

# **Exercise Physiology and Sport Sciences**

## **2-year Master of Science (MSc)**

Programme code: MSPORT

Webpage: [www.ntnu.edu/studies/msport/](http://www.ntnu.edu/studies/msport/)

This programme description is valid for students admitted in the academic year 2012/2013.

### **Introduction**

The Master of Science in Exercise Physiology and Sport Sciences is a research and thesis-based integrated programme of study at the Faculty of Medicine. It is exclusively concerned with basic research training and comprises compulsory courses together with specialization courses dependent upon the research interest of students.

The MSc programme is associated with the research group in Exercise and Extreme Environments at the Department of Circulation and Medical Imaging. One of the main research interests of this group is to examine basic mechanisms behind central and peripheral limitations to the supply and demand of oxygen transport, and to identify training responses. The group is also involved in examining the mechanisms behind muscular and neural limitations to strength and coordination, the prescription of effective endurance and strength training, and the effects on top sports performance.

Another aspect is based upon the fact that the fastest developing diseases within the population, such as obesity, atherosclerosis, diabetes II, osteoporosis and chronic obstructive pulmonary disease (COPD), are related to inactivity. Effective new training interventions based on basic biological adaptations have positive effects and are effective treatments with high socioeconomic as well as quality of life outcomes.

### **Learning Outcome**

The graduated student should be able to:

- demonstrate in depth insight in Exercise Physiology and Sport Sciences reaching from the molecular to whole body level, and have practical skills relevant for the field;
- describe how physical activity and exercise influence the heart, arteries and skeletal muscles in our bodies, both for health and performance;
- identify and describe the limitations for the energy delivery and utilization, as well as the muscular and neural limitations for strength and coordination;
- understand and describe the beneficial effects of physical activity for successful aging and disease prevention, and prescribe effective training programmes for treatment;
- formulate a research question based on adequate insight into current knowledge within Exercise Physiology and Sport Sciences;
- apply and adopt experimental methods to gain new knowledge within Exercise Physiology and Sport Sciences;
- present, evaluate and discuss scientific results in English (orally and in writing).

### **Target Groups and Admission Requirements**

Candidates should hold a bachelor's degree (or 3-year equivalent), preferably within biochemistry, biology, exercise physiology/sport sciences, movement science, nursing, occupational therapy, physiotherapy, or similar fields. A firm foundation in human biology is required. The minimum average grade required is the Norwegian "C".

International applicants need to submit proof of English proficiency (TOEFL, IELTS, APIEL or University of Cambridge test). More details about the language requirements are available at [www.ntnu.edu/studies/langcourses/languagerequirements](http://www.ntnu.edu/studies/langcourses/languagerequirements)

Applicants who are not citizens of the European Union (EU) or the European Economic Area (EEA) need to provide a financial guarantee to get a residence permit in Norway.

### Teaching Methods and Learning Activities

In 2010 the new Hearth and Lung Centre opened at Øya campus in Trondheim. In this building students get to work in high-tech laboratory environments side by side with researchers both from NTNU and St. Olav's Hospital.

The teaching includes lectures, colloquiums, problem-based learning (PBL), seminars, demonstrations, practical training, self-tuition, and independent work. During the work with the master's thesis the student will do research in our well-equipped laboratories.

### Programme Structure

The master's degree is a two-year, full-time programme starting in the autumn semester. There are two main components:

- Theoretical and methodological courses (totalling 60 credits)
- Master's thesis (60 credits)

The first semester is primarily based on theory and lectures. From the second semester most attention is directed towards preparing for carrying out an experiment representing work at the forefront of the research in exercise physiology in close co-operation with the professors in the research group. The quality of research is high, and the research project is expected to contain data of a quality that makes international publication possible.

Year 1		Year 2	
1 <sup>st</sup> semester (autumn)	2 <sup>nd</sup> semester (spring)	3 <sup>rd</sup> semester (autumn)	4 <sup>th</sup> semester (spring)
<i>KLH3100</i> Introduction to Medical Statistics (7.5 credits)	<i>EiT</i> Experts in Teamwork (7.5 credits)	<i>SPO3900</i> Thesis in Exercise Physiology (60 credits)	
<i>SPO3020</i> Training Circulation and Oxygen Consumption (7.5 credits)	<i>SPO3040</i> Environmental Adaptations (7.5 credits)		
<i>SPO3030</i> Training Muscle and Force Production (7.5 credits)	<i>SPO3060</i> Specialisation in Exercise Physiology (15 credits)		
<i>SPO3055</i> Research Methods in Exercise Physiology (7.5 credits)			

Experts in Teamwork (EiT) is compulsory for all master's degree students at NTNU, and it is taught intensively in the weeks 2, 3 and 4 in the second semester. Read more about EiT here: [www.ntnu.edu/dmf/studies/eit](http://www.ntnu.edu/dmf/studies/eit)

By the end of the first semester, the student must choose a topic for the thesis. A master's thesis agreement (including a project description) is drawn up by the student and submitted to the

programme board within the first academic year. More information is available at [www.ntnu.edu/dmf/studies/master](http://www.ntnu.edu/dmf/studies/master) (in English) / [www.ntnu.no/dmf/studier/master](http://www.ntnu.no/dmf/studier/master) (in Norwegian).

The student must have passed all theoretical and methodological courses before he/she can submit the thesis.

## Course Descriptions

### Year 1

<b>KLH3100</b>	<b>Introduction to Medical Statistics</b>
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures and compulsory exercises.
Required previous knowledge:	The course is primarily intended for students admitted to a 2-year master's programme at the Faculty of Medicine, NTNU. Other students may be accepted after an individual evaluation.
Compulsory activity:	Exercise assignments
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	HLS3550: 7.5 credits KLH3004: 7.5 credits KLMED8004: 5.0 credits MNFSIB1: 7.5 credits ST3000: 7.5 credits ST3001: 7.5 credits
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Professor Grethe Albrektsen

### Learning outcome

After completing the course the student understands basic concepts and principles of statistical analysis, and is able to perform and interpret results from simple statistical analyses.

### Academic content

- Introduction to SPSS (statistical program package).
- Descriptive statistic for continuous and categorical variables (measures of location and spread, graphical display), probability, probability distribution, estimation, hypothesis testing, one- and two-sample test on mean values (Student T-test), non-parametric tests (Wilcoxon and Mann-Whitney U-test), tests on differences in proportions (cross-table analysis; chi-square- and McNemar's test), correlation, linear regression.

<b>SPO3020</b>	<b>Training Circulation and Oxygen Consumption</b>
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures, laboratory work, PBL. Approved practice report and written report. The timetable is available at <a href="https://timeplan.medisin.ntnu.no/timetable_show.php">https://timeplan.medisin.ntnu.no/timetable_show.php</a>
Entry requirements:	Admission to MSc in Exercise Physiology and Sport Sciences
Compulsory activities:	1. Written report 2. Approved practice report
Mode of assessment:	4-hour written examination Letter grades (A-F)
Host department:	Department of Circulation and Medical Imaging
Course coordinator:	Professor Jan Helgerud

### Learning outcome

After completing the course SPO3020 the student is able to:

- demonstrate in depth insight into limitations for oxygen transport and effective training regimes for improved circulation and aerobic endurance performance and have practical skills relevant for the field;
- describe biological adaptations as a result of physical activity and exercise training on the heart, arteries and skeletal muscles in our bodies both for health and performance;
- identify and describe the supply and demand limitations for the oxygen transport and utilization in athletes and patients;
- identify and prescribe effective endurance training programs, and to study their effect on top sports performance;
- understand and describe the beneficial effects of endurance training for successful aging and disease prevention, and prescribe effective training programs for treatment;
- apply and adopt experimental methods such as maximal oxygen uptake, lactate threshold and work economy and have practical skills relevant to perform the tests;
- present outcomes of research in a written report, evaluate and discuss scientific results in English.

### Academic content

Circulatory function, supply and demand limitations of oxygen to working muscle. Limitations and adaptations in patients and athletes. Training methods and their application to various limitations.

<b>SPO3030</b>	<b>Training Muscle and Force Production</b>
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures, laboratory work, PBL. Approved practice report and written report. The timetable is available at <a href="https://timeplan.medisin.ntnu.no/timetable_show.php">https://timeplan.medisin.ntnu.no/timetable_show.php</a>
Entry requirements:	Admission to MSc in Exercise Physiology and Sport Sciences
Compulsory activities:	1. Written report 2. Approved practice report
Mode of assessment:	4-hour written examination Letter grades (A-F)
Host department:	Department of Circulation and Medical Imaging
Course coordinator:	Professor Jan Hoff

## Learning outcome

After completing the course SPO3030 the student is able to:

- demonstrate in depth insight into limitations for muscular force and effective training regimes for improved muscular function and coordination and have practical skills relevant for the field;
  - describe biological adaptations as a result of physical activity and exercise training on the neuromuscular system in our bodies both for health and performance;
  - describe muscle architecture and differences in the population;
  - identify and prescribe effective strength training programs, and to study their effect on top sports performance both for neural adaptations and protein synthesis;
  - understand and describe the beneficial effects of strength training for successful aging and disease prevention, and prescribe effective training programs for treatment;
  - apply and adopt experimental methods such as one-repetition maximum, peak force, rate of force development and have practical skills relevant to perform the tests;
  - present outcomes of research in a written report, evaluate and discuss scientific results in English
- Insight into limitations for muscular force and effective training regimes for improved muscular function and its effect on muscular as well as circulatory performance.

## Academic content

Muscle architecture and differences in the population. Changes related to age and diseases. Limitations and functional adaptations in patients and athletes. Training methods for neural adaptations and protein synthesis. Neuromuscular basis for motor skill acquisition.

<b>SPO3040</b>	<b>Environmental Adaptions</b>
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures, PBL. Approved written report. The timetable is available at <a href="https://timeplan.medisin.ntnu.no/timetable_show.php">https://timeplan.medisin.ntnu.no/timetable_show.php</a>
Entry requirements:	Admission to MSc in Exercise Physiology and Sport Sciences
Compulsory activity:	Written report
Mode of assessment:	4-hour written examination Letter grades (A-F)
Host department:	Department of Circulation and Medical Imaging
Course coordinator:	Professor Ulrik Wisløff

## Learning outcome

After completing the course SPO3040 the student is able to:

- demonstrate in depth insight into temperature regulation at rest and during exercise at different ambient temperatures, and have practical skills relevant for the field;
- describe biological processes during scuba diving and diving in space and how those processes may be regulated by both chronic and acute exercise;
- describe the physiological process of acclimatization to high altitude and in-depth describe the physiological challenges with exercise training at high altitude;
- present outcomes of literature studies in a written report, evaluate and discuss scientific results in English.

## Academic content

Circulatory and functional responses to a changed environment, such as diving, high altitude / mountaineering, exercise and training in cold and hot environments. Acute and chronic responses and adaptation to training.

<b>SPO3055</b>	<b>Research Methods in Exercise Physiology</b>
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures, PBL, laboratory work, tutoring. Approved practice report and written report. The timetable is available at <a href="https://timeplan.medisin.ntnu.no/timetable_show.php">https://timeplan.medisin.ntnu.no/timetable_show.php</a>
Entry requirements:	Admission to MSc in Exercise Physiology and Sport Sciences
Compulsory activities:	1. Written report 2. Approved practice report
Mode of assessment:	1-week home examination Letter grades (A-F)
Credit reduction due to overlapping courses :	SPO3050: 7.5 credits
Host department:	Department of Circulation and Medical Imaging
Course coordinator:	Professor Ulrik Wisløff

### Learning outcome

After completing the course SPO3055 the student is able to:

- know the nature of research - unscientific vs. scientific- ethical aspects;
- demonstrate in depth insight into different medical research designs, and have practical skills relevant for the field;
- demonstrate basic statistical knowledge and be able to calculate power;
- plan, design and apply for a research project to the Regional Ethical Committee;
- know in detail external and internal threats when designing studies as well as during the interpretations of data;
- present outcomes of literature studies in a written report, evaluate and discuss scientific results in English.

### Academic content

Introduction to theories of science, methods in exercise physiology research and basic statistics. Normally standard courses given at Faculty of Medicine constitutes the basic part of the course.

<b>SPO3060</b>	<b>Specialisation in Exercise Physiology</b>
Credits:	15
Period:	Spring
Teaching methods:	Lectures, tutoring. The timetable is available at <a href="https://timeplan.medisin.ntnu.no/timetable_show.php">https://timeplan.medisin.ntnu.no/timetable_show.php</a>
Entry requirements:	Admission to MSc in Exercise Physiology and Sport Sciences
Compulsory activity:	Compulsory literature: A minimum of 30 articles from peer-reviewed scientific journals.
Mode of assessment:	Report Letter grades (A-F)
Host department:	Department of Circulation and Medical Imaging
Course coordinator:	Professor Jan Helgerud

### Learning outcomes

After completing the course SPO3060 the student is able to:

- demonstrate intimate knowledge of the research forefront in the area of interest for the master's thesis and have practical skills relevant for the field;
- describe biological adaptations as a result of physical activity and exercise training within the area of research planned for the thesis;
- apply and adopt experimental methods within the area of specialisations and have practical skills relevant to perform the tests;

- present outcomes of research in a review article, evaluate and discuss scientific results in English leading to a logical research question for their thesis. Intimate knowledge of the research forefront in the area of interest for the master's thesis.

### **Academic content**

Specialisation within the area of research planned for the thesis. Review of research literature, and writing a review article in the area of specialisation for the thesis leading to a logical research question.

#### Year 2

<b>SPO3900</b>	<b>Thesis in Exercise Physiology</b>
Credits:	60
Period:	Autumn and spring
Teaching methods:	Tutoring and laboratory work
Required previous knowledge:	Admission to the MSc in Exercise Physiology and Sport Sciences
Mode of assessment:	Thesis and oral presentation/examination. The grade given on the thesis may be adjusted after the oral exam.
Credit reduction due to overlapping courses :	SPO3901:45 credits
Host department:	Department of Circulation and Medical Imaging
Course coordinator:	Professor Jan Helgerud

### **Learning outcome:**

After successful defense of the thesis the student is able to:

- carry out and present an experiment that can be developed to quality of an international peer-reviewed paper;
- demonstrate in depth knowledge of the theme built upon the specialisations in SPO3060 and have practical skills relevant for the field;
- apply and adopt experimental methods within the area of specialisations and have practical skills relevant to perform the tests;
- present outcomes of research in the thesis as an article with an extended introduction, evaluate and orally present and discuss the results in English.

### **Academic content**

The thesis should be within the area of the research competence among the available supervisors. The theme has to build upon the specialisation in SPO3060, and will be subject to approval by the programme board. The thesis is to be in the format of an article in a peer-reviewed research journal with an extended introduction, and will be subject to external evaluation. The evaluation is based on the thesis and an oral examination where the student presents his/her project (ca 30 min) with discussion. The oral examination is used to adjust the grade of the thesis.

More information is available at [www.ntnu.edu/dmf/studies/master](http://www.ntnu.edu/dmf/studies/master) (in English) or [www.ntnu.no/dmf/studier](http://www.ntnu.no/dmf/studier) (in Norwegian).