2020 Topics for Bachelor and Masters theses

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BSc projects

What strategies and devices can be used to reduce the risk of droplet and aerosol infection in sport? (Supervisor HW)

SARS-CoV-2 is the coronavirus that causes COVID-19. It is transmitted via droplets, aerosols or fomite (surfaces). When we breath, sneeze, cough, talk or sing we produce droplets and aerosols. Moreover, when we exercise our ventilation increases from 5-10 l/min to over 100 l/min during maximal exercise and it seems likely that this also increases droplet or aerosol production. The aim of the proposed thesis is to discuss the risk of droplet and aerosol infection during different types of sport and then to suggest strategies (e.g. increased building ventilation) and devices (e.g. facemasks that withstand the high exercise intensities during sport) how that risk can be reduced.

What strategies can be used to reduce the risk of fomite (surface) infection in sport? (Supervisor HW)

SARS-CoV-2 is the coronavirus that causes COVID-19. It is transmitted via droplets, aerosols or fomite (surfaces). Fomite infections are a problem esp. because we share sports equipment such as barbells or dumbbells or use the same surfaces such as rock during a climb. Thesis of the proposed thesis is to discuss the risk of fomite infections during different types of sport and to suggest strategies (e.g. disinfection) or devices (e.g. special gloves) to avoid SARS-CoV-2 infections during sports.

What is the evidence that EMS (electrical muscle stimulation) training works better than time-matched resistance training? (Supervisor HW)

EMS is a training method that is offered by gyms and other providers. But does it work? Will I gain more muscle mass and strength when I do EMS than when I spend the same time resistance training?

Should we be vegans or carnivores? A review of human diets since the out-of-Africa migration and evidence for genetic adaptation to regional diets. (Supervisor HW)

Roughly 55-65000 years ago, anatomically modern humans left their African home and peopled the rest of the world. As a consequence, diet changes and the introduction of agriculture and cattle further changed what we eat. The aim of this thesis is to find out how diets changed in this period and whether there is evidence that we have genetically adapted to diets.

Available subtopics:

- Domestication of plants, development of agriculture and evolution of agriculture diet-related alleles such as *AMY1*
- Change of human diet post the out-of-Africa migration until today

What is the carbon (CO_2) production per km of walking, running, cycling, e-cycling in comparison to cars, trains and planes? (Supervisor HW)

Regulation and association of protein breakdown proteins with exercise, muscle and disease (with Dr Arno Alpi at the Max Planck Institute in Martinsried)

Ubiquitins and related proteins break down proteins and have many other functions. For this project, you will be given a gene list and investigate through easy bioinformatical tasks whether these genes are switched on or off during exercise and in what organs these genes are expressed. Should you discover new information then a publication might be possible.

Development of a concept to produce training plans based on the best available scientific evidence. (Supervisor HW)

As a sport scientist you should be able to prescribe training plans that are based on the best available scientific evidence. But how is this done in practice? Your job is to develop a concept of how you can develop training planes based on mixed scientific evidence.

Compare and contrast the physiology and genetics of Tibetans and of people living in the Andes. (Supervisor HW)

Tibetans and people in the Andes have both genetically adapted to high altitude but there is evidence that there are differences. The aim of your project is to compare and contrast their physiology and to identify genetic variants selected in Tibetans and people living in the Andes.

What is the effect of catecholamines on cancer cell behaviour? (Supervisor HW)

Exercise increases the concentrations of catecholamines. Catecholamines then circulate in the blood and will also affect cancer cells, as many cancer cells carry adrenoceptors. Your task is to describe how different modes of exercise affect catecholamine concentrations, to illustrate the expression of adrenoceptors in cancer cells and to review studies that report the effect of catecholamines and related drugs such as beta-blockers on cancer cells and outcomes.

Do childhood cancer cells express receptors for hormones, myokines and metabolites that change during exercise? (Supervisor HW)

Exercise has beneficial effects in cancer but how exercise affects the behaviour of a cancer is poorly understood. The general mechanism must be that the exercising organs alter the composition of the blood and that the exercise-conditioned blood then perfuses and influences a tumour. The aim of your project is to complete the following tasks:

1) Produce a list of hormones such as catecholamines and myokines such as Il-6 that change during a bout of exercise.

2) Identify the receptors for these genes through a literature search.

3) Use tools such as Cancer Cell Line Encyclopedia to investigate whether childhood cancer cell lines and/or cancers express these receptors.

4) Use other tools to find out whether childhood cancer cells need these receptors for survival.

Based on this data you can then discuss whether it is likely that childhood cancers respond to exercise-induced hormones and myokines.

What is the role of genetics in iron deficiency and anemia? (Supervisor HW)

Human iron metabolism and haemoglobin concentrations vary greatly in a population, ranging from iron deficiency and anemia to hemochromatosis and extreme haemoglobin concentrations in individuals with chronic mountain sickness. Iron and haemoglobin metabolism is influenced by genetics, altitude exposure, nutritional iron intake and endurance training. The aim of your thesis will be to review the role of genetics in the variation of iron and haemoglobin metabolism. Based on your research, you should answer the following questions: Should at risk populations (e.g. female elite athletes or individuals that have been previously be identified as iron deficient or anemic) be genetically tested for iron and haemoglobin metabolism alleles? Should at risk individuals supplement with iron without testing? Should with high iron concentrations tested for alleles associated with hemochromatosis? What genetic and other tests should an athlete-focussed iron-haemoglobin lab offer?

Which proteomic biomarkers could be used to explain Unexpected Underperformance Syndrome, Overtraining, and overreaching in elite and/or recreational athlete? (Supervisor MS)

Excessive training and inadequate recovery could cause 'overtraining syndrome' (OTS), which is characterised by underperformance and fatigue. But the pathophysiology of OTS is unclear. In this systematic review, we want to discuss possible proteinogenic biomarkers which are associated with OTS.

Which metabolomic biomarkers could be used to explain Unexpected Underperformance Syndrome, Overtraining, and overreaching in elite and/or recreational athlete? (Supervisor MS)

Excessive training and inadequate recovery could cause 'overtraining syndrome' (OTS), which is characterised by underperformance and fatigue. But the pathophysiology of OTS is unclear. In this systematic review, we want to discuss possible metabolic biomarkers which are associated with OTS.

Which blood born micro RNAs are associated with Unexpected Underperformance Syndrome, Overtraining, and overreaching in elite and/or recreational athlete? (Supervisor MS)

Excessive training and inadequate recovery could cause 'overtraining syndrome' (OTS), which is characterised by underperformance and fatigue. But the pathophysiology of OTS is unclear. Circulating micro RNAs in the blood are new biomarker for diseases. In this systematic review, we want to discuss

MSc projects

Systematic literature review: What molecules significantly stimulate skeletal muscle hypertrophy in myotube cell culture, mice and humans? (Supervisor HW)

Abstract: Testosterone, Igf-1 and β2-agonists are examples for molecules that stimulate skeletal muscle hypertrophy. The aim of this review is to systematically screen the scientific literature (and anti-doping lists) for molecules that stimulate skeletal muscle hypertrophy. We will then discuss the pathways by which these molecules cause hypertrophy. The review will be useful anti-doping information and be a useful source of information for research into skeletal muscle hypertrophy. You will carry out the review together with Marius Meinhold who is a PhD student in the exercise biology group.

Scientific Interpretation of heart rate variability, fatigue and stress measured with in-ear sensor (Supervisor MS)

In this project, we would like to take a deeper look into the scientific interpretation of the heart rate variability (HRV) and it's corresponding parameters fatigue and stress using heart rate data measured with an in-ear sensor. The main purpose is to research the interpretation and possible evaluations of HRV parameters and their application in different scenarios (performance sports, occupational safety, medical). Before starting with the data collection and evaluation, a literature research on the different HRV parameters shall be conducted.