Research Methodology in Musculoskeletal Physiotherapy I

Course coordinators: Prof. dr. Michel W. Coppieters; dr. Marco J.M. Hoozemans

Period: 1 (September – October)

Tuition forms:
- Lectures
- Computer labs

Assessment type:
- Theory examination (65%)
- Practical examination (35%)

Credits: 6 EC

Literature:
- Selected scientific papers and book chapters (see blackboard)
- Fletcher (2014) Clinical epidemiology (5th edition)

Content:
Research in physiotherapy has evolved considerably over the last two decades. New insights in the pathobiology and psychology of patients seeking physiotherapy management, and technical advances in medical research, have led to many new research avenues. Research methodology is presented in two separate courses: Research Methodology in Musculoskeletal Physiotherapy Part 1 (Sept-Oct) and Research Methodology in Musculoskeletal Physiotherapy Part 2 (Nov-Dec). The content of the two courses is complementary; the format and aims are comparable.

Research Methodology in Musculoskeletal Physiotherapy Part 1 provides an overview of research methods and evidence-based musculoskeletal physiotherapy. Topics that are discussed are: revision of basic statistics, descriptive and analytic epidemiology, regression analysis (including multiple and logistic regression), research designs, qualitative research, prognostic research (including survival analysis and clinical prediction rules) and diagnostic research (including clinimetrics (reliability and validity)). The critical appraisal of the quality of studies in these domains is also covered. Practical sessions (computer labs) are organised for students to learn how to apply the statistical methods using statistical software packages (SPSS).

Aims of the course (with relation to end qualifications between brackets)
- To gain knowledge and understanding of research methods commonly used in musculoskeletal physiotherapy (epidemiology, regression analysis, research designs, qualitative research, prognostic research and diagnostic research) (1, 2)
- To be able to apply knowledge to formulate new research questions, to select appropriate research designs, to correctly select and perform statistical procedures using SPSS software, to interpret the output properly and to communicate the methods and findings correctly (4, 5, 10, 11, 14, 18)
- To be able to use appropriate knowledge and tools to critically appraise the quality of scientific research in musculoskeletal physiotherapy and related fields. (9, 18)
- To reach a level of understanding of clinical epidemiology, experimental research and statistics that enables participation in the debate about strengths and limitations of specific research designs and statistical procedures. (12, 13, 15)
Assessment information:
Learning outcomes are assessed via a theoretical and practical examination. Both examinations are conducted at the end of the teaching period. The theory examination (65% of total score) consists of short answer questions. In the practical examination (35% of total score), students are requested to analyse a dataset using SPSS software and report the methods and results in line with the requirements of a scientific journal. Both examinations are must-pass components (≥5.5/10).
Research Methodology in Musculoskeletal Physiotherapy II

Course coordinators: Prof. dr. Michel W. Coppieters; dr. Marco J.M. Hoozemans

Period: 2 (November – December)

Tuition forms:
- Lectures
- Computer labs

Assessment type:
- Theory examination (50%)
- Practical examination (30%)
- Oral group presentation with written report (20%)

Credits: 6 EC

Literature:
- Selected scientific papers and book chapters (see blackboard)
- Fletcher (2014) Clinical epidemiology (5th edition)

Content:
Research Methodology in Musculoskeletal Physiotherapy Part 2 continues the overview of research methods and evidence-based musculoskeletal physiotherapy. Topics that are discussed are: clinical effectiveness research designs (including randomised clinical trial methodology), statistics in experimental research (including one-way and two-way, repeated-measures, between groups and mixed design ANOVA), systematic reviews, and academic integrity and ethical conduct. The critical appraisal of the quality of studies in these domains is also covered. Practical sessions (computer labs) are organised for students to learn how to apply the statistical methods using statistical software packages (SPSS).

Aims of the course (with relation to end qualifications between brackets)
- To gain knowledge and understanding of research methods commonly used in musculoskeletal physiotherapy (clinical effectiveness research designs, statistics in experimental research, systematic reviews, and academic integrity and ethical conduct). (2)
- To be able to apply knowledge to formulate new research questions, to select appropriate research designs, to correctly select and perform statistical procedures using SPSS software, to interpret the output properly and to communicate the methods and findings correctly (4, 5, 10, 11, 14, 18)
- To be able to use appropriate knowledge and tools to critically appraise the quality of scientific research in musculoskeletal physiotherapy and related fields. (9, 18)
- To reach a level of understanding of clinical epidemiology, experimental research and statistics that enables participation in the debate about strengths and limitations of specific research designs and statistical procedures, and that enables effective communication and collaboration with other clinicians, researchers, epidemiologists and statisticians. (12, 13, 15)
- To understand academic integrity and ethical conduct, and to act accordingly (11)

Assessment information:
Learning outcomes are assessed via a theoretical and practical examination, and a group presentation accompanied by a written report. Both examinations are conducted at the end of the teaching period. The theory examination (50% of total score) consists of short answer questions. In the practical examination (30% of total score), students are requested to analyse a dataset using SPSS software and report the methods and results in line with the
requirements of a scientific journal. The group presentation (20% of total score) is presented during the teaching period. All three assessment components are must-pass components (≥5.5/10).
Physiotherapy organization and practice
Course coordinators: Dr. Wendy Scholten-Peeters, Dr. Annelies Pool-Goudzwaard

Period: 1 (September – October)
Tuition forms: lectures, tutorial groups, clinical internships

Assessment type:
1) critical appraised patient report (70%)
2) report on gaps of knowledge and research questions within the physiotherapy domain (30%)

Credits: 6 ECs

Literature
- https://www.fysionet.nl/centraal-kwaliteitsregister/beroepspromofiel.html
- http://www.cebp.nl/?NODE=64

Content
This course is only for students who are not physiotherapists. In this course students will get insight into the physiotherapy profession to create relevant research questions and to communicate and collaborate with physiotherapists in the field. Student will not be trained to become physiotherapists themselves. No ‘hands-on’ practicums will be performed.

The course will comprise of:
- Lectures and tutorial groups on the organization of physiotherapy in the Netherlands,
the domain of physiotherapy, competence profile of the physiotherapist, screenings process, diagnostic process, treatment process, clinical guidelines, commonly used classification systems in the physiotherapy field, use of questionnaires.

- Case studies to get insight into the physiotherapy diagnostic and treatment process and underlying models.
- Clinical internships into different physiotherapy care settings.

### Aims of the course (with relation to end qualifications between brackets)

- To gain knowledge of the organization of the Dutch healthcare system and the position of physiotherapy within this system: legal, financial, ethics, care settings (1,7)
- To gain knowledge of the processes and principles of screening, diagnosis and treatment in physiotherapy practice in primary, hospital and rehabilitation care (1, 7, 8, 17)
- To gain experience in physiotherapy settings within primary, hospital and rehabilitation care and to formulate relevant research questions acknowledging facilitators and barriers for setting up research (4, 8, 9, 10, 12, 14, 15, 16, 17)
- To communicate effectively with physiotherapists and other clinicians in different care settings (12, 13, 14, 15)

### Assessment information

**Examination**

The exam consists of a critical appraised patient report, a two-page summary of the best available evidence combined with patient and therapeutic perspectives, and additionally a report of gaps of knowledge in the physiotherapy field with corresponding relevant research questions.

**Conditional requirements**

Students need to deliver their critical appraised patient report and their report on gaps of knowledge and research questions in time and corresponding to the guidelines for authors as presented on Blackboard.

**Examination and grading**

The critical appraised patient report counts for 70%, the research questions for 30%. Students pass for the exam if the score is 5.5 or higher for each. A criteria list will be used to score the separate reports (see Blackboard). The grade will be rounded off at half points.

**Re-examination**

Failing the exam entitles the student to one re-examination implementing the feedback given by two independent reviewers on the critical appraised patient report and/or the research questions.

**Determining final grade**

The final grade will be determined as follows:

\[ 70\% \times \text{grade patient report (rounded of at half point)} + 30\% \times \text{grade research questions (rounded off at half point)} \]
Measuring Movement

Course coordinator: Dr. H. Houdijk and T. IJmker MSc
Period: 1 (September – November)
Tuition forms: lectures, practicals
Assessment type: Practical assessment (30%) and Knowledge assessment MC (70%)
Credits: 6

Used literature
- Syllabus “Measuring movement”

Content

Within physiotherapy research a large set of measurement techniques and methods is available, ranging from a psychosocial towards a biophysical approach. This course will only cover some of the most frequently used techniques from the biophysical approach to objectively quantify different aspects of human movement. The following techniques will be addressed specifically: measurement of kinematic quantities using Optotrak or video camera, measuring external forces with a force platform, measuring linear and angular accelerations with an accelerometer, and measuring muscle activity with electromyography (EMG).

The focus of this course is on the general principles techniques which apply to the measurement of almost any physical signal, and the processing of these signals into meaningful quantities. Students will learn how to perform measurements with the aforementioned equipment, and how to process the acquired signals using Matlab. Additionally, students will learn to analyze the reliability and precision of the given methods and to make a sound judgment as to the adequacy and limitations of a given measurement method to quantify human movement.

Aims of the course (with relation to end qualifications between brackets)
- To gain knowledge of common principles in signal processing. (2)
- To gain knowledge of the common function, applicability and limitations of measurement tools often used for measuring movement in physiotherapy research. Specifically: motion analysis, force sensors, accelerometers and electromyography (2)
- To be able to select the appropriate measurement set-up and parameters to answer a given research question (3,4)
- To be able to operate common measurement tool in movement analysis (3,4)
- To be able to process data collected with the designated measurement tools using Matlab (3,4)
- To be able to interpret and report the results of the measurement outcomes. (9,14)
- To be able to critically evaluate the accuracy and validity of the measurement outcomes. (9)

Assessment information

Practical assessment
Conditional requirements
Students need to attend the data collection part of each practical, in order to receive a grade for the practical exam.
Examination and grading
For each practical, the student has to hand in an assignment through BlackBoard before the deadline. Each assignment will consist of open-end questions covering the material of the practical in question. The average grade for the four practical assignments will make up 30% of the final grade for this course.

Final exam
Conditional requirements
Students need to be in time and to bring their VU_ID to the exam in order to be admitted. Students who are more than half an hour late are not allowed to take the interim exam. Their exam will be graded with a 1.0.

Examination and grading
The final exam will cover lecture sheets and syllabus material, and will consist of multiple choice questions. The exam will last 3 hours and will be administered electronically. The grade for the exam will be determined using the standard procedure for setting of a cutting score. This procedure can be found on Blackboard. You pass for the interim exam if you score a 5.5 or higher, and the grade will be rounded of at half point.

Determining final grade
The final grade will be determined as follows:

0.3 x grade practical exam (rounded off at half point) + 0.7 x final exam (rounded of at half point).
Biomechanical analysis of human movement

Course coordinator: Dr. J.H.P. Houdijk

Period: 2 (November – December)

Tuition forms: lectures, practicals

Assessment type: practical reports, MC and open-end exam

Credits: 6

Used literature
- Selected scientific papers

Content
In this course students will learn to understand and apply biomechanical analysis that are commonly used to describe and explain the kinematics and kinetics of human movement. The biomechanical models and techniques used in these analyses will be discussed and their potential pitfalls and limitations will be highlighted. Students will perform the analyses on several available data sets, interpret the results of these analysis in the light of clinical problems and contrast them with results from scientific literature. At the end of the course students are able to apply predefined data analysis routines to available data and interpret the results, moreover they are able to critically evaluate methods, results and interpretations of biomechanical analyses presented in scientific literature.

The course will comprise:
- Lectures on the theoretical background of biomechanical models and analyses used in the analysis of human movement.
- Praticals in which predefined data analysis routines are used to analyze available kinematic and kinetic data sets.
- Seminars in which results of the practicals are presented and discussed.

Aims of the course (with relation to end qualifications between brackets)
- To understand biomechanical concepts in the analyses of human movement. (2)
- To understand biomechanical models and analysis methods that are used to describe the kinematics and kinetics of human movement and be aware of their important assumptions and sources of error. (2,9)
- To select an appropriate model and analysis method to answer a clinical question related to movement analysis. (6)
- To apply predefined analysis routines to available kinematic/kinetic data sets and interpret the results through consistent biomechanical reasoning. (3)
- To relate the obtained results from movement analysis to clinical questions from the field of physical therapy and to compare these results to scientific literature on these issues. (1,5)
- To present the results of mechanical analyses graphically, in writing and verbally. (12,13)
- To be able to understand and critically evaluate existing scientific literature involving the use of mechanical analysis for physical therapy related research questions. (9)
**Assessment information**

**Practical reports**
Practical reports need to be handed in before the seminar in which the outcomes are presented and discussed. In the practical reports the results of the practical assignments need to be described in a complete and clear fashion to demonstrate that the student has completed the practical successfully. Compliance with this requirement and these deadlines is conditional for admission to the exam.

**Exam**
*Conditional requirements*
Students need to have handed in all practical reports before the designated deadlines. Students need to be in time and to bring their VU_ID to the exam in order to be admitted. Students who are more than half an hour late are not allowed to take the interim exam. Their exam will be graded with a 1.0.

*Examination and grading*
The exam exists of multiple choice questions and open-end questions. The MC part covers theoretical issues addressed in the lectures and practicals. In the open-end questions students need to analyze, visualize and interpret data in line with practical assignments. The multiple choice questions and the open-end questions both count for 50% of the exam grade.

The grade for the exam will be determined using the standard procedure for setting of a cutting score. This procedure can be found on Blackboard. You pass for the interim exam if you score a 5.5 or higher. The grade will be round off at half points.

**Determining final grade**
The final grade will be determined as follows: 50% x MC exam and 50% x Open-end exam.
Writing a Research Proposal

Course coordinator: Prof. dr. A.M.L. Kappers
Period: 3 (January)
Tuition forms: lectures, work groups
Assessment type: research proposal
Credits: 3
Used literature: -

Content
Writing a research proposal is not just about having a good idea, but also about motivating and clearly formulating a research question and substantiating the methods used to answer the research question. This skill is required when you conduct research, for example, during your research internship, but also if you want to submit a grant proposal or need to get approval for your study by a (medical) ethical committee.

In this course, students learn how to write a research proposal. Also the process of applying for a grant will be discussed. Experienced researchers will explain which elements of a proposal are important for reviewers. This also includes, for example, setting up your CV and considering ethical issues and societal relevance. These skills are required for and can be used in future (scientific) careers. The proposal can, if desired, be used as preparation for the research internship, which will start in period 4, but that is not mandatory.

Aims of the course (with relation to end qualifications between brackets)
• To acquire knowledge and insight into: Designing a research proposal, including to autonomously collect scientific information and to analyze and evaluate this information critically (6, 9, 14, 18)
• To acquire knowledge and insight into requirements imposed by different research funders for a research proposal (8)
• To be able to reflect on social and ethical issues (11, 16)

Assessment information
The research proposal will be assessed at the end by the chosen supervisor of the research internship. If the proposal is not meant to be the start of the student’s own research internship, a teacher with relevant expertise will be invited to assess the proposal.
All students are required to write their own research proposal, even if the actual research project will be conducted together with another student. It is very important to explain your own focus of and interest in the project. This will be strictly enforced. Identical descriptions of the proposed research will be considered as plagiarism.

Examination and grading
Below you will find the proportional weight of each item. For ease of assessment, each item will be given 0, 2, 4, 6, 8, or 10 points.
Failure and second chance

If the research proposal scores below threshold (≤ 5), the student has the right to make adjustments and to submit the research proposal again. The deadline for this second version is March 30, 2015. The same supervisor will assess this version. If the score is again insufficient, the student must write a new research proposal in the next academic year.

If the research proposal scores above threshold (≥ 6), but the student thinks he/she can do better, the student is allowed a second chance. In this case, the student has to submit a completely new research proposal (not a revised version of the first one) to an other lecturer.

Assessment of the research proposal

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<thead>
<tr>
<th></th>
<th>Weight (%)</th>
<th>Mark (0,2,4,6,8,10)</th>
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<tbody>
<tr>
<td>Scientific summary</td>
<td>5</td>
<td></td>
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<tr>
<td>Summary for general public</td>
<td>5</td>
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<tr>
<td>Applicant’s motivation</td>
<td>10</td>
<td></td>
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<tr>
<td>Description of proposed research</td>
<td>35</td>
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<tr>
<td>Literature</td>
<td>5</td>
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<tr>
<td>Time plan of the project</td>
<td>5</td>
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<tr>
<td>Summary of requested funding</td>
<td>5</td>
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<tr>
<td>Research equipment</td>
<td>5</td>
<td></td>
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<tr>
<td>Societal relevance</td>
<td>5</td>
<td></td>
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<tr>
<td>Ethical issues</td>
<td>10</td>
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<tr>
<td>Overall</td>
<td>10</td>
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Weighted average
**Translational research**

Course coordinator: Dr. A. Pool-Goudzwaard & Dr. W Scholten-Peeters

Period: 3 and 6 (January and June)

Tuition forms: Lecture/ Tutorial groups in preparation of writing own business case

Assessment type: Business case and presentation

Credits: 6

**Used literature**

- “Defining translational Research: Implications for training”. Rubio et al., 2010;85(3):470-475
- “Critical appraisal of translational research models for suitability in performance assessment of cancer centers” Rajan et al., The oncologist 2012;17:e48-e57
- www.leadershipthoughts.com/writing-an-effective-businesscase
- www.techrepublic.com “6 essentials elements for a winning businesscase” I. Bogorad 2008
- Dissemination and Implementation Research in Health: Translating Science to Practice Hardcover use pre formatted date that complies with legal requirement from media matrix – 2012 by Ross C. Brownson, Graham A. Colditz, Enola K. Proctor

**Content**

In this course students will gain knowledge and be trained in translational research within the domain of physiotherapy. Data derived from their own master research project will be used to set up the next step in translational research. Development of relevant research questions, setting up correct design, responding to pitfalls of implementation and reaching for efficacy and (cost) effectiveness will be studied. The student will learn to interpret and practice this knowledge in writing a business case for external stakeholders financially investing in translational research related to their own master project.

The course will comprise lectures and tutorial groups on:

- Translational research models
- Efficacy and (cost) effectiveness DALY’s QALY’s in PT
- Models in implementation research
- Skills to write a financial paragraph of a business case
- Skills in qualitative research
- Clinical guidelines
- How to write a business case relevant for stakeholders
- How to report on outcome of research and the next step in translational research related to own master project

**Aims of the course (with relation to end qualifications between brackets)**

- To gain insight in the complexity of translational research within the physical therapy domain (2,3)
- To enable students to select appropriate research questions, methods and study design to address translational research and report on them (4,7,8,14)
- Formulate own barriers and facilitators for implementation of research findings in physiotherapy practice (related to clinical internship) and report on them (5,6,9,10,11)
• Facilitate a level of understanding of all aspects of translational research and skills to communicate and collaborate with multidisciplinary working clinicians, researchers, grant institutions and insurance companies (business case) (12,13,15,17)

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<thead>
<tr>
<th>Assessment information</th>
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<tbody>
<tr>
<td>Examination</td>
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<tr>
<td>The exam exists of a written business case and a presentation of this business case.</td>
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<tr>
<th>Conditional requirements</th>
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<tr>
<td>Students need to deliver their business case prior to the deadline, specified on Blackboard. Students need to follow guidelines on how to write a business case and minimal requirements of the presentation, see criteria list as posted on Blackboard. The presentation of the business cases will be held on a specific date, which will also be presented on Blackboard.</td>
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<tr>
<th>Examination and grading</th>
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<tr>
<td>The interim exam exists of a written business case counting for 70% and a presentation of this business case, which counts for 30%. Prior to examination a student is entitled to one feedback moment of the business case by one reviewer. The grades for the interim exam will be determined by two separate reviewers using a criteria list. The criteria list can be found on Blackboard. You pass for the interim exam if you score a 5.5 or higher for the business case and presentation together. The grade will be round off at half points.</td>
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<tr>
<th>Re-examination</th>
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<tr>
<td>Failing the exam entitles the student to one re-examination implementing the feedback given by two reviewers on the business case used for the first attempt</td>
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<th>Determining final grade</th>
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<td>The final grade will be determined as follows:</td>
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70% x grade business case (rounded of at half point) + 30% x grade presentation (rounded off at half point)
Content
The objective of the Master Research Project is to obtain insight into the various components of the research process, as well as the cohesion between the various components. The intention being: how to phrase a question, formulate a hypothesis, prepare and perform experiments, classify data, interpret results (theory development) and write reports. Students are then able (under supervision) to apply this insight when preparing, performing and reporting on scientific research. This objective is mainly concerned with the research technical aspects of scientific research. During the research internship students will also have varying, often valuable, experiences. They will experience what it is to plan a research project from start to finish and to independently implement it, and that working with others is an interesting and often educational experience.

Aims of the course (with relation to end qualifications between brackets)
- To be able to formulate plans, including designs, methods, procedures and analyses, for tackling research questions (2, 3)
- To be able to autonomously collect scientific information efficiently and to interpret knowledge concerning specific topics with respect to causes, prevention, diagnosis and (conservative, physiotherapeutic) treatment of musculoskeletal disorders (4, 6, 8, 13, 18)
- To be able to apply knowledge from the human movement sciences to frame and answer clinical research questions relevant to this field of study (1, 5, 6, 12)
- To be able to reflect on social and ethical issues pertaining to the dissemination and application of research results (9, 10)
- To be able to communicate with experts from different disciplines and to build exchange and collaboration between disciplines (7, 11, 12, 14, 15, 16)
- To get awareness of one’s own scientific weaknesses and strengths (17)

Assessment information

Master Research Report
The Master Research report is assessed by two independent assessors. The report is handed in at the agreed date. The supervisor of the Master Research Project reviews the report according to a review process at a scientific journal. The student rewrites the paper and hands in the adjusted paper and a response to the review of the supervisor. Two independent assessors score the paper with help of the assessment form with a grade (on half points) between 1 – 10. If there is a difference of more than 1 point between both assessors, a third assessor will grade the report. If the student is scored with a 5.0 or less he/she is allowed to adjust the paper one more time.

Process
The process of the project is assessed by the supervisor of the Master Research Project, using an assessment form.

Presentation
The presentation is graded by two independent assessors, using an assessment form. If the student is scored with a 5.0 or less, he/she must resit the presentation.

Final grade
The final grade is determined as follows:
60% grade for the Master Research Report, 30% grade for the process, 10% grade for the presentation.
### 3D kinematics

<table>
<thead>
<tr>
<th>Course coordinator: Prof. dr. H.E.J. Veeger</th>
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<tr>
<td>Period: Block 4 (February – March)</td>
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<td>Tuition forms: Lectures, practicals, tutorials</td>
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<td>Assessment type: knowledge assessment, practical reports</td>
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<td>Credits: 3 EC</td>
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**Used literature:**
Scientific publications

**Content**

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.

The course consists of classes, computer practicals and work group, in which 3D kinematics theory and application will be taught and consequences for research will be discussed.

**Aims of the course (with relation to end qualifications between brackets)**

- To be able to define and calculate local joint coordinate systems (1, 2, 5)
- To be able to use and understand different calibration methods and their limitations (2)
- To be able to translate technical motion descriptions into clinically relevant units (1, 5)
- To apply the above to experimental data (5)
- To interpret and comment on methods as described in the literature (5)

**Assessment information**

The assessment exists of two in-term tests on calculation skills, partially exempting for exam and on a final test on calculation skills essay questions.

*Final grade*

The final grade is determined as follows:

3x 20% for calculation questions (one for each block) + 1x 40% for essay questions
Imaging

Course coordinator: Prof. dr. H.E.J. Veeger
Period: 4 (February – March)
Tuition forms: lectures, practicals
Assessment type:
Credits: 6

Used literature
• Cornwall, Nyre & Harris: Imaging Handbook for Physical Therapists (2014)
• Daniels & Dexter (eds.): Selected chapters from; Basics of Musculoskeletal Ultrasound (2013)

Content
In this course students will be trained in interpreting images from the most common imaging tools used in orthopaedics: x-ray, MRI and ultrasound. As ultrasound is one of the tools that is most easily available in physiotherapy practice, students will learn to record and interpret ultrasound images based on existing cases.
The course will comprise:
• classes on the basic theory behind x-ray, MRI, and ultrasound.
• classes on the recognition of a selection of musculoskeletal disorders using images.
• Visit to the imaging department VUmc
• Demo of ultrasound use within a physiotherapy practice.
• Practical + report on a specific case based on ultrasound recordings.

Aims of the course (with relation to end qualifications between brackets)
• To be able to interpret x-ray images, MRI and ultrasound and to recognize relevant structures of the musculoskeletal system (1)
• To be aware of projection and field strength pitfalls (2, 9)
• using x-ray: to be able to recognize signs of arthrosis and osteoporosis (3)
• using MRI: to be able identify ACL injuries and rotator cuff tears (3)
• using ultrasound: to be able to identify tendon and muscle damage (3)
• to be able to perform an ultrasound assessment evaluation of the shoulder or knee, based on a specific research question (3, 5, 6, 18)
• able to report on an ultrasound assessment evaluation of the shoulder or knee, based on a specific research question (14)

Assessment information

Interim exam

Conditional requirements
Students need to be in time and to bring their VU_ID to the exam in order to be admitted.
Students who are more than half an hour late are not allowed to take the interim exam.
Their exam will be graded with a 1.0.

Examination and grading
The interim exam exists of multiple choice questions and open-end questions. The multiple choice questions count for 70% to the grade for the interim exam, the open-end questions for 30%.
The grade for the interim exam will be determined using the standard procedure for setting of a cutting score. This procedure can be found on Blackboard. You pass for the interim
exam if you score a 5.5 or higher. The grade will be round off at half points.

**Determining final grade**
The final grade will be determined as follows:

30% x grade interim exam (rounded off at half point) + 70% x grade report (rounded off at half point).
### Electromyography

Course coordinator: Prof. dr. J.H. van Dieën  
Period: 5 (April – May)  
Tuition forms: lectures, practicals  
Assessment type: written exam  
Credits: 3

**Used literature**

**Content**

In this course, the students are introduced to the electrophysical and physiological 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.

**Aims of the course (with relation to end qualifications between brackets)**
- The student has a basic knowledge of electrophysiology and the background of electromyographical signals (2)  
- The student has a basic knowledge of the different ways of collecting electromyographical data in various fields of application (3, 4)  
- The student can choose the appropriate method for collecting and analyzing EMG data in a kinesiological study (3, 4)  
- The student knows the possibilities and limitations of EMG data (2)  
- The student can interpret EMG data in relation to motor control, force and fatigue (5, 9)  
- The student can identify contamination in EMG data and can select methods to reduce its effects (3, 4)

**Assessment information**

**Exam**

*Examination and grading*

The exam exists of equally weighted open-ended questions. You pass for the exam if you score a 5.5 or higher. The grade will be round to half points.
## Histology

<table>
<thead>
<tr>
<th>Course coordinator: Dr. Willem Hoogaars</th>
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<tbody>
<tr>
<td>Period: 5 (April – May)</td>
</tr>
<tr>
<td>Tuition forms: lectures, practical</td>
</tr>
<tr>
<td>Assessment type: exam, assignment</td>
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<tr>
<td>Credits: 3</td>
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### Used literature


### Content

This course will cover the microscopic anatomy and cellular and molecular biology of the musculoskeletal system as well as pathological changes that occur in musculoskeletal disorders. Students will be introduced to histochemical and immunohistochemical techniques that are used to study microscopic structure and function of cells in muscles, bones, joints and attachments. Practical exercises will be used to familiarize students with the cellular structure and organization of different tissues within the musculoskeletal system.

The course will comprise:

- Classes on basic histological and immunohistochemical techniques used to identify cells and in tissue sections.
- Classes on the microscopic anatomy and cellular/molecular biology of the musculoskeletal system.
- Classes on cellular and molecular changes in a selection of musculoskeletal disorders.
- Practical + report on the identification of different cells and tissues in muscle sections using histochemical stainings

### Aims of the course (with relation to end qualifications between brackets)

Upon completion of this course the student will be able to:

- understand and describe the principles of tissue sampling and preparation (2);
- describe and explain the principles underlying (immuno)histochemical methods and light microscopy (2, 3);
- identify and describe the microscopic organization and function of different cells and tissues in muscles, bones, joints and their attachments (2, 3);
- interpret and analyse histological sections using light microscopy and recognize relevant structures of the musculoskeletal system (2, 9);
- identify and describe pathological changes in cellular organization associated with a selection of musculoskeletal disorders (1, 2, 3 and 5).

### Assessment information

#### Interim exam

*Examination and grading*

The interim exam exists of multiple choice questions and open-end questions. The multiple choice questions count for 70% to the grade for the interim exam, the open-end questions for 30%.
The grade for the interim exam will be determined using the standard procedure for setting of a cutting score. This procedure can be found on Blackboard. You pass for the interim exam if you score a 5.5 or higher. The grade will be round off at half points.

**Practical assignment**

*Grading*
The practical assignment will consist of open questions that can be answered using microscopic analysis of histological sections.

**Determining final grade**
The final grade will be determined as follows:
70% x grade exam (rounded off at half point) + 30% x practical assignment (rounded off at half point).