22 Oct 2021
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- R.C.R. Meex

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations, Skills
Assessment methods:
Assignment, Attendance, Final paper, Participation, Written exam

Sports Supplements and Ergogenic Aids

Full course description

In the field of Sports and Nutrition, much attention is devoted to the potential of specific foods or substances to boost performance. While most academics and well-educated sport dieticians would agree that these substances should only be discussed when proper 'normal' nutrition is first optimized, they do represent an important topic within the field,both from a scientific and from a practical point of view. As an example, the finding that nitrate intake results in a reduction in the oxygen consumption during submaximal exercise has quickly elicited a widespread research effort into the potential ergogenic and health promoting effects of dietary nitrate supplementation. At the same time (long before evidence-based recommendations were available) a huge number of athletes started to adopt nitrate supplementation into their daily routine. Therefore, the central theme in this course is "supplements and nutraceuticals that have possible ergogenic effects". What is available, what is the evidence, what works, how and when, and –not trivial- what does not work? The course contains three cases which will discuss various supplements. During the practicals, various different performance measures will beintroduced and practiced, and within a project team, students will address the use of these measures in relation to a specific supplement of their choice. Topics that will be addressed include nitrate, creatine, carnitine, buffers (sodium bicarbonate), and ketones, but also vitamins, minerals, and anti-oxidants will be touched upon.

Course objectives

Knowledge and understanding

At the end of the course the students should have knowledge of:

- The proposed mechanism of action and ergogenic effectiveness of the most popular sport supplement, including carnitine, creatine, sodium bicarbonate, and nitrate. The pros and cons (including limitations) of physiological tests commonly used to assess functional performance in a sport-specific context. - - How to determine and interpret validity and (test-retest) reliability of such physiological tests.

Applying knowledge and understanding

At the end of the course, students should be capable of applying the above-mentioned knowledge:

- Conduct nutritional interventions and assess efficacy for sports performance enhancement.
- Provide evidence-based recommendations on the use of carnitine, creatine, sodium bicarbonate, and nitrate in relation to specific sport disciplines.

Making judgements

At the end of the course the student should be capable of:

- Critically evaluating nutritional intervention programs to improve sports performance and judge the quality of measurements and instruments used.
- Identifying opportunities to improve sports performance through sport supplements and ergogenic aids.

Communication

At the end of the course the student should be able to:

- Present a study plan to evaluate the efficacy of sport supplements.
- Write a science-based factsheet for laymen.
- Effectively and professionally communicate in project and tutorial groups

Learning skills

At the end of the course the student should be capable of:

- Critically evaluating the design of experiments/testing (research methods and design)
- Independently studying international literature related to human movement performance and sport supplements.

Recommended reading

Apart from focusing on finding literature through pubmed, these are exmples of relevant textbooks: • Jeukendrup A, Gleeson M. Sport Nutrition; an introduction to energy production and performance, 2nd ed. Human Kjnetics 2010. (Ch 10: Nutrition Supplements). • McArdle WD, Katch FI, Katch VL. Exercise Physiology; nutrition, energy and human performance. 8th ed. Wolters Kluwer-Lippincott Williams and Wilkins 2014. (e.g. Ch 23: Special aids to exercise training and performance). • Australian Institute of Sports. Physiological tests for Elite Athletes, 2nd ed. Human Kinetics, 2013

HMS4602
Period 1
1 Sep 2021
22 Oct 2021
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- L.J.C. van Loon

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations, Research, Skills
Assessment methods:
Assignment, Attendance, Participation, Presentation, Written exam
Keywords:
sport supplements, ergogenic, performance enhancement
Fac. Health, Medicine and Life Sciences

Nutrition to Support Training Adaptation

Full course description

For athletes to become world-class in their sport, there needs to be an optimal balance between

talent, commitment and devotion, and training. Indeed, exercise physiologists and nutritionists alike would agree that the physiological, structural and functional adaptation to (specific) training represents the key factor in the development of a gifted junior athlete toward an adult elite champion. However, in allowing the body to optimally adapt to a specific training regimen, proper nutrition is also essential. As such, this course is centered on training adaptation and how nutrition can support and enhance training adaptation. The course contains three cases in which it will be discussed how the body (with skeletal muscle as main tissue) adapts to different sports/training programs and how nutrition is more than just a performance fuel; i.e., how can nutrition be used to augment the adaptive response to exercise training, with a focus on protein nutrition. Thus, the course builds on the knowledge gained in course HMS4601. Topics that will be addressed in this course are muscle mass, structure and function, basic principles of training, nutrition to augment the adaptive training response, and nutrition during weight loss and injuries. Furthermore, different recovery strategies will be discussed and a practical experiment on cooling strategies will be performed.

Course objectives

Knowledge&understanding

- The basic principles of training, and the adaptive response to training.
- How nutrition can modulate the adaptive response to training.
- The use of protein in training adaptations.
- The role of post-exercise recovery in training adaptations.
- Methodological/statistical methods commonly used in relation to assessing training adaptations and the effects of nutrition on exercise adaptation, including (amino acid) tracer methodology, muscle tissue analyses, data processing , and repeated measures analyses.

Applying knowledge&understanding

- Design and interpret acute and long-term studies that assess training adaptation, as well as nutritional means to augment training adaptation.
- Design and conduct studies to evaluate the effect of recovery strategies.
- Apply academic skills like: formulating a hypothesis, writing.
- Interpret the pros and cons of data processing steps to reduce data load (e.g. selection of time points, nr of subsequent measures needed, etc).

Making judgements

- Critically evaluate training programs and judge the applicability (pros/cons, limitations) of measurements and instruments used.
- Critically evaluate nutritional interventions and their effectiveness to augment training adaptations.
- Critically evaluate recovery strategies and their effectiveness to augment training adaptations.
- Identify opportunities to improve sports performance through an optimal balance between training and nutrition, with a focus on nutrition to support and/or augment training adaptations.

Communication

- Write scientific reports and give scientific presentations.
- Effectively and professionally communicate in project and tutorial groups.

Learning skills

- Independently study international literature related to human movement performance, training adaptations, and (sports) nutrition

Recommended reading

Apart from focusing on finding literature through pubmed, these are exmples of relevant textbooks: • Jeukendrup A, Gleeson M. Sport Nutrition; an introduction to energy production and performance, 2nd ed. Human Kinetics 2010. (Ch 7: Protein and amino acids and Ch 11: Weight management). • McArdle WD, Katch FI, Katch VL. Exercise Physiology; nutrition, energy and human performance. 8th ed. Wolters Kluwer-Lippincott Williams and Wilkins 2014. (Ch 18, 21,22, 29).

HMS4603
Period 2
25 Oct 2021
17 Dec 2021
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- T. Snijders

Teaching methods:
Lecture(s), Work in subgroups, Paper(s), PBL, Skills, Training(s), Presentations, Assignment(s)
Assessment methods:
Attendance, Participation, Presentation, Written exam, Final paper
Keywords:
Exercise Training, resistance, endurance, protein metabolism, recovery
Fac. Health, Medicine and Life Sciences

Sports and Nutrition: Putting Science into Practice

Full course description

The central theme in this course is the translation from sport & nutrition research into practical guidelines for athletes. The purpose of this topic is to translate the knowledge gained in the other courses into practical guidelines tailored for the athlete. The course contains three cases in which a nutritional plan will be designed for athletes from different sports, taking into account their training practices. But the course also evolves around individualization or personalized nutrition depending on factors that go beyond the specific sport discipline, i.e., gender, ethnic background, culture, etc. Topics that will be addressed are popular diets, how dietary needs differ between persons, sports, and training phases, dietary assessment and how to communicate with athletes and be part of a larger coaching team.

Course objectives

At the end of this course, students have gained knowledge and understanding of the following topics:

- nutritional needs of athletes and how these differ per sport and per individual athlete. The
- How to determine the nutritional intake of athletes.
- How to make a food plan for athletes both for short and long term.
- Design and conduct customized nutritional plans for athletes from different sports and evaluate their applicability.
- Apply scientific knowledge in a practical sports environment.
- Synthesize and critically judge literature and translate to practical recommendations.
- Identify opportunities to improve sports performance through exercise and nutrition and translate to practical sports environments and/or individual athletes.
- Discuss and communicate with coaches and athletes.
- Write academic essays.
- Independently study international literature related to human movement performance and (sports) nutrition and translate scientific findings to practical recommendations.

Recommended reading

• Burke L. Practical Sports Nutrition. Human Kinetics, 2007. • Jeukendrup A. A Step Towards Personalized Sports Nutrition: Carbohydrate Intake During Exercise. Sports Med. 2014; 44(Suppl 1): 25–33. • Crighton B, Close GL, Morton JP. Alarming weight cutting behaviours in mixed martial arts: a cause for concern and a call for action. Br J Sports Med. 2016 Apr;50(8):446-7. • Wardenaar FC, Steennis J, Ceelen IJ, Mensink M, Witkamp R, de Vries JH. Validation of web-based, multiple 24-h recalls combined with nutritional supplement intake questionnaires against nitrogen excretions to determine protein intake in Dutch elite athletes. Br J Nutr. 2015 Dec 28;114(12):2083-92. • Maughan RJ, Burke LM. Practical nutritional recommendations for the athlete. Nestle Nutr Inst Workshop Ser. 2011;69:131-49.

HMS4604
Period 2
25 Oct 2021
17 Dec 2021
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- J. Trommelen

Teaching methods:
Lecture(s), Work in subgroups, Paper(s), PBL, Working visit(s)
Assessment methods:
Assignment
Keywords:
- practice - coaching - personalised nutrition - nutrition intake
Fac. Health, Medicine and Life Sciences

Designing Intervention Research

Full course description

The important aspects of physical activity as a means to promote mental and physical well-being have been well described in the Bachelor “Movement Sciences”. In our Western society the development of chronic metabolic diseases, like obesity and type 2 diabetes, is reaching epidemic proportions. Though part of this epidemic can be ascribed to the aging of the population, an alarming increase in the incidence of chronic metabolic disorders (particularly type 2 diabetes) has been reported among children and adolescents. The current epidemic is clearly associated with our sedentary lifestyle combined with an excessive energy intake. Therefore, combined exercise and nutritional interventions need to be designed on a scientific basis to improve health and/or functional performance. For such intervention programs to be effective it is essential to set well-defined goals specific for each target population. In this course we will integrate the different aspects of exercise and nutritional interventions to define the most effective interventions to improve health and/or (sports)performance in various populations. The permissive role of nutritional intervention to allow biological adaptation and improved functional capacity to an exercise stimulus will be addressed from the athletes’ perspective towards the clinical patient. Students will write a research grant application in which they will describe a self-designed (exercise and/or nutritional) intervention in an appropriate study population. Such an intervention can be both acute (i.e. studying mechanisms and/or potential strategies for more long-term application), short-term, or long-term (i.e. studying both mechanisms and actual outcome). The research hypotheses set in these grant applications are to be integrated in the field of sport and exercise sciences, rehabilitation, chronic metabolic disorders (diabetes, obesity, CVD, but also cancer, COPD, RA, etc) and/or general health promotion (including healthy aging, prevention, etc).

Course objectives

Students who have successfully finished this course will be able to:

1. design effective physical activity and/or nutritional interventions on a scientific basis
2. integrate the knowledge concerning the functional and/or biological adaptation to exercise and nutrition
3. select the most appropriate intervention for the desired effect: from athlete to patient
4. select the appropriate research proposal to test the efficacy of specific nutrition and/or research to large scale population studies in vivo exercise interventions: from invasive
5. define the relevant outcome parameters
6. write, present and defend a research grant proposal within this field of research

Recommended reading

- Guyton & Hall: Textbook of medical physiology. 10th ed. Saunders co. 2000, ISBN 0-8089-2187-8 - Maughan, Gleeson & Greenhaff; Biochemistry of exercise and training; Oxford university press, ISBN 0-19 262741-4 - McArdle WD, Katch FI, Katch VL: Exercise physiology, 5th ed. Lippincott Williams & Wilkins, 2001, ISBN 0-7817-2544-5 - McGinnis, P.M. Biomechanics of sport and exercise. Champaign, Ill, Human Kinetic Publishers, 1999 - Wasserman K. Principles of exercise testing and interpretation. Philadelphia: Lea & Febiger, 1994 - Passmore R, Eastwood MA. Davidson and Passmore, human nutrition and dietitics. Edinburgh: Churchill Livingstone, 1986 - Ellenberg M, Rifkin H and Porte D. Ellenberg & Rifkin’s diabetes mellitus, 5th edition, Stamford: Appleton

&Lange, 1997. - Shils ME, Young VR, Olson JA, Shike M. Modern nutrition in health and disease. Philadelphia: Lea and Febiger, 1994. - Ziegler EE, Flier LJ (eds). Present knowledge in nutrition. Washington: ILSI press/International Life Sciences Institute, 1996.

HMS4001
Period 3
3 Jan 2022
28 Jan 2022
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- T. Snijders

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations
Assessment methods:
Assignment, Attendance, Final paper, Participation, Presentation
Keywords:
Intervention research Exercise intervention Methodology Presentation Research proposal
Fac. Health, Medicine and Life Sciences

Reviews

Full course description

The aim of this course is for you to formulate a sound research question regarding a topic in human movement science and to find, select, read and evaluate scientific literature critically. You will also learn how to acquire skills in reporting on the results of this process and in providing and receiving peer feedback. The final end product will be the writing of an actual systematic review, following the PRISMA and Cochrane guidelines.

This is a fully online course, delivered via the Canvas environment. The course is broken down into Modules based on the different stages of conducting a systematic review. These are roughly arranged into the different weeks of the course, but you will also be able to look one or two sections ahead throughout the course. This will offer you the opportunity to look and work a little ahead of schedule if desired. Each of the Modules holds several Learning Activities. No presence at UM is required, enabling students to simultaneously start with their placement independent of whether this will be at UM or external (e.g. abroad). However, weekly deadlines and some virtual meetings take place on Fridays.

Course objectives

Knowledge and understanding

After following this course, you are able to:

- describe and show understanding of what a systematic review is and how to conduct a

systematic review;
- define and evaluate scientific research questions for systematic reviews;
- summarize observational, diagnostic or intervention studies within the field of human movement science;
- critically evaluate systematic reviews;
- describe methodological decisions which are necessary in conducting a systematic review.

Application of knowledge and understanding

You can:

- search, find, select and read critically and evaluate relevant literature and answer a research question;
- apply criteria of the quality of studies and the strength of the evidence that can be derived from the studies;
- provide conclusions about the evidence regarding observational, diagnostic or intervention studies.
- apply the findings from your systematic review to advice for research and practice.

Making judgements

You are able to:

- demonstrate that you can apply criteria for the quality of the studies and the strength of the evidence that can be derived from the studies;
- recognize gaps in the knowledge and describe topics that need further study based on the systematic review.

Communication

You are able to:

- write a systematic review in the field of human movement science;
- present the progress of your systematic review and the methodological choices you made to other students;
- provide clear and constructive feedback on the work of other students in oral and written form.

Learning skills

You can:

- search, find, select, read critically and evaluate relevant literature to define and answer a self-defined research question;
- develop a critical attitude towards the evidence of empirical studies in human movement science settings;
- respond adequately on oral and written peer feedback received from fellow student;
- apply the content of this module in given situations and in professional life.

Recommended reading

For conducting the systematic review, we recommend that you read the following references: -

Higgins JPT, Green S (editors). Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from http://handbook-5-1.cochrane.org/. - Liberati, A., Altman, D.G., Tetzlaff, J., Mulrow, C., Gøtzsche, P.C., Ioannidis, J.P.A., Clarke, M.,Devereaux, P.J., Kleijnen, J., Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. British Medical Journal, 39, b2700 doi: 10.1136/bmj.b2700. - Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., for the PRISMA Group (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRIsMa statement. British Medical Journal, 339, b2535 doi: 10.1136/bmj.b2535. - Zaza, S., Wright-De Agu¨ero, L.K., Briss, P.A.,Truman, B.I. Hopkins, D.P., Hennessy, M.H., Sosin, D.M., Anderson, L. Carande-Kulis, V.G., S.M. Teutsch, Pappaioanou, M. (2000). Data Collection Instrument and Procedure for Systematic Reviews in the Guide to Community Preventive Services. American Journal of Preventive Medicine, 18, 1S, 44–74. - Egger, M., Smith, G. D., Altman, D. G. (2001). Systematic reviews in Health Care. Meta-analysis in context. BMJ books.

HMS4707
Period 4
1 Feb 2022
1 Apr 2022
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- C. McCrum

Teaching methods:
Assignment(s), Lecture(s), Paper(s)
Assessment methods:
Final paper, Participation
Keywords:
systematic review, literature search, PRISMA, PICOS
Fac. Health, Medicine and Life Sciences

Placement and Thesis

Full course description

During the second semester of the master’s year students will perform a research project. The aim of this project is to provide students with experience in various aspects of scientific research. The students select a research project themselves. This project can be carried out at different departments within Maastricht University or Maastricht University Medical Centre, but also at other national or international universities, hospitals, or (research) institutes, or research-driven (sports or health) organisations. The opportunity to go abroad for the placement provides students with a great way of gaining international experience, broadening their academic as well as their ‘life’ perspectives, and (based on experiences from many previous students) helps them prepare for an international career. The experimental work for the placement is generally done on an individual basis (under supervision), but can also be accomplished in ‘teams’ of 2 or (occasionally) more students. However the final thesis, which will be the report of this study, will have to be an

individual product. To allow proper and timely preparation for the research project, students will select a research topic and supervisor during the first period of the master year (september/november). To this end, various running projects that can place an intern will be advertised, but students can also look for other options themselves.

In close consultancy with their supervisor, students write and agree upon a specific research question, select adequate methods to perform the experiments and chose appropriate techniques for analysing the data, including statistical analyses. The thesis will have the layout of a scientific paper from a specific Journal. Specific guidelines for the research placement and thesis are available.

The placement and thesis period provides 24 ECTS (i.e., 16 full time weeks), which is divided over an 8 week start-up period in which a part-time course is also performed, followed by a 12 week full time period.

Course objectives

Students who have successfully finished this part of the master programme are able to:

- Derive hypotheses for a study from current knowledge
- Design and perform a research project
- Analyse and interpret results of an experiment
- Present results in an organized and structured way
- Discuss the data and relate results and conclusions to initial hypotheses
- Write a scientific paper

HMS4003
Year
1 Sep 2021
31 Aug 2022
Print course description
ECTS credits:
24.0
Instruction language:
English
Coordinators:

- L.B. Verdijk
- T. Snijders

Teaching methods:
Paper(s), Research
Assessment methods:
Final paper, Participation
Keywords:
placement, internship, Thesis, research

Specialisation Physiotherapy

Fac. Health, Medicine and Life Sciences

Growth and Ageing from a Systems Biology Perspective

Full course description

At first glance, growth and aging appear to be opposites. Growth is the energy-driven synthesis of macromolecules from simple nutrients, an increase of order and a decrease of entropy. Aging is decay, a loss of order and a rise of entropy. Seemingly, growth and aging are mutually exclusive. Forever proliferating cells, such as legendary hydras, do not show signs of aging. In contrast, when an organism ceases to grow, aging follows. However, manipulations that decrease growth also decrease aging and prolong life span." (Blaglosklonny and Hall, 2009).

To probe the complexity of the growth and aging process, a combination of approaches will be sought to understand how aging is caused via

i studying the intracellular mechanisms that play a role in growth and aging and age-related damage

ii studying how the accumulated damage in cells (which may vary considerably between individual cells) gives rise to age-related decline in tissue function.

Systems biology is focused on developing biological, technical and computational tools to interpret the complexity of (age-related) disorders, pathologies and health states to enable diagnosis, therapy and prevention for the individual patient. P4 medicine (predictive, preventive, personalized and participatory) employs the strategies and tools of systems biology for quantifying wellness and deciphering disorders. The systems biology approach uses data that ranges from molecular and cellular data, conventional medical data, demographic and environmental data, and imaging.

In this course, growth of humans as well as aging and degeneration of the human body will be studied making use of cases with different (stages of) disorders and comorbidities, illustrating the complexity of an evolving organism. This course will focus particularly on muscle-, bone- and cartilage-related growth, aging and disorders using short, interactive lectures.

Course objectives

At the end of this course, students have gained knowledge and understanding of the following topics:

Knowledge and understanding

The student:

- has knowledge of and insight in the normal growth and aging mechanisms of the muscles, bone and cartilage
- is able to identify the main characteristics of complex health-related disorders linked to the aging process
- can use a systems biology approach to identify relationships between growth and aging-related disorders on the one hand, and possible consequences of such disorders at the level of activity and participation (restrictions) on the other hand

Applying knowledge and understanding

The student is able to:

- apply the systems biology approach to interpret health-related problems that arise from growth and aging disorders with regard to muscles, bone and cartilage function and development
- apply the knowledge of muscle, bone and cartilage physiology to explain the consequences of growth and ageing disorders on functioning in all age categories
- integrate the measurement findings of the Biodex system in the physiotherapeutic clinical reasoning process

Making judgments

The student is able to:

- differentiate between normal and abnormal prognosis in growth and aging-related disorders with regard to muscle, bone and cartilage function and development
- interpret the results from the four practicals, such as analyze and evaluate the effects of post-exercise cooling on muscle strength using the Biodex system

Communication

The student is able to:

- communicate with experts and non-experts, verbally and by means of written reports, on normal and abnormal prognosis in growth and aging-related disorders with regard to muscle, bone and cartilage function and development
- write a well-structured, concise and well-argumented practical report on the findings from the four practicals

Recommended reading

All literature and references to other sources will be available from a reference list

HMS4801
Period 1
1 Sep 2021
22 Oct 2021
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- M.M.J. Caron

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, PBL, Presentations, Training(s)
Assessment methods:
Assignment, Attendance, Written exam
Keywords:
Physiology of growth and aging, sarcopenia, Physical Inactivity, nutrition, homeostasis, muscle and bone, developmental disorders, osteoarthritis

The Entrepreneurial Healthcare Professional

Full course description

In the Western countries there is growing awareness that the aging of the population, and the accompanying growth in needs for care, puts serious pressure on the current healthcare system and increases the complexity of care delivery. Meanwhile, the application of digital technology in all the realms of healthcare, continues relentlessly. The increasing need for health services, the growing complexity and the necessity of cost containment offer exciting opportunities for entrepreneurial professionals.

Entrepreneurship in healthcare entails that healthcare professionals are capable of discovering and taking opportunities to create value (=providing a product/service that a customer needs/wants) for patients. Entrepreneurship usually includes the actual creation of value by developing a product or service, by designing a value creation strategy, and by creating an (inter)organisational entity that provides the product or service to the customer. This course draws the boundary at outlining products or services for patients, strategies and (inter)organisational arrangements.

This course introduces students to value creation and the features of healthcare systems, (inter)organisational arrangements and strategies for value creation. These features are considered from one perspective: Which opportunities for value creation do these features provide for the student as a future entrepreneurial professional in healthcare and which threats should this future professional deal with? What are the advantages and disadvantages of (inter)organisational arrangements and strategies for value creation?

During the course, students will make individual assignments about several of the aforementioned topics. As a member of a study team, they will also work on project assignments and on a group paper about these assignments. The knowledge from a number of individual assignments will serve as input for the project assignments. The students will write an individual essay based on a number of individual assignments and the project assignments.

Course objectives

Knowledge and insights

The student has knowledge of:

- The characteristics of healthcare systems.
- The positions/functions of healthcare professionals in the healthcare system.
- Theories about entrepreneurial professionals, value creation, (inter)organisational arrangements and strategies for value creation.
- The competencies and other personal characteristics of entrepreneurial professionals.

Application of knowledge and insights

The student is able to:

- Explain how opportunities, threats, strengths and weaknesses for value creation can be discovered by entrepreneurial healthcare professionals and how they can take advantage of

their discoveries.
- Use the gained knowledge to outline products or services for patients, strategies and (inter)organisational arrangements for value creation.

Forming opinions

The student:

- Has a scientific – positive and critical – attitude.
- Is able to critically assess the validity and utility of the gained knowledge.

Communication

The student:

- Can express the knowledge and insights offered in this course in writing and orally.
- Can communicate effectively about the gained knowledge and the results of the assignments.

Skills

The student has the skills to use the newly acquired knowledge:

- To identify the opportunities, threats, strengths and weaknesses for value creation by entrepreneurial healthcare professionals.
- To develop a well-argued advice for value creation for patients.

The student has the skills:

- To work in a study team and to contribute to effective teamwork, while also taking responsibility for one's own actions and learning.

Recommended reading

The course uses chapters from the following handbook: Wilden R., Garbuio M., Angeli F., Mascia D. (2018), Healthcare Entrepreneurship. Routledge, New York, NY/ Abingdon, Oxon. In addition, for the assignments the students should use the literature from the repositories. The literature is one of three knowledge repositories to be used by the students and the teams.

HMS4802
Period 1
1 Sep 2021
22 Oct 2021
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- A.J.A. van Raak

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations, Training(s)

Master Human Movement Sciences

Assessment methods:
Attendance, Final paper, Written exam
Keywords:
Entrepreneurial healthcare professional Healthcare systems Value creation (Inter)organisational arrangements Strategies
Fac. Health, Medicine and Life Sciences

Analysis and Restoration of Human Locomotion

Full course description

The aim of this course is to educate students on the basics of 3D motion analysis and its clinical applications for the analysis and restoration of human locomotion. From a clinical perspective walking ability has been identified as a vital sign for health. The course uses a combination of classic PBL for knowledge and understanding of the principles and project education in the form of a clinical case to understand the potential application s of the field. These are supported by lectures on the basic concepts and practicals to acquire skills in the methods and approaches of the field. The focus of the course will be on human locomotion. The students will work with real anonymized patient data to solve their clinical question and they will report their findings to a multi-disciplinary team of experts. They will also gain experience in novel approaches for clinical motion analysis and treatment.

Course objectives

Knowledge and understanding

- Biomechanical principles of human locomotion: kinematics, kinetics, muscle function
- Current concepts in gait restoration: Virtual Reality training, Assistive devices/Exoskeletons, Rehabilitation robotics & Prosthetics
- Basics of signal processing in 3D Motion Capture; filtering, differentiation/integration
- Statistical approaches to analyse complex biomechanical data
- Basic research skills; e.g. formulating hypothesis

Applying knowledge and understanding

- Choosing and adapting the appropriate technique to measure relevant aspects of human locomotion
- Performing post-processing of motion analysis data •Report gait data in a comprehensive manner
- Develop a testable hypothesis

Making judgements

- Interpret the results of a gait analysis trial to assess functional deficits
- Advice (clinical) experts on results of the analysis

Communication

- Write a scientifically sound report for a clinical case
- Orally present and communicate to/with (clinical) experts

Learning skills

- Critically analyse and report gait data
- Critically review research studies and the methodology applied

Recommended reading

R. Baker Gait analysis methods in rehabilitation Journal of NeuroEngineering and Rehabilitation 2006, 3:4 doi:10.1186/1743-0003-3-4• J.R. Gage et al The identification and treatment of gait problems in cerebral palsy 2009 Mac Keith Press Kuo AD. The six determinants of gait and the inverted pendulum analogy: A dynamic walking perspective. Hum Mov Sci.2007 Aug;26(4):617-56.• Kuo AD, Donelan JM. Dynamic principles of gait and their clinical implications. Phys Ther. 2010 Feb;90(2):157-74. doi: 10.2522/ptj.20090125.

HMS4503
Period 2
25 Oct 2021
17 Dec 2021
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- K. Meijer

Teaching methods:
Lecture(s), Work in subgroups, Paper(s), PBL, Presentation(s), Research, Skills
Assessment methods:
Final paper, Presentation, Written exam
Keywords:
3D motion analysis, Movement disorders
Fac. Health, Medicine and Life Sciences

Pharmacology for Physiotherapists

Full course description

This pharmacology course for physiotherapists aims at enabling students to gain knowledge on drug use and molecular drug actions that are necessary for optimal consultation and treatment of patients taking (self)-medication to cure, alleviate, or prevent complaints related to their medical problem. The course will focus on (self)- medications that are most-frequently observed in physiotherapy practice and may have important consequences for diagnosis and treatment by the physiotherapist. Special attention is paid to problems reported by elderly persons.Currently the Netherlands has 3 million inhabitants above the age of 65. About 1/3 of this group presents with multi-morbidity and is treated with 5 drugs or more. Due to increasing numbers of elderly patients, polypharmacy is rising. Consequently the risk of adverse drug-drug interactions and negative effects on the well-being of the ageing population increases too. The physiotherapist might be treating patients from this group to alleviate various pulmonary, musculo-skeletal or cardio-metabolic problems or might be giving advice to prevent such problems. In these settings it is mandatory to understand how drug-actions

can interfere with the intended treatment outcomes.At the end of the course, the student should have the following competences in the following domains (see learning goals).

Course objectives

Knowledge and understanding of:

1. Basic pharmacological principles related to pharmacodynamics (what does the drug do to the body) and pharmacokinetics (what does the body do to the drug).
2. The actions of major drug classes prescribed by medical professionals to patients who visit the physiotherapist.
3. The actions or consequences of nutritional ingredients, self-medication or over the counter medicines that are frequently taken by patients who visit the physiotherapist.
4. Drug-drug or drug-food interactions with major consequences

Applying knowledge and understandingThe student is able to:

1. Recognize and interpret physical symptoms or behaviour of patients that can be a consequence of drug actions (both negative and positive)
2. Reason how (self)medication may positively or negative influence treatment interventions installed by the physiotherapist
3. Make optimal use of digital sources or databases that are set up to provide professionals as well as patients with relevant information on drug actions and drug interactions.

Making judgmentsThe student is able to:

1. Identify serious (side)-effects of drug treatment that need direct and additional consultation by a medical professional (‘red flags’)
2. Critically assess the validity and utility of drug information that is presented by patients, medical doctors, industry or public sources.

CommunicationThe student is able to:

1. Inform patients on how (self)medication may positively or negative influence treatment interventions provided by the physiotherapist
2. Adequately inform medical specialists on potential ‘red flags’ related to (self)medication

Learning skills The student has the skills to:

1. Keep up with new developments in pharmacotherapy related to physiotherapeutic problems
2. Engage in multidisciplinary discussions on (drug) treatment optimisation

HMS4803
Period 2
25 Oct 2021
17 Dec 2021
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

Master Human Movement Sciences

- B.J.A. Janssen

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), Presentations
Assessment methods:
Assignment, Final paper, Participation, Presentation, Written exam
Fac. Health, Medicine and Life Sciences

Designing Intervention Research

Full course description

The important aspects of physical activity as a means to promote mental and physical well-being have been well described in the Bachelor “Movement Sciences”. In our Western society the development of chronic metabolic diseases, like obesity and type 2 diabetes, is reaching epidemic proportions. Though part of this epidemic can be ascribed to the aging of the population, an alarming increase in the incidence of chronic metabolic disorders (particularly type 2 diabetes) has been reported among children and adolescents. The current epidemic is clearly associated with our sedentary lifestyle combined with an excessive energy intake. Therefore, combined exercise and nutritional interventions need to be designed on a scientific basis to improve health and/or functional performance. For such intervention programs to be effective it is essential to set well-defined goals specific for each target population. In this course we will integrate the different aspects of exercise and nutritional interventions to define the most effective interventions to improve health and/or (sports)performance in various populations. The permissive role of nutritional intervention to allow biological adaptation and improved functional capacity to an exercise stimulus will be addressed from the athletes’ perspective towards the clinical patient. Students will write a research grant application in which they will describe a self-designed (exercise and/or nutritional) intervention in an appropriate study population. Such an intervention can be both acute (i.e. studying mechanisms and/or potential strategies for more long-term application), short-term, or long-term (i.e. studying both mechanisms and actual outcome). The research hypotheses set in these grant applications are to be integrated in the field of sport and exercise sciences, rehabilitation, chronic metabolic disorders (diabetes, obesity, CVD, but also cancer, COPD, RA, etc) and/or general health promotion (including healthy aging, prevention, etc).

Course objectives

Students who have successfully finished this course will be able to:

1. design effective physical activity and/or nutritional interventions on a scientific basis
2. integrate the knowledge concerning the functional and/or biological adaptation to exercise and nutrition
3. select the most appropriate intervention for the desired effect: from athlete to patient
4. select the appropriate research proposal to test the efficacy of specific nutrition and/or research to large scale population studies in vivo exercise interventions: from invasive
5. define the relevant outcome parameters
6. write, present and defend a research grant proposal within this field of research

Recommended reading

- Guyton & Hall: Textbook of medical physiology. 10th ed. Saunders co. 2000, ISBN 0-8089-2187-8 - Maughan, Gleeson & Greenhaff; Biochemistry of exercise and training; Oxford university press, ISBN 0-19 262741-4 - McArdle WD, Katch FI, Katch VL: Exercise physiology, 5th ed. Lippincott Williams & Wilkins, 2001, ISBN 0-7817-2544-5 - McGinnis, P.M. Biomechanics of sport and exercise. Champaign, Ill, Human Kinetic Publishers, 1999 - Wasserman K. Principles of exercise testing and interpretation. Philadelphia: Lea & Febiger, 1994 - Passmore R, Eastwood MA. Davidson and Passmore, human nutrition and dietitics. Edinburgh: Churchill Livingstone, 1986 - Ellenberg M, Rifkin H and Porte D. Ellenberg & Rifkin's diabetes mellitus, 5th edition, Stamford: Appleton &Lange, 1997. - Shils ME, Young VR, Olson JA, Shike M. Modern nutrition in health and disease. Philadelphia: Lea and Febiger, 1994. - Ziegler EE, Flier LJ (eds). Present knowledge in nutrition. Washington: ILSI press/International Life Sciences Institute, 1996.

HMS4001
Period 3
3 Jan 2022
28 Jan 2022
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- T. Snijders

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations
Assessment methods:
Assignment, Attendance, Final paper, Participation, Presentation
Keywords:
Intervention research Exercise intervention Methodology Presentation Research proposal
Fac. Health, Medicine and Life Sciences

Clinical Placement

Full course description

In the third clinical rotations period of 8 weeks (two 10 weeks periods have been already fulfilled in the bachelor curriculum) students will be placed in more complex environments in which physiotherapeutic health care is delivered e.g., the rehabilitation center, the hospital setting, a stroke center.
Students are also permitted to take this clinical rotations period abroad, or combine it with their master thesis, in which case a 20 weeks part-time internship is possible.
A clinical rotations coordinator will assign students to and monitor their progress at the various institutions.
The clinical rotation period is structured in the same way as in the bachelor and builds a student portfolio

Course objectives

- Acts and thinks with a strong awareness of the concept of a physiotherapy professional at a basic academic and clinical level
- Is conversant with the terms and theories and key concepts of the underlying basic disciplines and is able to communicate this to other stakeholders
- Is conversant with current health care and practice problems, questions and challenges in the field of physiotherapy (profession), and is able to interpret and explain and act on these problems in both theoretical -academic as well as in clinical or professional setting with awareness of responsibility to society
- Has organizing clinical thinking, and reasoning skills at the Bachelors/ level demonstrable in well described training situations and supervised situations during clinical rotations
- Is able to demonstrate integrated academic competencies (science in practice) and clinical competencies including critical appraisal and EBP at a bachelor of science level
- Has broad knowledge and skills in the physiotherapy sciences and is able to comply with current and future clinical guidelines and professional standards at bachelor of science level and communicate this to stakeholders towards own functioning as well as to society H. Has developed a lifelong learning, organizing and critical thinking attitude and skills and acts accordingly with respect and responsibility
- Is able to adequately communicate in both written and spoken language to specified target groups (share knowledge, collaboration with other professionals, researchers, companies) and use this communication in collaboration with other stakeholders

HMS4804
Period 4
1 Feb 2022
1 Apr 2022
Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinator:

- R.A. de Bie

Teaching methods:
Patient contact, Training(s)
Assessment methods:
Observation, Portfolio
Keywords:
Clinical rotation, Portfolio
Fac. Health, Medicine and Life Sciences

Placement and Thesis

Full course description

The aim of the thesis project is to provide students with experience in subsequent aspects of scientific research. The students select a research project themselves. This project can be carried out at departments in the university or university hospital, but also at other national or international

universities or (research) institutes, or research-driven (sports or healthcare) organisations. The opportunity to go abroad for their placement provides students with a great way of gaining international experience, broadening their academic as well as their 'life' perspectives, and (based on experiences from many previous students) helps them prepare for an international career. For the specialty physiotherapy a combination with their clinical rotation is possible – especially when they want to go abroad, since this gives them the opportunity to work for 20 weeks (30 ECTs) in one place.

The experimental work for the placement is generally done on an individual basis (under supervision), but can also be accomplished in 'teams' of maximum 2 students; however the final thesis, which will be the report of this study, will have to be an individual product. To allow proper and timely preparation for the research project, students will select a research topic and supervisor during the first period of the master year.

In close consultancy with their supervisor, students write and agree upon a research proposal, select adequate methods to perform the experiments and chose appropriate techniques for analysing the data, including statistical analyses. The thesis will have the layout of a scientific paper from a specific Journal (to be determined with the supervisor).

Specific guidelines for the research and thesis placement are also found in the separate document "Information on placement and guidelines for thesis" that accounts for all Health Master programs.

Course objectives

Students who have successfully finished this part of the master program are able to:

- Derive hypotheses for a study from current knowledge
- Design and perform a research project
- Analyse and interpret results of an experiment
- Present results in an organized and structured way
- Discuss the data and relate results and conclusions to initial hypotheses
- Write a scientific paper

HMS4805
Year
1 Sep 2021
31 Aug 2022
Print course description
ECTS credits:
18.0
Instruction language:
English
Coordinator:

- R.A. de Bie

Teaching methods:
Paper(s), Research
Assessment methods:
Observation
Keywords:
Master thesis