# Scientific Symposium
# University Vienna Research Platform
# Active Ageing

**9. April 2013**

at

University of Vienna, UZA II, Lecture Hall 6
Althanstraße 14, A-1090 Vienna, AUSTRIA

## Scientific Programme

## At University of Vienna Research Platforms have been established to pool scientific expertise for high level research

After a comprehensive international review process the Faculty of Life Sciences and the Centre of Sport Science and University Sports of the University of Vienna were able to establish a unique interfaculty Research Platform, focusing on research in Health Sciences and Ageing on a cellular and molecular level which should also include educational training of graduate students embedded in a multidisciplinary research cluster. The platform is based on collaborative research and also on the educational capacity from Nutritional Sciences (Emerging Field Oxidative Stress and DNA Stability), Pharmacy (Pharmacognosy, Molecular Target group), Sport Science (Sport and Exercise Physiology) and the Austrian Institute of Sports Medicine (ÖISM). Health and health promotion are major topics of both faculties and represent a central intersection of the present as well as of future research perspectives. The complementary expertise of the consortium members with background in nutritional sciences, pharmacy, sports sciences, exercise physiology and molecular biology and their national and international cooperations enables the establishment of a national unique research platform at the University of Vienna with international linkage. The work focuses on ageing and lifestyle changes thereby elucidating underlying molecular mechanisms and genome stabilizing effects, training-effect relationships and improving the general health and nutritional status. Experiments consider at the beginning lymphocyte studies isolated from people of different age as well as a large and long term human intervention study, addressing physical activity and/or nutrition optimization. The effect of lifestyle interventions will be observed comprehensively in muscle, plasma, lymphocytes and urine with sound and strongly accepted biomarkers as well as with observational assessments such as Quality of Life or depression score measurement, which are state of the art in gerontology. Particularly age-related goals will be addressed such as strategies in the prevention and therapy of sarcopenia, the increase of the nutritional status or the fall frequency, which significantly impacts elderly health but also health economy.
The major aim of the Active Ageing Group is, however, to provide high-level research on ageing and the impact of lifestyle on elderly with molecular and cellular tools. Cooperation partners such as the Institute of Physical Medicine and Rehabilitation, Social Medical Centre South - Kaiser Franz Joseph Hospital and the KWP (Kuratorium Wiener Pensionisten-wohnhäuser; largest provider of senior homes in Vienna) will guarantee that the results will be translated to public and implemented in official recommendations.
Another goal is the education and the training of master and PhD students, who are working within the platform activities, by lab rotations, joint supervision as well as support to attend conferences and for international research training.

This first scientific meeting shall introduce the research topic with national and international experts and inform on the preliminary results of the first research activities.

We hope that you will find the symposium stimulating,
On behalf of the organising committee

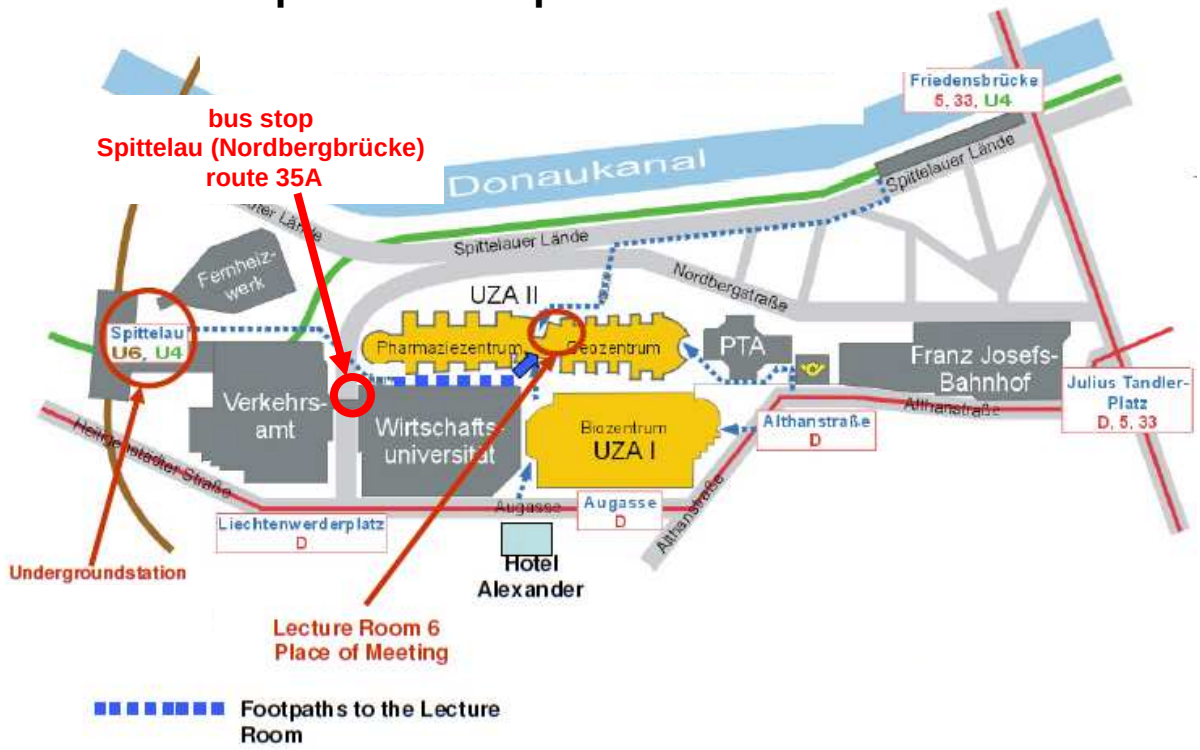
Karl-Heinz Wagner
Chair “Active Ageing”

Barbara Wessner
Vice Chair “Active Ageing”

## CONFERENCE VENUE

University of Vienna, UZA II,
Althanstrasse 14,
A-1090 Vienna, AUSTRIA
Lecture Room 6

## Map of the Campus Althanstrasse




## ORGANISATION

**Organising Institutions**
University of Vienna
Research Platform Active Ageing
Department of Nutritional Sciences
Department of Sport Science

**CREDITS FOR STUDENTS OF NUTRITIONAL SCIENCES**
Participation: 1 ECTS for the Master Programme (Modules 9 or 10)

# Programme

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| 08:15-09:00 | **Registration** |
| 09:00-09:15 | **Welcome address**<br>Susanne Weigelin-Schwiedrzik, Vice Rector for Research, University of Vienna |
| 09:15-09:45 | **Background of the Platform**; **Introduction into the scientific programme**<br>Karl-Heinz Wagner and Barbara Wessner, University of Vienna |
| 09:45-10:15 | **Physical activity in the elderly - needs for the future**<br>Norbert Bachl, Institute of Sport Science, University of Vienna |
| 10:15-10:45 | **Nutrition and physical fitness in the elderly**<br>Daniel König, Department of Rehabilitative and Preventive Sports Medicine, University of Freiburg, Germany |
| 10:45-11:15 | **Coffee/Tea break** |
| 11:15-11:45 | **Redox-regulating sirtuins in aging, caloric restriction, and exercise**<br>Zsolt Radak, Research Institute of Sport Science, Semmelweis University, Budapest, Hungary |
| 11:45-12:15 | **Functional, cardiovascular and molecular adaptations to resistance training in the elderly**<br>Daniela Caporossi, Italian University of Sport and Movement „Foro Italico“, Rome, Italy |
| 12:15-12:45 | **MicroRNAs and exercise adaptation**<br>Barbara Wessner, Institute of Sport Science, University of Vienna |
| 12:45-14:00 | **Lunch break** |
| 14:00-15:30 | **Insights into the first years of field work of the Platform**<br>Bernhard Franzke, Barbara Halper, Marlene Hofmann, Stefan Oesen, Anela Tosevska<br>Research Platform Active Ageing, University of Vienna, Vienna, Austria |
| 15:30-16:00 | **Coffee/Tea break** |
| 16:00-16:30 | **Assessment of skeletal muscle mass and muscle morphology**<br>Eva-Maria Strasser, Institute of Physical Medicine and Rehabilitation, Kaiser Franz Joseph Hospital, Vienna, Austria |
| 16:30-17:00 | **Ageing and its effects on inflammation in the skeletal muscle**<br>Jonathan Peake, School of Biomedical Sciences, Queensland University of Technology, Australia |
| 17:00-17:30 | **Transcriptomic responses of circulating neutrophils and skeletal muscle during recovery from endurance exercise**<br>Oliver Neubauer, Department of Nutritional Sciences, University of Vienna |
| 17:30-18:00 | **Open discussion, European/International links, Summary, Closing**<br>Karl-Heinz Wagner, Department of Nutritional Sciences, University of Vienna |

## PARTICIPANTS

### Affiliations of Speakers and Chairs

Prof. Norbert Bachl, Institute of Sport Science, University of Vienna, Auf der Schmelz 6, 1115 Vienna, Austria

Prof. Daniela Caporossi, Department of Movement, Humanistic and Health Sciences, University of Rome "Foro Italico"Piazza Lauro de Bosis 15, 11135 Rome, Italy

Mag. Bernhad Franzke, Research Platform Active Ageing, Department of Nutritional Sciences, Althanstraße 14, A-1090 Vienna

Mag. Barbara Halper, Research Platform Active Ageing, University of Vienna, Auf der Schmelz 6, 1115 Vienna, Austria

Mag. Marlene Hofmann, Institute of Sport Science, University of Vienna, Auf der Schmelz 6, 1115 Vienna, Austria

Prof. Daniel König, Division of Sports Nutrition, Department of Sports Science, University of Freiburg, Schwarzwaldstr. 175, 79117 Freiburg, Germany

Dr. Oliver Neubauer, University of Vienna, Department of Nutritional Sciences, Althanstraße 14, A-1090 Vienna; Heart Foundation Research Centre, Griffith Health Institute, Griffith University (Gold Coast Campus), Australia, 4222

Mag. Stefan Oesen, Research Platform Active Ageing, University of Vienna, Auf der Schmelz 6, 1115 Vienna, Austria

Dr. Jonathan Peake, School of Biomedical Sciences, Queensland University of Technology | Rm 603G Q Block (IHBI), Kelvin Grove Campus, Brisbane, QLD 4059, Australia

Prof. Zsolt Radak, Research Institute of Sport Science, Semmelweis University, Budapest, H-1085 Budapest, Hungary

Dr. Eva-Maria Strasser, Institute of Physical Medicine and Rehabilitation, Social Medical Centre South-Kaiser Franz Joseph Hospital, Vienna, Austria

Anela Tosevska, MSc, Research Platform Active Ageing, Department of Nutritional Sciences, Althanstraße 14, A-1090 Vienna

Prof. Karl-Heinz Wagner, University of Vienna, Department of Nutritional Sciences, Althanstraße 14, A-1090 Vienna; Heart Foundation Research Centre, Griffith Health Institute, Griffith University (Gold Coast Campus), Australia, 4222

Ass. Prof. Barbara Wessner, Institute of Sport Science, University of Vienna, Auf der Schmelz 6, 1115 Vienna, Austria

**ABSTRACTS**

*Session 1-1: 09:45-10:15*

## Physical activity in the elderly – needs for the future

***Norbert Bachl, MD, Institute of Sport Science, University of Vienna, Austria***

Ageing is a complex process, which generally needs more knowledge about genetic influences of the ageing processes itself, more knowledge about the impact of life style factors – epigenetic influences, more knowledge about the attitude and motivation to regular physical activity and how to induce more self-responsibility, more knowledge about how to implement greater support from public health organizations/health politics and - of course - more knowledge about the impact of physical activity from different disciplines like physiology, molecular biology, training science and others.
Although there is satisfying knowledge about physiologic adaptions with regard to regular physical activity or sedentary life style in the ageing process and although worldwide accepted recommendations for training programs for the elderly are existing, a lot of questions remain unclear, especially about the relation between strength-, endurance-, flexibility-, coordination and safety-training between young and older individuals. In addition, molecular signalling pathways show that there are a lot of influences which may induce or inhibit different processes in the balance of protein synthesis and protein degradation. One example of this is myostatin, which influences not only muscle strength, but also different metabolic pathways, interfering with other factors. Last but not least, electrostimulation, the application of growth factors and different drugs in addition to regular training will play an important role in the prevention of muscle atrophy, sarcopenia and mortality risks. Beside animal and human studies, a three dimensional bioengineered construct will be discussed, which allows to model in vivo skeletal muscles ageing in vitro and probably can be used for modelling the ageing process, depending on different interventions.

**Biosketch:** The specialisation of Prof. Bachl is Medical Exercise Physiology

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| 1984, 1988 | Team Physician of the Austrian National Team during the Olympic Games, Los Angeles Seoul |
| October 1991 | Appointment as Full Professor for Sports and Exercise Physiology at the Basic and Integrative Scientific Faculty at the University of Vienna |
| June 1994 – 1999 | Dean of the Basic and Integrative Scientific Faculty at the University of Vienna |
| since 1995: | Member of the Scientific Commission of FIMS (International Federation of Sports Medicine) |
| 1997-2009: | President of the European Federation of Sports Medicine |
| since May 1998: | Member of the Executive Committee of the FIMS |
| December 2002 | Appointment as General Secretary of the MC-EOC |
| since 2003 | Member of the Medical and Scientific Commission of the International Olympic Committee (IOC-MC) |
| 2004-2010 | Dean of the Faculty of Sports Science and University Sports Institute, University Vienna |
| July 2005 | Head of the IOC-MC Working Group „Molecular basis of connective tissue and muscle injuries in sport“ |
| June 2006-2014 | Vice-President of FIMS |
| 2007-2008 | Expert of the EU Commission “Physical, Activity and Health” |

*Session 1-2: 10:15-10:45*

## Nutrition and physical fitness in the elderly

***Daniel König, MD, Department of Sport Science, University of Freiburg, Germany***

Ageing is associated with a decline in motor function, muscle muss and muscular functional capacity. This goes in line with an increased risk for falls and overall prevalence for frailty. Although this process is to some extent part of the genetically predetermined process of ageing, it is well known that the extent and the speed of this process can be influenced by lifestyle interventions such as physical activity and nutrition.
A large number of reasons have been identified why dietary behaviour and nutrient uptake becomes suboptimal in aged subjects. This implies an unbalanced uptake of macronutrients as well as a decline in micronutrient density. Several investigations have shown that the process of debilitation with increasing age may be postponed or decelerated by an improved dietary behaviour. It has been shown that raising the amount and quality of dietary proteins may enhance the muscular anabolic response following resistance exercise and may increase muscle mass. Omega-3 fatty acids have been linked to promising results in preventing inflammatory processes, improved joint mobility and reduced pain. A higher amount of fruit and vegetable consumption has shown to be associated with improved immune function and oxidative stress following exercise. In a most recent trial it was demonstrated that compliance with dietary guidelines was associated with a better physical health related quality of life in aged subjects.

### Biosketch

Dr. König is Professor at the University of Freiburg. He is consultant for Internal Medicine and specialized in Cardiology, Endocrinology and Diabetology.
He is the Head of the Division of Sports Nutrition at the Department of Sports Science. His main areas of research interest are nutrition and chronic diseases, the effects of lifestyle intervention on obesity and the metabolic syndrome, fatty acids and lipoprotein metabolism, antioxidants and oxidative damage and nutritional needs of athletes.

*Session 2-1: 11:15-11:45*

## Redox-regulating sirtuins in aging, caloric restriction, and exercise

***Zolt Radak, PhD, Research Institute of Sport Science, Semmelweis University, H-1085 Budapest, Hungary;*** *radak@tf.hu*

The consequence of decreased nicotinamide adenine dinucleotide (NAD+) levels as a result of oxidative challenge is altered activity of sirtuins, which, in turn, brings about a wide range of modifications in mammalian cellular metabolism. Sirtuins, especially SIRT1, deacetylate important transcription factors such as p53, forkhead homeobox type O proteins, nuclear factor κB, or peroxisome proliferator-activated receptor γ coactivator 1α (which controls the transcription of pro- and antioxidant enzymes, by which the cellular redox state is affected). The role of SIRT1 in DNA repair is enigmatic, because it activates Ku70 to cope with double-strand breaks, but deacetylation of apurinic/apyrimidinic endonuclease 1 and probably of 8-oxoguanine-DNA glycosylase 1 decreases the activity of these DNA repair enzymes. The protein-stabilizing effects of the NAD+-dependent lysine deacetylases are readily related to housekeeping and redox regulation. The role of sirtuins in caloric restriction (CR)-related longevity in yeast is currently under debate. However, in mammals, it seems certain that sirtuins are involved in many cellular processes that mediate longevity and disease prevention via the effects of CR through the vascular, neuronal, and muscular systems. Regular physical exercise-mediated health promotion also involves sirtuin-regulated pathways including the antioxidant-, macromolecular damage repair-, energy-, mitochondrial function-, and neuronal plasticity-associated pathways. This review critically evaluates these findings and points out the age-associated role of sirtuins.

### Biosketch

Zsolt Radak is a professor and the current dean of the Faculty of Physical Education and Sport Science of Semmelweis University, Budapest, Hungary. He is in the editorial board of Biogerontology, Dose Response, The Open Journal of Sport Medicine, and Journal of Sport Science and Medicine.

He graduated in Physical Education from Hungarian University of Physical Education and received PhD from Tsukuba University, Japan. He worked as a post-doc at Toho University, Japan. He established the Research Institute of Sport Science at Semmelweis University, and served as a head of Sport Science doctoral school and from November of 2012 he is the dean of the Faculty.

His research interest involves molecular mechanism of oxidative stress, aging in a relation to physical exercise. His group published papers on the effects of exercise on redox regulation in skeletal muscle and brain and his group published papers on how exercise and aging modulates DNA damage and repair. Recently he is interested on the complex role of sirtuins in aging and exercise-mediated adaptation.

*Session 2-2: 11:45-12:15*

## Functional, cardiovascular and molecular adaptations to resistance training in the elderly

***Daniela Caporossi, PhD, Department of Movement, Humanistic and Health Sciences, University of Rome*** *daniela.caporossi@uniroma4.it www.uniroma4.it*

Current recommendations aimed at reducing neuromuscular and functional loss in aged muscle have identified muscle power as a key target for intervention trials, although little is known about the biological and cardiovascular systemic response in the elderly. We investigated the effects of 12 weeks of low frequency, moderate intensity, explosive-type resistance training (EMRT) on muscle strength and power in old community-dwelling people (70–75 years), monitoring daily living activities (ADL) task performance and cardiovascular response, as well as biomarkers of muscle damage, cardiovascular risk, and cellular stress response. EMRT significantly enhanced muscular strength and power as well as in functional performance without causing any detrimental modification in cardiovascular, inflammatory and muscle damage parameters. Moreover, trained elderly subjects showed an adaptive response both at systemic and cellular level by modulation of anti-oxidant and stress induced markers. Given the difficulties to motivate individuals to take part in a vigorous training program, healthy elderly subjects participating in supervised low-frequency EMRT can effectively maintain a critical level of muscle capacities, benefiting both systemic and cellular levels.

### Biosketch

Daniela Caporossi is Associate Professor of Biology and Genetics at the University of Rome "Foro Italico", and Chair of the Unit of Biology, Genetics and Biochemistry of Movement. She is a member of the SFRR-Europe Executive Committee and of the ECSS (European College of Sport Science) Scientific Committee. She is an Associate Editor for European Journal of Sport Sciences.

She graduated in Biological Sciences from "La Sapienza" University in Rome, followed by post-doc position in Rome and Hamilton (Canada), faculty position in Rome, and professorship at the "Tor Vergata" University and, lastly, at the "Foro Italico" University, in Rome, where she established a new research group working on the cellular and molecular basis of health-related physical activity.

Her research interests are on the role of altered redox potential in the in vivo and in vitro induction of DNA damage and apoptosis, and on the involvement of free radicals in the signal transduction pathways of skeletal muscle cells. Recently, her group focused on physical activity-related changes on the expression of stress response proteins, pointing to the role of redox state in modulating the post-transcriptional regulation processes. Model systems of immune, skeletal and cardiac muscle cells are employed to investigate processes of alternative splicing and microRNA expression correlated to the oxidation of cellular components.

*Session 2-3: 12:15-12:45*

## MicroRNAs and exercise adaptation

***Barbara Wessner, PhD, Institute of Sport Science & Research Platform Active Ageing, University of Vienna, Vienna, Austria,*** *barbara.wessner@univie.ac.at*

MicroRNAs (miRNAs) are small, non-coding, single stranded RNA molecules (19-24 nucleotides in length) that influence mRNA or protein levels by promoting either mRNA degradation or by preventing protein translation. *In silico* target prediction has revealed that they might regulate more than two thirds of human genes therefore playing an important role in physiological as well as pathophysiological processes. As such miRNAs have been identified as mediators of biological processes such as inflammation, angiogenesis, mitochondrial metabolism, cardiac and skeletal muscle contractile force generation and muscle hypertrophy.
Adaptation to exercise involves changes of course in skeletal and cardiac muscle but also in other cell and tissue types such as immune cells or endothelial cells. It has been shown that various miRNAs are involved in the fine-tuned regulation of these adaptive or regenerative processes.
Besides their abundance within different cell types, significant levels of miRNAs were detected in serum and other body fluids such as plasma, saliva, and urine. In serum they are remarkably stable due to their association with RNA-binding proteins, exosomes or HDL. Given this stability and the fact that the expressions of certain miRNAs are linked to specific tissues, expectations for the use of circulating miRNA as non-invasive biomarkers for the diagnosis, prognosis and therapeutic appraisal of diseases such as cancer, cardiac failure, diabetes mellitus, and acute hepatitis are raised.

### Biosketch

Barbara Wessner currently is Assistant Professor in the field of Molecular Exercise Physiology at the Centre of Sport Science and University Sports of the University of Vienna. She also acts as Deputy Head of the Research Platform Active Ageing.
She graduated in Biotechnology/Molecular Biology and has a strong background in Nutritional Science and Immunology. After her period as Research Associate and lecturer at the Medical University of Vienna (1999-2006), she was entrusted with the task to establish a molecular biological laboratory at the Institute of Sports Sciences at the University of Vienna which aims to study molecular, cellular, physiological and integrative processes of normal and altered skeletal muscle during health, ageing and disease.
Main research topics include the influence of nutritive antioxidants on the cellular redox potential, assessment of the antioxidative status in critically ill patients, improvement of the muscular performance of elderly persons, application of microarray-technology for the characterisation of effects of human growth hormone on blood mononuclear cells in healthy, active subjects, and influence of age, gender, and strength training on human muscle microRNA expression.

*Session 3: 14:00-15:30*

## The Research Platform Active Ageing

***Bernhard Franzke, Barbara Halper, Marlene Hofmann, Stefan Oesen, Anela Tosevska, Department of Nutritional Sciences, Institute of Sport Science, University of Vienna, Vienna, Austria,***

### Introduction

Von Haehling et al. [1] showed that 5-13% of 60- to 70-year-old and 11-50% of people over 80 years are affected by sarcopenia. Recent observations proved that resistance training is effective up to old age to mitigate the effects of sarcopenia [2,3]. However, most of the studies applied resistance training performed on weight machines which is not practicable for most of seniors. Therefore, we aimed to capture the effect of resistance training using "Therabands" and own body weight on a wide range of physiological parameters in institutionalized elderly. Moreover, the effect of dietary supplementation enriched with branched chain amino acids was examined. Besides the classic nutrient analyses we also measured the impact of the intervention on DNA and chromosomal damage, oxidative stress related markers as well as the telomere length.

### Methods

The population of this randomized, observer-blind, controlled intervention study consisted of healthy untrained men (n=14) and women (n=103) aged 82.8 (±6.0) years. They were distributed randomly but stratified by sex to one of 3 groups [Cognitive training (CT), resistance training (RT), RT+supplement (RTS)]. Resistance training was performed supervised 2x/week in small groups during the first 6 months. In the following 6 months it was completed supervised 1x/week and 1x/week self-organized. After one year, the exercises were performed independently 2x/week for another 6 months including a support team to provide assistance. Strength training protocol follows the guidelines of the American College of Sports Medicine (ACSM). CT was based on activities with coordinative or cognitive tasks. The supplement (FortiFit, Nutricia) was distributed every morning as well as after training. Besides the collection of anthropometric data such as size, weight and body composition, body fat and fat-free mass, functional tests of physical performance and strength tests were measured. These investigations furthermore include an isokinetic torque measurements of knee extensors - and flexors, the isometric handgrip strength, chair-sit & reach test to assess the flexibility, the single leg balance test for balanced state, the maximum walking speed, the arm curl test and the Chair-Rising test for measuring the dynamic force capability of the upper and lower limbs as well as the 6min walking test to assess aerobic endurance. The muscle mass is measured by ultrasonic or DXA. Objective assessment of physical activity is completed by means of accelerometers. To assess the impact of each intervention and to understand mechanistically clinical laboratory parameters, immunological parameters and oxidative stress, blood samples were taken, as well as muscle biopsy for measuring inflammatory and growth factor signalling pathways. DNA and chromosomal damage were measured in blood and buccal cells by Comet Assay and Cytokinesis Block Micronucleus Cytome Assay. Furthermore we aim to assess the changes in oxidative stress related enzymes (SOD, GSH and Catalase), telomere length as well as the nutritional status.

## Summary

The results of this study are universally applicable. From a scientific point of view, it provides information on the effectiveness of a combined nutrition and resistance training intervention in older institutionalized persons. In this case, functional parameters are associated with mechanistic parameters. Through the sustainable approach, the study is also interesting for social policy, since it also aims the feasibility of such a program including aspects such as well-being and social interaction.

## References

[1] von Haehling, S, et al. (2010). J Cachex Sarcopenia Muscle, 1(2), 129-133
[2] Peterson, MD, et al. (2010). Ageing Res Rev, 9(3), 226-237
[3] Rabelo, HT, et al. (2011). J Strength Cond Res, 25(8), 2298-303

## Biosketches

**Bernhard "Billy" Franzke**
Billy Franzke was born in 1981 in Vienna. Sports and exercise have been a part of his life ever since. After finishing high school with a focus on sports he studied Sports Science at the University of Vienna (Austria). There he specialised in the field of performance sports and graduated in 2008. He spent some time in doing sports and health related projects and never totally lost contact to science. Within these projects he became an expert in training and working with older people. Now he is part of the research platform "Active Ageing" (Department of Nutritional Sciences, University of Vienna) and is working on his PhD theses where he focuses on the effects of exercise and nutrition on DNA damage and chromosmal damage in the elderly. Besides his tasks at the research platform he invented the "Vienna City Boot Camp", an outdoor fitness class, where he motivates and trains people to lead a healthy lifestyle and to reach their fitness goals.

**Barbara Halper**
Born in 1984 Barbara Halper studied Sport Science at the University of Vienna (Austria). After Graduation in August 2010 she started her PhD in June 2011 at the Research Platform "Active Ageing", a project of the Institute of Sport Science and the Department of Nutritional Sciences. Within this project she is investigating the effects of progressive resistance training on inflammatory parameters in institutionalized elderly. Moreover she works as a lecturer at the Institute of Sport Science.

**Marlene Hofmann**
Born 1985 in Upper Austria, Marlene Hofmann studied Sport Science at the University of Vienna. After finishing her diploma thesis on the influence of sport massage on muscle damage parameters after high intensity training, she has been to Berlin (Germany) to complete an internship at the laboratories of the Berlin-Brandenburg Center of Regenerative Therapies of the Charitè (University of Medicine Berlin) to gain knowledge about cell analysis methods. She started to work with the team of the "Active Ageing" project in April 2012 and focuses now on the signaling pathways of skeletal muscle cell in aged humans. Therefore human muscle biopsies and blood is used to determine parameters like Myostatin, IGF-1 and in this context also muscle specific micro RNAs and Exosomes. Moreover she is lecturer at the Center of Sport Science and is currently working on publications to finish her PhD studies next summer.

**Stefan Oesen**
Born in 1985 Stefan Oesen studied Sport Science at the University of Vienna (Austria). After Graduation he started his PhD at the Research Platform “Active Ageing”, a project of the Institute of Sport Science and the Department of Nutritional Science. Within his project he is investigating the effects of progressive resistance training on physical activity and functional performance in institutionalized elderly. Moreover he works as a lecturer at the Institute of Sport Science.

**Anela Tosevska**
Anela Tosevska was born in 1986 in Skopje, Macedonia. She studied at the Ss. Cyril and Methodius University Skopje, Macedonia, obtaining the degree Master of Pharmacy. After graduation she was working within a research project at the Max F. Perutz Laboratories in Vienna, Austria, where she gained practical experience in various methods and techniques used in Molecular Biology.
She started her PhD in February 2012 at the working group of Prof. Wagner, within the Research Platform Active Ageing at the University of Vienna. The focus of her research are the cellular and molecular changes happening in the human body during physiological ageing, as well as the effects of physical exercise on oxidative stress and inflammation. She is especially interested in telomere biology and its link to ageing and age-related diseases.

*Session 4-1: 16:00-16:30*

## Assessment of skeletal muscle mass and muscle morphology

***Eva – Maria Strasser, MD, Institute of Physical Medicine and Rehabilitation / Karl LandsteinerInstitute of Remobilisation and Functional Health, SMZ-Ost / Kaiser Franz Joseph Spital, Vienna, Austria,*** *Eva-maria.strasser@wienkav.at*

Sarcopenia is characterized by significantly reduced skeletal muscle mass, muscle strength and functional physical performance. Changes in skeletal muscle mass are closely related to a progressive loss of skeletal muscle strength in ageing people. Moreover, low muscle strength is predictive for immobilization, physical disability and increased mortality. The increase of elderly in our society requires simple tools for quantification of sarcopenia. Until now, magnetic resonance tomography or computer tomography are the gold standards to measure muscle mass and muscle composition. Although these techniques provide precise results, they are expensive, cause radiation exposure and are of restricted availability. Musculoskeletal ultrasound is another bedside imaging method used to assess muscle mass as well as architecture and composition. Muscle thickness, pennation angle and echogenicity are parameters which can be easily determined with musculoskeletal ultrasound. In a recent publication we investigated the correlation between skeletal muscle strength of m. quadriceps and parameters assessed by musculoskeletal ultrasound in young and elderly patients. We found a significant and strong correlation between isometric maximum voluntary contraction force and muscle thickness of all muscles of m. quadriceps in young as well as in old patients. Therefore, musculoskeletal ultrasound measurement of muscle thickness could be an accurate and bedside tool for diagnosis and course of sarcopenia in neuromuscular unimpaired patients. This presentation should give a short overview about the methods used to quantify skeletal muscle mass and should introduce musculoskeletal ultrasound as an upcoming method to investigate muscle morphology in sarcopenic patients.

### Biosketch

Eva – Maria Strasser finished her study of medicine at the Medical University of Vienna in 2005. During her study she frequently was involved in research projects at the Surgical Research Laboratories, Medical University of Vienna with the main focus on effects of oxidative stress and antioxidants on immune function. Since then her research work focused on the investigation and treatment of muscle loss during acute or chronic illness as well as ageing. In correlation to her research interests she started a clinical education to become a specialist in Physical Medicine and Rehabilitation in 2007. Theoretical and practical educations in the field of sports medicine, manual medicine and pain management accompanied the clinical education, which will be finished in May 2013. The recent focus of her research interest is musculoskeletal ultrasound and the investigation of bedside methods for sarcopenia diagnosis

*Session 4-2: 16:30-17:00*

## Ageing and its effects on inflammation in the skeletal muscle

***Jonathan Peake, PhD, School of Biomedical Sciences, Queensland University of Technology, Australia***

The aging population is increasing dramatically throughout the world. Current estimates predict that by 2050, the world's elderly population (>60 yr) will have tripled from 650 million at present to 2 billion. This trend presents special health challenges, which include assisting the elderly population to maintain or improve physical activity, independence, and quality of life. Skeletal muscle mass decreases by 1–2% each year beyond the age of 50. This process is commonly referred to as 'sarcopenia'. Importantly, sarcopenia is a key factor contributing to frailty, loss of functional mobility and independence, and mortality in the elderly. Sarcopenia is a multifactorial condition. Various factors are believed to contribute to sarcopenia, including reduced neural innervation of skeletal muscle, decreased physical activity, changes in diet, hormonal alterations and chronic low grade inflammation. The combination of declining muscle mass and reduced physical activity creates a 'vicious cycle', whereby elderly people are weaker and physically active, which contributes to further loss of muscle mass. Coupled with the loss of muscle mass is the loss of muscle quality with aging, whereby muscle tissue is replaced with adipose tissue. This process can lead to another condition known as 'sarcopenic obesity'. Sarcopenia is a risk factor for falls among the elderly, which can result in bone fractures and other soft tissues injuries. Aging reduces the efficiency of tissue regeneration in such a way that bones become more brittle and muscles become more fibrotic. Once again, these processes create an undesirable situation that predisposes the elderly to increasing risk of injuries. Physical exercise has many potential benefits for the elderly, including the maintenance of muscle mass, increased fat oxidation and potential anti-inflammatory effects. Aerobic exercise appears to be effective for stimulating metabolism within adipose tissue stores, while resistance exercise is effective for counteracting inflammation-induced muscle wasting. Supplementing with dietary protein may also be beneficial for maintaining muscle mass, although these benefits may depend on regular protein intake in the diet. This presentation will introduce the concept of aging, its importance in society, and recent trends/topics in the area of inflammation, immunity and lifestyle.

**Biosketch**

Dr Peake completed his PhD in exercise physiology in the School of Human Movement Studies at The University of Queensland in 2004. In 2005, he worked as a JSPS postdoctoral research fellow at Waseda University in Japan. Between 2006 and 2008, he worked as a postdoctoral research fellow in the School of Human Movement Studies at The University of Queensland. Between 2009 and 2011, he continued working as a research fellow in the School of Human Movement Studies and the Centre for Military and Veterans' Health at the University of Queensland. Since 2012, he has been working as a lecturer in physiology in the School of Biomedical Sciences at Queensland University of Technology. His main research interest is in the area of exercise, muscle metabolism and inflammation. He has conducted research on the relationship between exercise-induced muscle injury and inflammation in athletes. He has also conducted research on the relationship between inflammation, metabolic disease and muscle wasting in the elderly and people with chronic diseases. He is also interested in gastrointestinal inflammation, diet and heat stress.

*Session 4-3: 17:00-17:30*

## Time-course of transcriptomic responses in circulating neutrophils and skeletal muscle tissue during recovery from endurance exercise

***Oliver Neubauer, PhD*** [1.,2.]
***1.) Department of Nutritional Sciences, Emerging Field "Oxidative Stress and DNA Stability" and "Research Platform Active Ageing", University of Vienna, Austria;***
***2.) Heart Foundation Research Centre, Griffith University, Australia***
*oliver.neubauer@univie.ac.at*

Re-programming of gene expression is fundamental for regulating immune cellular activity and skeletal muscle adaptations in response to endurance exercise. This study aimed to investigate the changes in the transcriptome of circulating neutrophils and skeletal muscle throughout recovery and, for the first time, beyond 48 hours after an endurance exercise trial consisting of 1 hour (h) of cycling followed by 1 h of running. Eight healthy, endurance-trained, male subjects participated (age: 25.0 ± 4.1 years). Blood and skeletal muscle samples were taken one week before, and 3, 48, and 96 h after exercise under standardized conditions. RNA was extracted from blood neutrophils and muscle tissue. Differential gene expression was evaluated using Illumina microarrays, and validated with qPCR. Gene set enrichment analysis identified functionally related gene groups chosen from the Molecular Signatures Database. The data indicated that circulating neutrophils were transcriptionally activated and primed in particular in response to exercise-induced muscle damage 3 h post-exercise. Observed concomitant counter-regulatory responses in the neutrophils might have contributed to the return to their non-activated state, and the resolution of systemic inflammatory response by 48 h post-exercise. The molecular signature of skeletal muscle 3 h post-exercise indicated leukocyte infiltration, immune and chaperone activation, the activation of transcription factors and distinct signalling pathways, several of which were related to the muscle damaging component of the exercise trial. At 48 and 96 h post-exercise, the transcriptional activity in the muscle was mainly associated with cytoskeleton and extracellular matrix remodelling, chemokine signalling, and cell stress management, indicating that recovery was still incomplete. The current study provides novel insights into the molecular mechanisms underlying the pro- and anti-inflammatory responses of neutrophils, and the acute stress, recovery, and adaptive responses of skeletal muscle to endurance exercise.

### Biosketch

Dr. Oliver Neubauer is a Postdoctoral Research Fellow and Lecturer at the Department of Nutritional Sciences at the University of Vienna. He completed his doctoral studies within the scope of an Austrian Science Fund (FWF)-funded study on the acute stress and recovery responses in Ironman triathletes, led by Prof. Karl-Heinz Wagner. For the publication output acquired from the "Ironman study", Dr. Neubauer was awarded with the Faculty of Life Sciences-Young Investigator Award and the prestigious Erwin Schrödinger-Fellowship by the FWF. Within the frame of this Fellowship, Dr. Neubauer has been undertaking a research study at Griffith University (Australia), which is currently presented. At present, Dr. Neubauer has eleven publications in internationally referred scientific journals, most of which are top-10% or top-25% journals in their respective disciplines. In accordance with his own experience as an Ironman triathlete, Dr. Neubauer is committed to translate science into practical applications. His main research interests include molecular exercise physiology focused on health-related implications, redox biology and antioxidants in acute exercise and exercise training, exercise immunology, and sports nutrition.

*Session 5-1: 17:30-18:00 - Summary*

## Research Platform in the International context

***Karl-Heinz Wagner, PhD*** [1.,2.]
***1.) Department of Nutritional Sciences, Emerging Field "Oxidative Stress and DNA Stability" and "Research Platform Active Ageing", University of Vienna, Austria;***
***2.) Heart Foundation Research Centre, Griffith University, Australia***
*karl-heinz.wagner@univie.ac.at*

Ageing represents one of the major challenges common to all European countries, which is reflected in the upcoming HORIZON 2020 program of the European Commission. "Active ageing, independent and assisted living" is one of the health priorities which will be set in the program. However, not only in Europe but also in other countries/regions worldwide ageing represents a major field of interest and investment.
Our long term aim is to link the activities of our platform into large international projects related to ageing, but also to specialized topics related to the ageing aspect.
One example of an overseas link is the BIOAGE project. BIOAGE is a collaborative research project between five distinguished universities and research institutes in Europe (Austria and Norway), New Zealand and Australia. The overall aim of the proposed staff exchange program is to build, extend and strengthen sustainable international collaborations between the partners so as to create a knowledge base for biomarker based research related to ageing, sampling techniques in the elderly and biomonitoring studies. Further, young researchers should be trained to be the next biomarker experts. Within this aim the exchange objective is to provide researchers with: 1] an international platform to learn, train and apply novel biomarkers as well as sampling techniques and methods, 2] the opportunity to formulate new joint collaborative research and funding proposals, 3] the possibility to participate in large human biomonitoring studies, and 4] international exposure and intercultural understanding.

### Biosketch

K.H. Wagner is Nutritionist and received his PhD 1999 in Vienna focusing on lipid oxidation pathways, the evaluation of various bioactive substances and their antioxidative potential. During his Post Doc period, which he did in Vienna and Uppsala (Sweden) he focused on food bioactivity studies and also explored potential anti-genotoxic effects of food compounds. Since 2011 he is Full Professor for Nutritional Sciences and Food Quality at University of Vienna, Faculty of Life Sciences and he is co-leading the faculty focus "Nutrition associated molecular mechanisms of ageing" and leading the Emerging Field "Oxidative Stress and DNA Stability". The latter field is now the main research focus which he is exploring in several international human intervention studies. Since 2010 he is Adjunct Professor at School of Public Health at Griffith University in Australia and in this year he also received the leadership of the University Research Platform "Active Ageing". He is member of several commissions on nutrition and food quality and in the Leadership teams of the Austrian Nutrition Society, the Austrian Nutrition Commission the Austrian Society of Agricultural and Environmental Research as well as the European Section of the American Oil Chemists Society.

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