RUHR-UNIVERSITÄT BOCHUM
FAKULTÄT FÜR SPORTWISSENSCHAFT

RUB

MODULHANDBUCH

MASTER OF SCIENCE (M. SC.)

SPORTWISSENSCHAFT

Sport & Exercise Sciences for Health & Performance

VOM 10. OKTOBER 2018

Module 1 - M.Sc.		**Biomechanics & Motor Control**		
		Types of classes: Seminars, practice, self-study		
Number of CP: 11	**Student workload:** 330 h	**Number of SWS:** 7	**Modus:** Mandatory	**Turnus:** Yearly

Courses:

a. Kinematics and Kinetics (5 CP)
b. Muscle Mechanics (3 CP)
c. Sensorimotor Neuroscience (3 CP)

Description:

Biomechanics & Motor Control deals with the structure and function of the human musculoskeletal system and how human locomotion is controlled by the nervous system. *Kinematics and Kinetics* are branches of classical biomechanics that describe human motion and the relationship to its causes, namely muscle forces. *Muscle Mechanics* examines the force generating motor of human locomotion itself, the muscle-tendon complex and its structural and mechanical properties. Finally, *Sensorimotor Neuroscience* studies how the nervous system drives skeletal muscles and how the central and peripheral nervous system interact to control human movement.

Learning Goals:

Kinematics and Kinetics:

- to independently perform human motion analyses based on state-of-the-art experimental techniques
- to obtain relevant knowledge about human body models and their limitations to represent the actual biological system and to understand how to use inverse and forward dynamics
- to prepare for working in professional fields like sports performance or clinical gait analysis

Muscle Mechanics:

- to obtain detailed knowledge on the mechanical properties of muscles, tendons and aponeurosis in order to understand the details of skeletal muscle force production and to understand the role of series elasticity of the muscle-tendon complex for human locomotion
- to become familiar with muscle models and relevant experimental techniques
- to obtain muscle-mechanical functions in athletes as well as healthy or pathological states

Sensorimotor Neuroscience:

- to gain deep insight into the interaction of the nervous system and the locomotor system also called the neuromechanics of human movement
- to gather knowledge on the physiology of the nervous system and learn how to experimentally test the neuromuscular system by electrical and magnetic stimulation techniques
- to investigate the motor control of human movement in healthy and impaired populations

The “Module 1 Biomechanics & Motor Control” is closely linked to the modules 4 to 6 where students apply their knowledge in the lab as well as in the field and during their master thesis. The module further helps students to decide which field to select in Module 5.

Literature:

- Enoka, R.: Neuromechanics of Human Movement.
- Nigg, B. & Herzog, W.: Biomechanics of the musculo-skeletal system.
- Pierrot-Deseilligny, E. & Burke, D.: The Circuitry of the Human Spinal Cord: Spinal and Corticospinal Mechanisms of Movement.
- Zatsiorsky, V.M.: Kinematics of human motion.
- Zatsiorsky, V.M.: Kinetics of human motion.

Credit points and mode of examination:

- Credit points are obtained based on regular attendance. Based on self-study, students further have to practice lab skills, to perform data analysis and to do homework.
- The module will be marked based on a written exam covering all three topics. In order to pass, students have to achieve at least grade 4.

Author:

Hahn, Daniel

Module 2 - M.Sc.		**Exercise Science**		
		Types of classes: Seminars, practice, self-study		
Number of CP: 11	**Student workload:** 330 h	**Number of SWS:** 7	**Modus:** Mandatory	**Turnus:** Yearly

Courses:

a. Strength & Conditioning Research (5 CP)
b. Exercise/Sport Psychology & Psychometrics (3 CP)
c. Monitoring, Training Prescription & Recovery Science (3 CP)

Description:

Exercise Science primarily deals with the impact of training interventions on health and performance adaptations in different sports and for all age groups. Important additional aspects are talent research and talent support, training monitoring and periodization as well as competition analyses. Psychological measurements are frequently combined to exercise research.

a. Strength & Conditioning Research provides methods and methodologies for training and testing of physical performance. Current research questions, practices, trends, and recommendations related to training and testing of strength, speed, agility, and quickness as well as to endurance and flexibility will be presented and critically discussed for health and performance issues. In addition, the students are introduced into the handling of measurement devices of the Department of Training and Exercise Science.
b. Exercise/Sport Psychology & Psychometrics introduces psychometric instruments used in exercise/sport psychology and provides substantial knowledge about the criteria for the selection of appropriate tools. The application of these instruments will be addressed along with chances and limitations of monitoring stress, recovery and mood in different applications of exercise in health and performance settings over a longer period.
c. Monitoring, Training Prescription & Recovery will present statistical and practical approaches for monitoring fatigue and recovery. Potential markers of fatigue (e.g. neuromuscular function, heart rate-based parameters, blood markers, psychometric parameters) and the effects of different recovery interventions are presented and critically discussed.

Learning Goals:

- to obtain methodological competences in Exercise Science and Sport Psychology
- to critically handle research methods and methodologies for testing procedures & training interventions in health & performance related settings
- to manage monitoring systems and making individual data based adjustments
- to individually prescribe training by monitoring the process of training and recovery

The “Module 2 Exercise Science” is closely linked to the modules 4 to 6 where students apply their knowledge in the lab as well as in the field and during their master thesis. The module further helps students to decide which field to select in Module 5.

Literature:

- Fleck, S. J. & Kraemer, W. J. (Eds.). (2014). Designing Resistance Training Programs.
- Haff, G. G. & Triplett, N. T. (Eds.). (2016). Essentials of Strength Training and Conditioning.
- Hausswirth, C. & Mujika, I. (Eds.). (2013). Recovery for Performance in Sport. Joyce, D. & Lewindon, D. (Eds.). (2014). High-Performance Training for Sports.
- Mc Guigan, M. (2017). Monitoring Training and Performance in Athletes.

(All four: Champaign, IL: Human Kinetics)

- Kallus, K.W. & Kellmann, M. (Eds.). (2016). The Recovery-Stress Questionnaires: User Manual. Frankfurt am Main: Pearson Assessment & Information GmbH.
- Kellmann, M. & J. Beckmann (Eds.). (2018). Sport, Recovery and Performance. Abingdon: Routledge.
- Tanner, R. & Gore, C. (Eds.). (2012). Physiological Tests for Elite Athletes. Champaign, IL: Human Kinetics.

Credit points and mode of examination:

a) Credit points are obtained based on regular attendance. Based on self-study, students further have to practice lab skills, to perform data analysis and to do homework.
b) The module will be marked based on a written exam covering all three topics. In order to pass, students have to achieve at least grade 4.

Authors:

Ferrauti, A., Kellmann, M

Module 3 - M.Sc.		**Sports Medicine & Sports Nutrition**		
		Types of classes: Seminars, practice, self-study		
Number of CP: 11	**Student workload:** 330 h	**Number of SWS:** 7	**Modus:** Mandatory	**Turnus:** Yearly

Courses:

a. Genetic and Molecular Basics of Exercise Physiology for Health & Performance (3 CP)
b. Sports Nutrition for Health & Performance (5 CP)
c. Applied Exercise Physiology & Sports Nutrition for Health & Performance (3 CP)

Description:

Exercise physiology addresses 1) the short-term biological responses to the stress of physical activity and 2) how the body adapts to repeated bouts of physical activity over time. Exercise physiology professionals often have the responsibility of conditioning a person to a higher level of fitness and/or health. They are aware of safety issues (risk of injury, illness, environmental exposure). The type of client ranges from world class athletes to patients with chronic illnesses. Sports nutrition is the study and practice of nutrition and diet with regards to improving one's athletic performance and health. Nutrition is an important part of many sports training regimens.

a. Genetic and Molecular Basics of Exercise Physiology for Health & Performance addresses the underlying physiological, biochemical & molecular mechanisms of training adaptations.
b. Sports Nutrition for Health & Performance focuses its studies on the type, as well as the quantity of fluids and food taken, and deals with the consumption of nutrients such as vitamins, minerals, supplements, carbohydrates, proteins and fats.
c. Applied Exercise Physiology & Sports Nutrition for Health & Performance deepens the knowledge about client-and disease-oriented performance diagnosis, training load, training control and adaptations, dietary history and its anamnesis, and further focuses on the development of targeted training and nutrition plans.

Students can apply their knowledge, experience and expertise to jobs that involve exercise testing and training and diet analysis and recommendations, including programs designed to improve health and fitness in well trained and untrained individuals and in people with or at risk for chronic illness or disability, and in community, clinical, research, and public health settings.

Learning Goals:

- to obtain detailed knowledge on the complex interactions of physiological, biochemical and molecular mechanisms during physical activities and learn to critically question universal platitudes in exercise physiology and training
- to understand the function of the micro- and macro-nutrients in the body, how these nutrients affect health and performance, and to analyse nutrient intake, body composition, and energy expenditure with different methods and in different physical activities
- to transfer the knowledge to client-oriented performance diagnosis and training plans, and to develop adapted nutrition plans for the optimization of performance and health

The “Module 3 Sports Medicine & Sports Nutrition” is closely linked to the modules 4 to 6 where students apply their knowledge in the lab as well as in the field and during their master thesis. The module further helps students to decide which field to select in Module 5.

Literature:

- Campbell, B.I., Spano, MA. (Eds.). (2011). NSCA´s Guide to Sport and Exercise Nutrition. Human Kinetics.
- Jeukendrup, A., Gleeson, M. (Eds.). (2010). Sport Nutrition. 2nd ed., Human Kinetics.
- Manore, M.M., Meyer, N.L., Thompson, J. (2009). Sport Nutrition for Health & Performance. Human Kinetics.
- McArdle, W.D., Katch, F., Katch, V.L. (2014). Exercise Physiology. 8th ed., Williams & Wilkins.

Credit points and mode of examination:

c) Credit points are obtained based on regular attendance. Based on self-study, students further have to practice lab skills, to perform data analysis and to do homework.
d) The module will be marked based on a written exam covering all three topics. In order to pass, students have to achieve at least grade 4.

Author: Platen, P.				
Module 4 - M.Sc.		**Lab & Field Studies**		
		Types of classes: Seminars, practice, self-study, team work, congress participation		
Number of CP: 27	**Student work-load:** 810 h	**Number of SWS:** 6	**Modus:** Mandatory	**Turnus:** Yearly

Courses:

a. Lab & Field Experience (4 CP)
b. Applied Experimental Studies & Diagnostics (9 CP)
c. Advanced Lab & Field Experience (12 CP)
d. Congress Participation (ECSS/ ISB/ DVS…) (2 CP)

Description:

The general aim of Lab & Field Studies is to introduce students to the field of experimental sport science and to the scientific community.

a. Lab & Field Experience: In this course students gain first insight into working in a research and diagnostic laboratory/area. They accompany students from Module 5 who are doing their research training project and assist them during experimental pre-studies in a mentor/mentee relationship.
b. Applied Experimental Studies & Diagnostics: In this course, groups of students develop their own research questions and methodological approaches in three different disciplines (biomechanics, exercise science, and sports medicine & sports nutrition).
c. Advanced Lab & Field Experience: This course in semester 2 further promotes student's knowledge and skills in doing experimental research. Here they assist students from Module 6 doing their master thesis again in a mentor/mentee relationship.
d. Congress Participation: This course allows students to visit and participate at a scientific conference in the fields of Sport & Exercise for Health & Performance. Students further learn that having a critical view and providing constructive criticism are important in order to promote science. They are encouraged to participate with their own research presentation.

Learning Goals:

- to experience several experimental setups, techniques and scientific approaches from the different fields in the areas of Sports, Exercise and Health Sciences.
- to further deepen sport scientific expertise and analytical, methodological and communicative competences for the solution of self-developed experimental scenarios
- to deepen research skills and to develop and realise own research projects
- to develop their own critical view and constructive criticism
- to learn about how conferences are organized, what kinds of different presentation formats exist, and how the scientific community discusses new findings
- to develop an abstract submission and a congress talk or poster presentation

The "Module 4 Lab & Field Studies" brings together students from the 1st and 2nd semester with students from the 3rd and 4th semester building close student-tutor partnerships. Student´s experiences during Module 4 further help them in their decision which area to choose from Modules 1-3 when proceeding to Module 5 and 6.

Literature:

- ACSM. (2017). ACSM´s Guidelines for Exercise Testing and Prescription. Lippincott, Williams & Wilkins.
- ACSM. (2017). ACSM's Health-Related Physical Fitness Assessment Manual. Lippincott, Williams & Wilkins.
- ACSM. (2017). ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription. Lippincott, Williams & Wilkins.
- ACSM. (2013). Surface Electromyography: Physiology, Engineering&Applications. Lippincott, Williams & Wilkins.

Credit points and mode of examination:

a) Credit points are obtained based on regular attendance. Based on group-study, students further have to practice lab skills, to perform data analysis and to do homework.
b) The module will be marked based on preparing and executing an experiment / a diagnostic task. In order to pass, students have to achieve at least grade 4.

Authors:
Ferrauti, A., Hahn, D., Platen, P.

Module 5 - M.Sc.		**Research Training**		
		Types of classes: Seminars, practice, self-study, team work		
Number of CP: 28	**Student workload:** 840 h	**Number of SWS:** 10	**Modus:** Mandatory	**Turnus:** Yearly

Courses:
a. Tutoring, Communication & Presenting (4 CP)
b. Research Training Project (15 CP)
c. Data Processing and Analysis (3 CP)
d. International Studies / Journal Club (3 CP)
e. Study Designs, Ethics & Statistics (3 CP)

Description:
Successful acting in sport science research requires a wide range of skills from different areas. Accordingly, this module addresses qualifications from different areas.

a. Tutoring, Communication & Presenting: This course follows the learning-by-teaching approach. After an introductory lesson and in-between reflections, students become tutors of the students from the first semesters and integrate them as assistants into their own projects. The course further addresses consulting and presentation skills for different groups.
b. Research Training Project: In this course, students work individually on an own scientific project. The project topic can be freely chosen from one of the three main areas (Modules 1-3). Within the project they learn to set up their experiment and get familiar with specific experimental techniques necessary for data acquisition. Based on self-responsible pilot testing students further learn to critically review and to optimize their own scientific approach.
c. Data Processing and Analysis: This course allows students to gain deep insight into how to successfully and efficiently handle and analyse large amounts of data.
d. International Studies / Journal Club: In this course students will search for, present and discuss actual scientific publications in relevant topics of biomechanics, exercise science, sports medicine and sports nutrition.
e. Study Designs, Ethics & Statistics: This course deepens the knowledge on the common frameworks that sport scientists bring to their research inquiries and on quantitative methods in practice-based research. It further approaches ethical issues in sports science.

Learning Goals:

- to deepen methodologic and communicative skills together in a team of researchers
- to be prepared for working with clients of different fields
- to set up one`s own experiment considering ethical and statistical issues
- to understand how data can be appropriately analysed and processed (e.g. filtering, smoothing) without losing relevant information
- to learn basic programming skills and how to use scientific software packages (e.g. Matlab, Origin) that allow efficient data analysis
- to independently search for, critically reflect and present sport scientific literature
- to develop and submit an ethical approval

The “Module 5 Research training” brings together students from the 3rd and 4th semester with students from the 1st and 2nd semester building close tutor-student partnerships. Module 5 prepares students for their master thesis (Module 6).

Literature:

- ACSM. (2017). ACSM´s Guidelines for Exercise Testing and Prescription. Lippincott, Williams & Wilkins.
- ACSM. (2017). ACSM's Health-Related Physical Fitness Assessment Manual. Lippincott, Williams & Wilkins.

Credit points and mode of examination:

a) Credit points are obtained based on regular attendance. The module will be marked based on a scientific presentation, a written synopsis of a research project and an ethical approval (each counts one third). In order to pass, students have to achieve at least grade 4.

Authors:
Ferrauti, A., Hahn, D., Platen, P.

Module 6 - M.Sc.		**Master Thesis and Scientific Writing**		
		Types of classes: Seminar, practice, self-study		
Number of CP: 32	**Student workload:** 960 h	**Number of SWS:** 1	**Modus:** Mandatory	**Turnus:** Yearly

Course:
a. Master Thesis (30 CP)
b. Scientific Writing (2 CP)

Description:
The master thesis involves the planning, conduction and analysis of an individual research study as well as the preparation of a written master thesis based on this research. This is accompanied by a seminar on Scientific Writing.

Learning Goals:
- knowing how to plan and to structure a scientific manuscript for publication in relevant journals in the field of Sports, Exercise and Health Science
- knowing the process of manuscript submission in order to understand all steps involved in a rigorous peer-review process
- knowing the different kinds of publishing policies (paper publication versus open access)
- being able to independently plan and conduct a sport scientific research project, to analyse research data and to present new knowledge

Literature:

Credit points and mode of examination:
a) Credit points are obtained based on regular attendance at the seminar on scientific writing. The module will be marked based on the written Master Thesis.

Authors:
Ferrauti, A., Hahn, D., Platen, P.