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Eesti Teadusagentuur  
Estonian Research Council

# Mobilitas **COMPASS** Grantees

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**2013**

Estonian Research Council

**Mobilitas  
COMPASS**

**2013**

**Grantees**

Tallinn  
2014

## Estonian Research Council

(Eesti Teadusagentuur)

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# Dear reader

The researcher mobility programme Mobilitas, co-funded from the European Social Fund, is running from 2008 until the end of July 2015. The programme aims to activate the international exchange of researchers and knowledge and is targeted at postdoctoral and top-level researchers. Based on the profiles recognised by the European Framework for Research Careers, this means Recognised Researcher (R2) through Established Researcher (R3) to Leading Researcher (R4).

The Estonian Research Council has awarded 127 postdoctoral grants, the majority of which are for incoming grants, but there are also 28 outgoing grants and 12 grants for mobility within Estonia. The postdocs who have received grants work in seven different R&D institutions – 73 in the University of Tartu, 27 in the Tallinn University of Technology, 10 in Tallinn University, 8 in the National Institute of Chemical Physics and Biophysics, 7 in the Estonian University of Life Sciences, and one in both the Estonian Literary Museum and Protobios.

18 top researchers have received funding for creating their own research group. 6 of the research groups are working in the area of material technology, 5 investigating topics related to biotechnology, and the others are concerned with environmental technology (3 groups), energy (3 groups) and information and communication technology (one group).

The grants are divided between 4 R&D institutions: the University of Tartu and the Tallinn University of Technology (both have 6 grants), the National Institute of Chemical Physics and Biophysics (4 grants), and Tallinn University (2 grants).

2013 marks a turning point for the Mobilitas programme: we have reached the second half of the programme with all the activities in progress. Over 50 researchers have already finished their project work and it is now a good time to have an overview of what we have achieved and also inform the public about our grantees' contribution to both Estonian and international research. With this aim in mind, we decided to publish this booklet – “Mobilitas Compass 2013” containing a collection of popular narrative texts on research conducted by the Mobilitas postdocs and top researchers. The initiative involves all the grantees who fully completed their research project within the programme period.

“Mobilitas Compass 2013” is co-authored by 52 researchers – one top researcher and 51 postdocs. It is a joint effort and I want to thank everyone for their contributions.

*Tiina Loit  
Mobilitas Programme Manager*

# **Partner Institutions**

**University of Tartu**

**Tallinn University of Technology**

**Tallinn University**

**National Institute of Chemical Physics and Biophysics**

**Estonian University of Life Sciences**

**Estonian Literary Museum**

**Protobios LLC**

# **Intermediate Body**

**Ministry of Education and Research**

# **Implementing Agency**

**SA Archimedes**



# Thomas Fehniger

Top Researcher in the field of biotechnology

- Title: Biomarkers Measuring Inflammation
- Grant: MTT12, 1 Jan 2010 – 31 Dec 2012
- Partner institution: Tallinn University of Technology

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**“** I thank the Estonian Research Council for the opportunity to work in Tallinn. Collaborations with Estonian scientists are continuing in Sweden at Lund University where I have taken the position of Director, Center of Excellence in Biological and Medical Mass Spectrometry. **”**

## Biomarkers Measuring Inflammation

The development of human disease is accompanied by changes in the expression profiles of proteins that serve important biological purposes in cellular function. The identification and measurement of such proteins can serve to support clinical decision making, for example, in the diagnosis of disease, providing evidence of the response to therapy, or the prediction of clinical outcome.

The aim of this research program was to discover new clinical biomarkers of inflammatory disease in the lungs of smokers that may indicate early signs of bronchitis, emphysema, and airway obstruction. At the Institute of Clinical Medicine at the Tallinn University of Technology (TUT) led by Professor Ruth Sepper, MD, PhD, we investigated the cell marker phenotype of inflammatory macrophages, neutrophils, and lymphocytes that accumulate in the lung. We discovered that macrophages developing in the lungs of smokers showed

abnormal gene and protein expression and cell differentiation, including a switch to an unusual state of mucin hyper-expression. In another line of study that investigated drug delivery to the lungs of smokers, we provided the first direct evidence of the fate of an unlabeled drug, following delivery to human patients. Here, we exposed patients to inhaled anti-muscarinic receptor antagonists and then measured the location of the drug in the airway walls. The projects performed at the Institute of Clinical Medicine at TUT provided successful graduate training for three young scientists and more than twelve publications.

In conclusion, these studies have brought forward new opportunities for identifying novel patterns of biomarker expression and new knowledge that can be used to diagnose and monitor early disease development in smokers.



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# Vincent Perrier

- Title: Biodiversity changes across the Ordovician and Silurian environmental crises
- Supervisor: Tõnu Meidla
- Grant: MJD1, 1 Oct 2009 – 30 Sept 2012
- Partner institution: University of Tartu

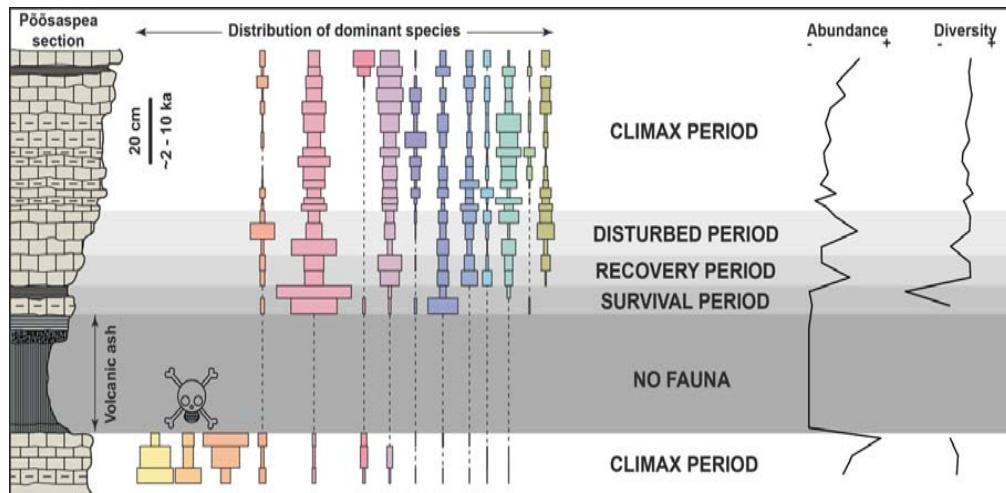
“ My Mobilitas grant opened the gates to a postdoc in Leicester (UK) to study the first planktonic ostracods. The next step is to find a position, why not in Estonia! ”

## Impact of Volcanism on Past Sea Life

We studied the biotic effect of ancient volcanic ash-falls in the subtropical sea that covered the Estonian territory 450 million years ago (Ordovician).

To record the biotic response to the environmental perturbation, we selected fossils of small crustaceans (ostracods) that are very diverse and abundant in these rocks.

We recovered and identified 13,000 fossils from two sections in NW Estonia across two volcanic ash layers of different age and thickness (~40 cm, Põõsaspea section; ~6 cm, Ristna section). In both cases, the fossil evidence reflects a complex recovery process that follows several steps: a survival period (few tolerant species), a recovery period (recolonization)



and the return to climax assemblages.

The recovery intervals are less than 1 m thick in both sections, but time estimates show that the recovery period lasted much longer than similar processes in modern seas.



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## Hugo Reinert

- **Title:** Sacred Others in a Changing Landscape – Environmental Change and Animal Practice in the Norwegian Arctic
- **Supervisor:** Hannes Palang
- **Grant:** MJD3, 1 Oct 2009 – 30 Sept 2012
- **Partner institution:** Tallinn University

“Currently, I’m a senior researcher at the Estonian Institute of Humanities, where I am conducting a research project on the new wave of mining activities in the European Arctic. I still have a thing for geese.”

”

## On a Wild Goose Chase

Ethnography is an art of disciplined serendipity: it invites you to follow strange trails and look for unexpected puzzles. My postdoctoral project set out to investigate the changing nature of human–nonhuman relations in the Arctic: soon enough, the actors I followed also took me elsewhere.

My principal case study focused on exploring conservation efforts for the diminutive and highly endangered Lesser White-fronted Goose (*Anser erythropus*). The species breeds in Northern Norway but migrates in vast loops across the length of the Eurasian landmass. Its transnational range complicates conservation: as I was to discover, international conservation work was further complicated by powerful controversies over issues such as the use of captive-bred birds for supplementation or the validity of “artificial” migration paths. Some believed such methods were acceptable; oth-

ers, that they compromised the natural “wildness” of the birds. Normative conceptions of “nature” were at odds everywhere, sharply entangled with scientific methods, influencing policy, defining the scope of conservation on a rapidly changing planet. Across northern Europe, I heard stories of peaceful ornithologists coming to blows at conferences over issues of genetic purity. I learned about ringing schemes and illegal markets for rare eggs, the dangers of imprinting, how to tell Barnacles from Pink-foots. For three years, I dreamed about geese.

Writing up this material, in turn, helps me draw out another aspect of ethnography — the craft by which the tiniest details help reframe the issues of the day, and a small and disappearing goose can tell us much about how we live, how we deal with change and agency and limits in a world defined increasingly by climate change and mass extinctions.



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## Triin Reitalu

- **Title:** Unraveling the history of plant diversity patterns by means of pollen analyses: an interdisciplinary approach
- **Supervisor:** Siim Veski
- **Grant:** MJD4, 1 Nov 2010 – 31 Oct 2013
- **Partner institution:** Tallinn University of Technology

**“** *I would like to study and develop methods to reconstruct long-term (millennial scale) plant diversity changes using pollen data, plant macro-remains and ancient DNA.* **”**

## Human Impact on Long-Term Forest Change

In Europe, humans have influenced natural communities for thousands of years. It is not clear whether long-term vegetation changes are caused by climate or by human influence like the expansion of agriculture.

The aim of my project was to statistically assess the relative importance of climate and human impact on Estonian forest composition during the last 5000 years. Data on forest composition (10 most abundant tree and shrub taxa) were derived from 18 Estonian pollen records and transformed into vegetation cover estimates using a vegetation reconstruction model. Human impact was quantified with palaeoecological estimates of openness and proportion on cereal cultivation. Climate was characterized with the help of a climate model and stable oxygen isotope data.

The results showed that both climate and human impact were significant predictors of forest compositional change during the last 5000 years. While climate exerted a dominant influence on forest composition at the beginning of the study period, human impact was the strongest driver ca 4000–2000 years ago when permanent agriculture became established and expanded.

Human impact has favoured early-successional trees and shrubs that colonize abandoned fields (birch, willow, alder) or that can grow on less fertile soils (pine); it has limited trees that tend to grow on more fertile soils (spruce). Our results show that, in addition to climatic influence on forest composition, several forest taxa have been significantly influenced by human impact over the last four millennia.



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# Athanassios Giannitsis

- **Title:** Development of a Microfluidic lab-on-chip for bioimpedance measurements on droplet-based bioreactors
- **Supervisor:** Mart Min
- **Grant:** MJD5, 1 Sept 2009 – 31 Aug 2012
- **Partner institution:** Tallinn University of Technology

**“** In my present occupation at the Leiden University, Netherlands, I am working on the design, fabrication, and optimisation of microfluidic well-plates which are devoted to cell culturing, elastomeric microvalves for liquid control, and plastic microfluidic devices. **”**

## Microfluidic Lab-On-Chip for Bioimpedance

In the bioelectronics discipline, there is an emerging technology called microfluidic lab-on-chip, which aims to develop miniaturised measuring devices which can analyse tiny liquid samples of nanolitres to picolitres volume. Of particular interest is the application of microfluidic lab-on-chips to cell counting and especially to the detection and assessment of microreactors which enclose cells.

Within the frames of this project, we fabricated an impedimetric microfluidic sensor, the size of a chip, which is capable of measuring, merely electrically, the concentration of suspended model-cells or microparticles which imitate cells that are enclosed in droplet microreactors of picolitres volume. The droplets were generated on separate microfluidic hardware – coupled with our impedi-

metric sensor – that injected, by means of pumping, droplets containing floating cells or particles. Supporting our impedimetric microfluidic sensor was an impedance analyser which recorded each droplet's dielectric response and a computer that analysed cell/particle concentration and size distribution per individual droplet.

Our experimental setup included additional peripheral electronic instruments that supplied our impedimetric sensor with essential electronic excitation signals as well as supported the analysis of the response measuring signals. Communication and control via an external computer offered precise synchronization of the overall instrumentation. This project benefited research in sensorics and analytical instrumentations.



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## Sandra Zetterström Fernaeus

- Title: Studies of the neurotoxic mechanisms of mutated versions of APP related to Familial Alzheimer's Disease
- Supervisor: Tiit Land
- Grant: MJD7, 1 Aug 2009 – 31 July 2012
- Partner institution: Tallinn University

**“** *I currently investigate inflammatory nitric oxide production in response to LPS and cellular iron levels in microglia cells.* **”**

## Alzheimer's Disease and Inflammation

Alzheimer's disease (AD) is the most common dementia worldwide, affecting about 10% of the population over the age of 65. Genetic analyses associate at least three genes with AD, where Amyloid Precursor Protein (APP) is one. APP is the precursor protein for the AD associated peptide A $\beta$  which, in turn, is associated with AD hallmarks like amyloid depositions, oxidative stress, inflammation, microglia activation and increased intra neuronal- and extracellular iron depositions.

Microglia activation might be beneficial since they phagocytose A $\beta$  oligomers and fibrils, but may also be detrimental since they are chronically activated producing pro-inflammatory compounds like nitric oxide.

We are exploring neuronal inflammation by stimulating microglia cells with bacteria-derived

lipopolysaccharide (LPS) and analysing the expression of the induced nitric oxide synthase (iNOS) and how it is regulated. MAPK pathways represent a group of cell pathways that transfer signals into the cell nucleus, resulting in gene transcription.

We showed that the iNOS enzyme was produced to a higher extent in response to LPS and anti oxidants when combined in mouse microglial cell lines. This indicates that cells can control iNOS production through an oxidative mechanism. We also showed that the mechanism acts specifically on the pathway known as JNK pathway.

In a second study, we demonstrated that both JNK and p38 MAPK pathways have pro-survival effects on microglial cells stimulated with LPS.



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## Anna Volkova

- **Title:** Small-scale cogeneration plants in Estonian towns
- **Supervisor:** Andres Siirde
- **Grant:** MJD10, 1 Aug 2009 – 31 July 2012
- **Partner institution:** Tallinn University of Technology

**“** During the project, I became a part of the Department of Thermal Engineering in TUT and continue to work as a researcher in the field of cogeneration and renewable energy. **”**

# Small-Scale Cogeneration Plants in Estonian Towns

The main goal of the project was to analyze the possibilities of installing new small-scale cogeneration plants in Estonian towns. There are high perspectives for the small-scale cogeneration development in Estonia.

Methods for evaluating the best places in Estonia for the new cogeneration plants were offered. Additionally, methodology for calculating the optimal size of cogeneration plants was developed. Advantages and disadvantages of fuels (oil shale, wood and peat) for use in cogeneration plants were discovered and compared. The difficult question was the analysis of significantly and rapidly changing Estonian legislation in the field of energy and its influence on cogeneration.

A great possibility for improving cogeneration implementation in Estonia, which is not used at the moment, is the application of accumulator tank together with cogeneration plant. This can allow the production of electricity in the periods when the thermal load is low; and later consumption of heat, when the load is high. Research showed that the use of the accumulator tank can increase the heat and electricity produced by a cogeneration plant by more than 25%. It is possible because the usage of the accumulator tank prolongs the annual operation time of the cogeneration plant.



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# Mats Hansen

- ▶ **Title:** Design and mitochondrial transport of novel antioxidant molecules
- ▶ **Supervisor:** Ursel Soomets
- ▶ **Grant:** MJD12, 1 Aug 2009 – 31 July 2012
- ▶ **Partner institution:** University of Tartu

**“** After the postdoctoral project, I have continued my work here. My project is related to my postdoctoral study and involves the research of mitochondria penetrating peptides. **”**

## Targeting Mitochondria

Increased production of reactive oxygen species (ROS) is a hallmark of many disorders, such as psoriasis, type II diabetes, Parkinson's Disease, Alzheimer's Disease, Friedrich Ataxia, Huntington's Disease, amyotrophic lateral sclerosis, etc.

Although ROS is also produced inside mitochondria during normal cellular respiration where approximately 4% of the molecular oxygen is converted into superoxide radicals, this “basal” ROS production is counterbalanced by the cell's own defensive mechanisms (coenzyme Q<sub>10</sub>, vitamin E, glutathione system, etc.). However, sometimes these mechanisms cannot neutralize the ROS and, in order to prevent the development of various disorders, additional antioxidants must be administered. Targeted delivery of antioxidants to damaged mi-

tochondria is, therefore, an effective therapeutic strategy.

This project focused on designing and characterizing peptide sequences that are able to localize inside the mitochondrial matrix and possibly deliver some bioactive substances while doing so. After several unsuccessful attempts to design these sequences using computer-based algorithms, we finally pointed our search towards naturally occurring mitochondrial proteins, which are normally coded from nuclear DNA, translated in the cytoplasm and transported inside mitochondria. That strategy proved successful and we were able to find three promising peptide sequences that, when applied to the cell culture, were capable of localizing inside mitochondria.



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# Astrid Kännaste

- **Title:** Plant defense reaction triggered by abiotic and chemical stressors
- **Supervisor:** Ülo Niinemets
- **Grant:** MJD14, 1 Sept 2009 – 31 Aug 2012
- **Partner institution:** Estonian University of Life Sciences

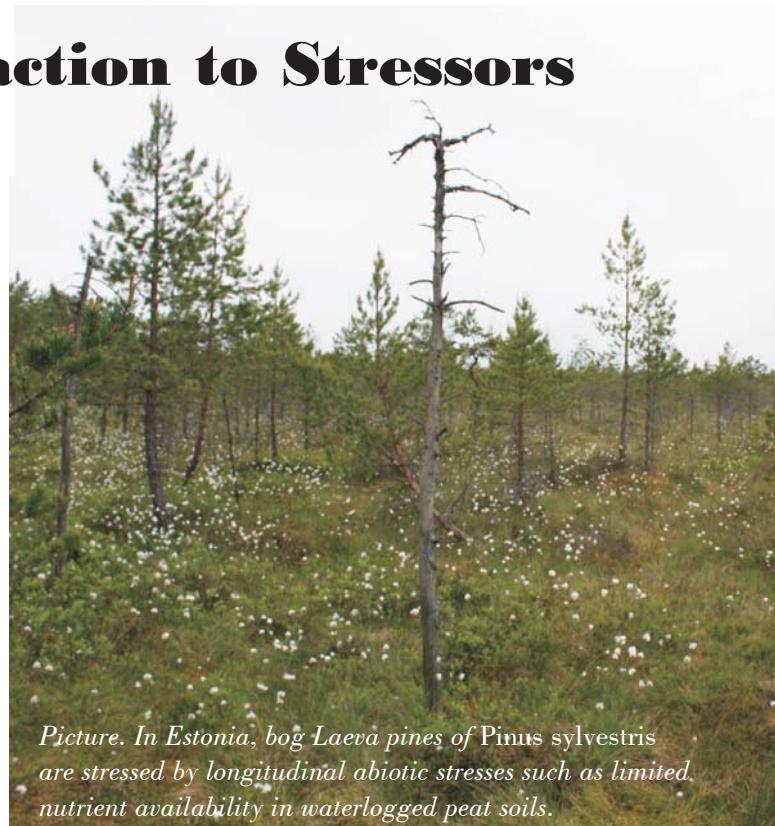
“ After the postdoc grant, the studies on plant stress will continue with herbaceous plant species such as *Brassica nigra* known for its high stress tolerance. ”

## Plant Defense Reaction to Stressors

Global climate changes have a great impact on plants' physiology via affecting their defence reaction against simultaneously or successively existing longitudinal or short-term abiotic and biotic stresses (drought, ozone, temperature, herbivores, etc). The severity of stresses on plants varies greatly in different ecosystems.

By today, various hypotheses regarding plant growth and defense reaction exist. However, several results contradict these hypotheses, citing the undiscovered facts in plants' response to stresses.

Hence, the goal of the project was to study secondary metabolites in leaf tissues of stressed plants such as pines *Pinus sylvestris*. Results showed extensive variations in terpene contents and composition among and within different pine populations, suggesting a large adaptive capacity of pines within and among population.



Picture. In Estonia, bog Laeva pines of *Pinus sylvestris* are stressed by longitudinal abiotic stresses such as limited nutrient availability in waterlogged peat soils.



## Andres Marandi

- Title: Geochemical evolution of groundwater in Cambrian-Vendian aquifer system in Estonia
- Supervisor: Rein Vaikmäe
- Grant: MJD17, 1 Sept 2009 – 31 Aug 2012
- Partner institution: Tallinn University of Technology
- Receiving institution: Alberta Innovates Technology Futures

**“** My current activities are in the field of the formation of groundwater resources. Special attention is paid to changes to water budget generated by large intakes, e.g., underground mines. **”**

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## Geochemical Evolution of Groundwater

Conceptual understanding or a conceptual model is a simplified representation or a working understanding of the real hydrogeological system and its processes. Voronka groundwater body ( $V_2\text{vr}$ ) in northeastern Estonia is a good example of a complicated, overexploited groundwater system where conceptual understanding of baseline quality and governing hydrogeochemical processes can support sustainable aquifer management.

The baseline chemical composition of the  $V_2\text{vr}$  was formed during the last glaciation when melted glacial water intruded into water bearing rocks. In present day, the seawater intrusion and the water exchange between groundwater and water from buried valleys can change the  $V_2\text{vr}$  quality (see Figure).

Future monitoring and management should focus on the changes in the natural composition of groundwater caused by abstraction.  $\text{HCO}_3^-/\text{Cl}^-$  value is the best parameter to describe the fluctuations in natural background chemistry in the groundwater body

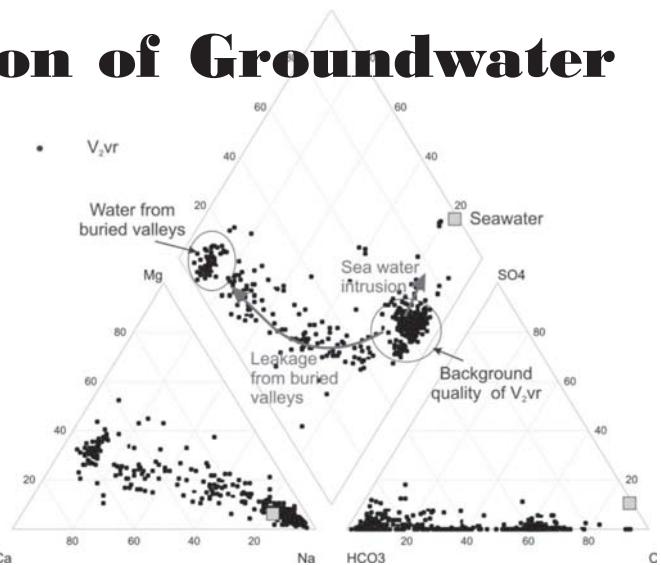


Figure. Conceptual model of the formation of the chemical composition of Voronka groundwater body.

and to assess significant trends induced by abstraction. If such trends are discovered, a complex of isotope methods, especially  $^{14}\text{C}$ ,  $^3\text{H}$ ,  $\delta^2\text{H}$ ,  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$ , can be used to detect whether an intrusion of seawater or water from buried valleys is taking place.



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# Toomas Kirt

- ▶ **Title:** Computational Modelling of the Binding Problem
- ▶ **Supervisor:** Talis Bachmann
- ▶ **Grant:** MJD22, 1 Aug 2009 – 31 July 2012
- ▶ **Partner institution:** University of Tartu

**“** After finishing the postdoc project, I have been accompanying a diplomat on assignment. When I return, I plan to advance the field of computational neuroscience in Estonia. **”**

## Bind or Not to Bind

The aim of my postdoctoral project was to build a computational model of the binding mechanisms taking place in the human brain. The binding mechanism forms assemblies of simultaneously firing neurons that describe the distinct features of one unitary object. It is suggested that the synchronization is achieved by the coordination of the gamma-band neuronal oscillations by a modulating oscillatory system. The perceptual retouch model proposes that binding is achieved by non-specific thalamic modulation of the neurons in cortical areas (see Figure). In this project, data were gathered in experimental tests on humans and used as an input to the project. We have performed a number of simulations in different configurations and have obtained results that support the predictions put forward by the perceptual retouch theory and qualitatively simulate the results of human experiments.

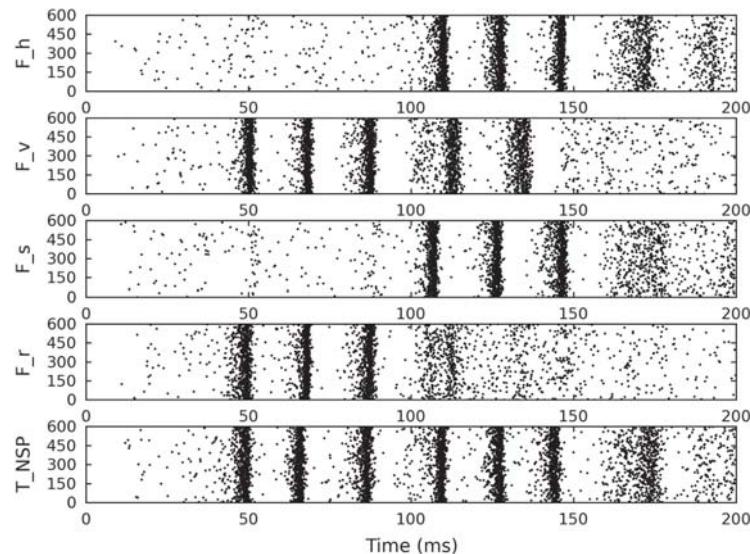


Figure. A raster plot of spikes from different types of neuron groups featuring clear oscillations in the frequency of (synchronous) spiking. The modulator group  $T_{NSP}$  synchronizes the activity of two pairs of exclusive feature groups ( $F_{\cdot}$ ). The pair  $F_r$  and  $F_s$  corresponds to exclusive features r-round and s-square, and  $F_v$  and  $F_h$  represent another category of features: v-vertical and h-horizontal stripes.



[mart4353@gmail.com](mailto:mart4353@gmail.com)

## Mart Anton

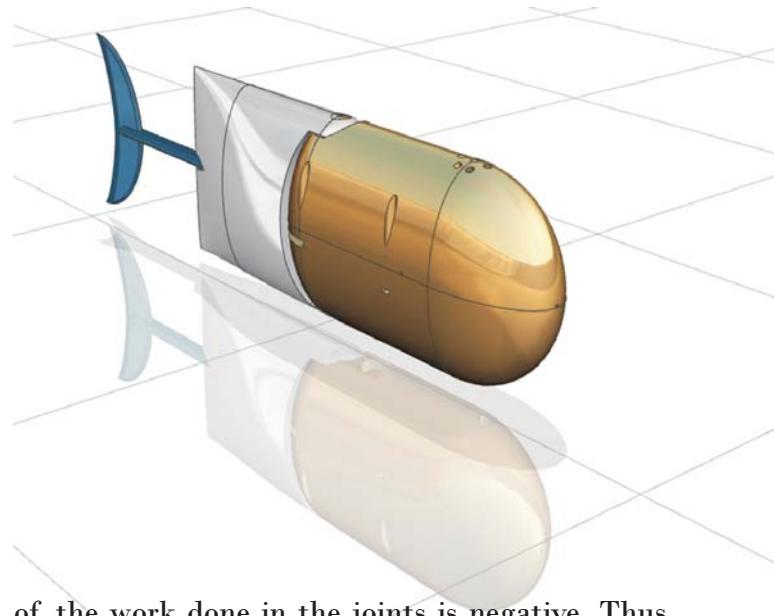
- **Title:** Mechanical design and locomotion of an underwater vehicle
- **Supervisor:** Maarja Kruusmaa
- **Grant:** MJD23, 3 Aug 2009 – 2 Aug 2012
- **Partner institution:** Tallinn University of Technology

*“ I plan to develop a better prototype to attract funding, work on the movement strategies of the robotic fish that would increase battery life, and add pectoral fins to the robot to increase manoeuvrability. ”*

## Underwater Robot for Environmental Monitoring

Pollution in bodies of water is an increasing problem. Therefore, means to detect pollution quickly become more and more important. A novel autonomous underwater vehicle was developed that can carry sensors, take sediment samples and, at the same time, have minimal presence. The vehicle has no propellers. Instead, it propels itself like a fish – using an oscillating hydrofoil. Therefore, it is quiet, gentle and robust. The robot poses no threat to the marine life and has limited ability to crawl in seaweeds.

The robot consists of two rigid links and a tail – it has two joints. Computational hydrodynamic simulations revealed that, during swimming, some



of the work done in the joints is negative. Thus, only one motor is used to move both joints. A simple mechanism is used to drive both joints in a way that the robot can, like fish, achieve both S-shape and C-shape.



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# Matthieu Chillaud

- ♦ Title: Controlling Frontiers and Mapping the field of European ‘Freedom, Justice and Security’
- ♦ Supervisor: Eiki Berg
- ♦ Grant: MJD25, 3 Sept 2009 – 2 Sept 2012
- ♦ Partner institution: University of Tartu

**“** Even though my postdoctoral research was a positive experience, for various reasons, I had to drop my initial idea to continue to work in this institution. But I have to acknowledge that my postdoctoral research gave my academical profile a veneer of credibility in French and Estonian academia. **”**

## The EU and its Internal Security

My research was about how the European Union (EU) constructs its internal security. Traditionally, scholars, when they carry out research on the EU and its security, focus on the external one. Yet, the internal one turns out to be a very important aspect. A neglected topic of research among academics, the internal security is actually a fundamental aspect of the construction of the EU. This is the progressive abolition of borders which, by encouraging a feeling of security at the level of the European community, forced the European states to delegate certain competencies to the EU.

When I kicked off my research, I was struck by the growing importance granted to the issue of migration, the EU seeing movements of populations more and more through the lens of security considerations. After having penned a chapter on the

Baltic States and the internal security of the EU for a book, I have decided to focus my research exclusively on Frontex and the triangle migration, security and borders management. Frontex is the European agency, based in Warsaw, in charge of helping border authorities from different EU countries. The agency was set up in 2004 to reinforce and streamline cooperation between national border authorities.

What was the most interesting aspect of my work was undeniably the research field. I conducted interviews with officials at Frontex in Warsaw as well as with Estonian, Latvian and Lithuanian border guards. They even invited me to the border between their country and Russia in order to show me how they work.



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## Sónia Sousa

- ▶ **Title:** Activity patterns in informal virtual learning communities
- ▶ **Supervisor:** Peeter Normak
- ▶ **Grant:** MJD28, 1 Jan 2010 – 31 Dec 2012
- ▶ **Partner institution:** Tallinn University

**“** After completing this project, I continue my research at Tallinn University by further exploring to what extent and how can the socio-technical dimensions of trust be promoted and sustained in interactive systems. This will result in designing, developing and evaluating a toolset to monitor trust levels. **”**

## Activity Patterns in E-Learning Communities

The “Activity Patterns in Online Learning Communities” research project aimed to explore the effects of trust in the online activity patterns of learners engaged in e-learning activities through the lens of the previously defined socio-technical model of trust. This goal was achieved in four different stages.

In stage one, we designed a comprehensive and fully annotated concept map of people’s Trust motivations and expectation when interacting online. In stage two, we explored the concepts related to online learning communities and its interconnection with Trust.

Stage three explored the effects of trust in online learning communities and their activity patterns. We positively identified significant effects of trust in learners’ attitudes in e-learning settings, like openness, sharing, privacy and collaboration. And finally,

stage four explored the design of a strategy driven analysis to understand how some Trust factors (presented in the socio-technical model of Trust) can influence learners’ attitudes towards interaction in those community-learning environments.

After grasping the effects of trust in online learning communities and their activity patterns, future research should explore to what extent and how can the socio-technical dimensions of trust be promoted and sustained in interactive systems and focus on developing strategies to design for Trust; and to design, develop and evaluate a toolset to monitor trust levels.

The main goal is to consolidate the acquired body of knowledge and to provide more tangible and actionable results; to foster other researchers’ interest in leveraging the shortcomings of Human-Centered Computing with our knowledge of Trust.



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# Bulent Cavas

- **Title:** Modelling Teacher Needs for Competence and Confidence in Conducting Inquiry Based Science Activities
- **Supervisor:** Miia Rannikmäe
- **Grant:** MJD32, 11 Dec 2009 – 10 Dec 2012
- **Partner institution:** University of Tartu

**“** *The Mobilitas funding advanced my academic career in science education. Recently, when attending the World Science and Technology Education Conference of the ICASE (International Council of Associations for Science Education), I was elected the president-elect for this Council.* **”**

## Inquiry Based Science Education at School

My research topic is related to Estonian and Turkish Science Teachers' preferences in using Inquiry Based Science Education (IBSE) in their classroom.

According to a report published by the European Commission, the science education community mostly agrees that inquiry based science education is an effective method in teaching and learning science. However, the reality of classroom practice is that, in the majority of European countries, these methods are being implemented by only relatively few teachers. The report continues to explain the advantages of IBSE and the recommendations clearly promote the use of IBSE for the teaching and learning of science in Europe.

My research was focused on how science teachers in both countries use IBSE in their science teaching environments.

According to the results of my research, science teachers in both countries still use structured inquiry as the dominant teaching method. However, there are differences in Guided and Open Inquiry type teaching methods. While Estonian Science Teachers prefer Open Inquiry as the second teaching method, Turkish teachers use Guided Inquiry as the second teaching method. Open Inquiry type teaching method is used by Turkish science teachers as third preference in their teaching. Estonian Teachers use Guided Inquiry as the third teaching method for their science classroom.

The research concluded with new challenges to overcome, e.g., to what extent do science teachers feel confident in promoting teaching and learning environments for IBSE.



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## Tiina Kirsipuu

- ▶ **Title:** High-throughput screening of inhibitors of A $\beta$  peptide aggregation
- ▶ **Supervisor:** Peep Palumaa
- ▶ **Grant:** MJD37, 1 Sept 2009 – 31 Aug 2012
- ▶ **Partner institution:** Tallinn University of Technology

**“** After Mobilitas, I'm a research scientist in TUT and CCRMB, specialized in the development and application of analytical methods based on liquid chromatography and/or mass spectrometry. **”**

## Searching for A $\beta$ Peptide Aggregation Inhibitors

The aggregation of amyloid-beta (A $\beta$ ) peptides is causatively linked to Alzheimer's disease (AD) and the suppression of this process by various inhibitors is a common therapeutic and preventive strategy.

For this purpose, an automated, fast and highly sensitive *in vitro* screening assay for the detection of A $\beta$  aggregation inhibitors has been developed. It is based on the use of robotic workstation for automatic preparation of MALDI spots and MALDI-TOF MS for monitoring the peptide aggregation. This assay provides a unique possibility to work in a label-free system, containing only the fibrillating A $\beta$  peptides and the test compounds, and enables to test large libraries of compounds. Nearly 100 different compounds have been tested, 10 of which have showed a statistically relevant (95%) inhibitory effect on the

A $\beta$  aggregation. Among others, some food colorants have showed a notable suppressing effect. All these compounds can be considered potential A $\beta$  inhibitor candidates. As formation of the complex between the compound and monomeric A $\beta$  might be a cause for A $\beta$  aggregation suppression, the complex formation has been checked using ESI MS. For one tested compound, the clear complex between the compound and monomeric A $\beta$  has been observed.

Further detailed studies are needed to evaluate the mechanism of the inhibitory effect of discovered compounds and, even more, to check the suitability of these compounds for AD treatment. However, the results of the current project can be a good basis for further biochemical and medical studies.



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# Satish Narayana Srirama

- ▶ Title: Scientific Computing on the Cloud
- ▶ Supervisor: Eero Vainikko
- ▶ Grant: MJD38, 15 Oct 2009 – 19 Oct 2012
- ▶ Partner institution: University of Tartu

**“** Currently, I am heading the Mobile Cloud Lab in the University of Tartu, where we are performing research in the science on cloud, mobile computing and mobile cloud domains. **”**

## Scientific Computing on the Cloud

The project studied the scope of establishing private clouds at universities and, in the process, has established SciCloud at the University of Tartu. Students and researchers are using SciCloud in solving computationally intensive scientific, mathematical, and academic problems. SciCloud mainly helped us in evaluating the suitability of cloud computing for different scientific computing problems.

Several standard scientific computing problems have been ported to the cloud and their performance is evaluated in detail. During this analysis, it was realized that, to be able to run the scientific computing applications on the cloud infrastructure, the applications must be reduced to frameworks that can successfully exploit the cloud resources, like the MapReduce framework.

The project tried to reduce several standard sci-

entific computing problems to MapReduce model and came up with a classification mechanism for scientific computing algorithms in general and later suggested the suitable frameworks and implementations for solving each class of these problems.

The project also resulted in significant contributions in our Mobile Cloud and Mobile Enterprise research domains. Most notable of these is the Mobile Cloud Middleware (MCM) that helps in integrating cloud services from multiple providers; in building mashup applications for the smart phones. MCM handles the interoperability issues across multiple clouds, and eases the use of process intensive services from mobile phones.

More results at  
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## Yanina Timasheva

- ▶ **Title:** Genetic variation in human growth hormone / chorionic somatomammotropin genes and susceptibility to cardiovascular disease
- ▶ **Supervisor:** Maris Laan
- ▶ **Grant:** MJD39, 16 Oct 2009 – 15 Oct 2011
- ▶ **Partner institution:** University of Tartu

*“ After completing this project, I continue my research on cardiometabolic traits and aging in the Institute of Biochemistry and Genetics Ufa Scientific Centre of Russian Academy of Sciences. ”*

## Adult Height Programming in Utero

My research project was focused on the effect of human placental growth hormone on cardiometabolic features and body stature. This hormone is only expressed in placenta, and therefore its activity is limited to the intrauterine period of development. It appears, however, that height in adulthood can already be programmed before birth. While the growth hormone gene cluster has a very complex structure with many different variants, placental growth hormone has only two major allelic variants.

My research started with the observation that one genetic variant of placental growth hormone was prevalent in African population which is characterized by tall body stature, while another variant was more frequent in Chinese population with smaller body size, and, among Europeans, both vari-

ants were commonly represented. It led me to investigate an association between placental growth hormone gene variants and anthropometric traits in three Central and Eastern European populations (Czechs, Estonians, Tatars and Bashkirs). As a result, significant association was found between the genetic variant in placental growth hormone gene and height. The carriers of one particular genotype of this gene were significantly taller than others.

There is a lot left to be understood, but it appears that placental growth hormone cannot only influence intrauterine growth but also affect later development. It adds a new piece to the puzzle of genetic basis of height, and I am very grateful for the opportunity to be a part of such an exciting study. After completing this project, I continue my research on cardiometabolic traits and aging.



## Janis Zakis

- ▶ **Title:** Research and Development of Bi-Directional Power Converters for Energy Storage Applications
- ▶ **Supervisors:** Juhan Laugis & Dmitri Vinnikov
- ▶ **Grant:** MJD42, 15 July 2009 – 14 July 2012
- ▶ **Partner institution:** Tallinn University of Technology

**“** After my three-year postdoctoral research, I proceed to work at TUT and Riga Technical University on several international projects and grants connected with my postdoctoral research. **”**

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## Power Electronics Supporting Us

My postdoctoral research activities were focused on power electronic interface converters for renewable and energy storage systems.

What is a power electronic interface converter? It is a black box (the colour is not important) that converts electric energy from one state to another. For example, to charge a cell phone or a laptop, we need this black box (charger) to connect the device with the grid; similarly, we use an interface converter for a laptop, hair dryer or a shaving machine on a car trip to convert 12 V to the household standard of 220 V. Power electronic converters also provide a connection between renewable energy sources (wind generators, photovoltaic devices, etc.) and utility grids or energy storage batteries.

My work became more interesting and exciting when the focus of R&D shifted from purely scientific results to projects conducted in close cooperation with the business and industrial environment in Estonia and abroad.

Besides R&D activities, I was involved in the whole spectrum of hosting department activities: giving lectures, organizing excursions for students to energy handling facilities, organizing conferences and symposiums and performing editor's tasks for the Doctoral School Proceedings.

Diversity was the keyword of my daily life. Each day was filled with new tasks and meetings not only in the laboratory but also far from the university walls.



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## Ringa Raudla

- ▶ **Title:** Evolution of Fiscal Governance Institutions in Estonia from 1994 to 2009
- ▶ **Supervisor:** Wolfgang Johannes Max Drechsler
- ▶ **Grant:** MJD43, 1 Mar 2010 – 28 Feb 2013
- ▶ **Partner institution:** Tallinn University of Technology

**“** *In the next couple of years, I am planning to work for Ragnar Nurkse School of Innovation and Governance at the Tallinn University of Technology. I will focus specifically on how fiscal and financial bureaucracy have influenced economic policy choices in the Baltic and the Nordic regions.* **”**

# Evolution of Fiscal Governance in Estonia

The general goal of the research project was to examine the evolution of fiscal governance institutions in Estonia.

Specifically, the research project focused on the following research questions: To what extent can the theoretical propositions put forth by the existing fiscal governance literature explain the development of budgetary institutions in Estonia since 1994? Does the Estonian case point to other factors driving institutional choices which have been neglected by the fiscal governance literature?

The main finding of the study was the following: The Estonian case points to gaps in the existing theoretical literature. In explaining the evolution of fiscal governance, several additional factors have to be taken into account next to the po-

litical factors that the existing studies focus on.

For example, the historical experience of the inter-war period, lesson-drawing and policy transfer from other countries can influence how much power is given to the Ministry of Finance and what role is foreseen for the parliament in the budget process. Changes to budgetary processes can also be influenced by external consultants and policy trends.

The study also showed that the fiscal governance arrangements strongly influenced fiscal policy during the economic crisis in Estonia: for example, the extensive power of the Ministry of Finance and the constrained role of the parliament facilitated the swift adoption of austerity measures.



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## René Mõttus

- ▶ **Title:** Predictors and mechanisms of successful cognitive ageing
- ▶ **Supervisor:** Ian J. Deary
- ▶ **Grant:** MJD44, 1 May 2010 – 30 Apr 2013
- ▶ **Partner institution:** University of Tartu
- ▶ **Receiving institution:** University of Edinburgh

**“** *In collaboration with researchers from various European countries, I plan to study (a) how psychological factors moderate the manifestation of polygenic disease risk and (b) reciprocal connections between lifestyle and personality.* **”**

## Cognitive Ageing and Beyond

I was funded by Mobilitas for three years. I spent this time with the Centre for Cognitive Ageing and Cognitive Epidemiology, which is a research group affiliated with the University of Edinburgh, Scotland, UK. The research group is world-leading and the project was a success in all respects. The training and research experience were fantastic and my stay with the centre resulted in more than ten publications in peer-reviewed journals. And some more will follow for sure.

The plan was to study ageing and cognition. These two are known to have an inverse relation: one goes up, the other goes down. Well, not always but, by and large, this tends to be the case. The idea was to see how we can break the link, because age-related cognitive decline is a major public health concern.

I investigated the link between cognition and ageing. For example, a unique set of data spanning nearly 60 years allowed us to show that diabetes may not impair cognition in older age, although low cognition may contribute to ending up with diabetes. We call this reverse causation.

In addition to the link between ageing and cognition – the initial aim of the project – I found myself examining the psychological predictors of health-related life-style choices and various health conditions in older age. Dietary habits, inflammation, oral health, general physical fitness were some of the phenomena I was lucky to link with psychological factors in the course of my extracurricular activities.



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## Jodi Price

- ▶ **Title:** The generality of assembly rules in herbaceous vegetation: a macroecological approach
- ▶ **Supervisor:** Meelis Pärtel
- ▶ **Grant:** MJD47, 1 Apr 2010 – 31 Mar 2013
- ▶ **Partner institution:** University of Tartu

**“** *I am now working at the University of Western Australia and continuing to research similar themes as I did in Estonia but now with a restoration focus.* **”**

## Plant Community Assembly

In this research project, our main aim was to search for general ‘rules’ for community assembly in grassland communities at global scales. By ‘rules’, we mean repeatable patterns in species associations that are indicative of processes. For example, a long held belief in ecology is that species that are too similar cannot co-exist as they will compete more strongly for resources than species that differ in the way they access resources (i.e., there is a limit to how similar species can be). We found evidence in a synthesis of experimental studies that species colonising areas that contained species from the same functional group were only disadvantaged in artificial communities and not in natural systems. Hence, experimental methods strongly affect the conclusions. In several studies, we also found evidence that increased productivity and greater competition produced communities of species that were more similar, and we sug-

gest this is due to species that are different (in traits associated with competitive ability from dominant species) being excluded. In an extensive study of alvar grasslands in Estonia, we found, based on 6 species traits, that at small-scales co-occurring species are more similar than expected at random. We suggest that small-scale environmental conditions increase similarity among co-occurring species, and this pattern also contrasts with the idea that co-occurring species should have a limit to how similar they can be. We expanded on this work by sampling grasslands around the world with sites in Estonia, Iceland, Mongolia, Spain, Canada, Argentina and Australia. We found that grassland communities do not seem to be governed by the same ‘rules’ of community assembly. In addition, we explored this concept more in glasshouse studies and using molecular techniques to study patterns of association in root communities.



## Anu Kisand

- ▶ **Title:** Application of sediment pore water fluorescence index in paleolimnological studies of a large shallow lake
- ▶ **Supervisor:** Atko Heinsalu
- ▶ **Grant:** MJD51, 1 June 2010 – 31 May 2013
- ▶ **Partner institution:** Tallinn University of Technology

“ *At present, I continue with paleolimnological studies (DNA based analysis of microbial community changes in post-glacial lake sediments) through ERC Personal research grant no 134.* ”

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## Exciting Organic Matter in Lake Sediments

Lake sediments contain a significant part of water in the pores between sediment particles. The fluorescence signature of fulvic acids dissolved in the pore water of deeper sediment layers gives us information on the origin of organic matter entered to the lake from catchment or formed within the lake in previous periods. This, in turn, allows us to use sediment records for reconstructing former climate conditions in that region and the history of nutrient dynamics of the lake.

Since small differences in fluorescence signature can lead to important palaeolimnological conclusions, we need to know whether and how our analysis methods can alter fluorescence signatures. The present study with different sediment types showed that the conditions for pore water analysis and sedi-

ment storage can remarkably change the fluorescent signature of fulvic acids. Freezing the sediment samples can significantly enhance the signal of microbial origin of dissolved organic matter; it also magnifies the effect of pore water acidification on fluorescence signatures. Diluting the pore water has a minor effect on fluorescence signatures. Different sediment types vary in their response to freezing, acidification and dilution. In addition, within the same lake, we can get different signals on the origin of organic matter from sediments with different grain size.

The findings of the study enable us to choose proper methods for spectrofluorimetical studies and critically compare the results of different studies for sound palaeolimnological conclusions.



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## Andi Hektor

- ▶ **Title:** Data mining in the CMS experiment at CERN
- ▶ **Supervisor:** Alexandre Nikitenko
- ▶ **Grant:** MJD52, 1 July 2010 – 30 June 2013
- ▶ **Partner institution:** National Institute of Chemical Physics and Biophysics
- ▶ **Receiving institution:** European Organization for Nuclear Research

**“** After my postdoc, I got a position as researcher at NICPB. I am establishing my own research group in collaboration with Helsinki University and Cavendish Lab in Cambridge. **”**

## Dark Side of the Universe Probed by Cosmics

The dream of any physicist is to discover something beyond our present knowledge. In particle physics, the proved description of the microscopic world is called the Standard Model. Gravitation provides us with an infallible signal of physics beyond Standard Model — Dark Matter (DM). Our matter is in the form of stars, planets, gas and plasma clouds in and between galaxies, making up 5% of the Universe. The origin of DM (27%) and Dark Energy (68%) remains a mystery. So far, the evidence for their existence is purely gravitational.

Cosmic rays *aka* “cosmics” can shed light on the non-gravitational nature of DM. According to terminology, cosmic rays mean energetic electrons, positrons, protons, antiprotons, gamma rays, neutrinos and nuclei coming from space. Measurements

of cosmics are very complicated, since the upper layers of atmosphere already absorb most cosmic rays. Thus, cosmics can be accurately measured only by satellite and high altitude balloon experiments. Alternatively, one can observe tiny secondary effects in the atmosphere caused by cosmics: weak light flashes, radio impulses, etc.

In the postdoc project, we modeled the annihilation and decay signals of DM and their effect on cosmic rays. We analyzed different types of cosmic rays and their effects on Cosmic Microwave Background. An interesting original result of the project was the discovery of a line-like excess of gamma rays at the Galactic Centre and the nearby galaxy clusters.



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# Chong-Geng Ma

- **Title:** Ab initio and semi-empirical modelling of optical properties of materials doped with rare earth and transition metal ions
- **Supervisor:** Mikhail Brik
- **Grant:** MJD54, 1 Sept 2010 – 31 Aug 2013
- **Partner institution:** University of Tartu

“

*A continued study on the theoretical design of lighting phosphors will be carried out by collaborating with my colleagues in the Institute of Physics, University of Tartu, Estonia.*

”

## Go with Lighting

The looming problems of climate change and the energy crisis have motivated a great deal of research seeking the improved efficiency of lighting. New light sources, such as white light LEDs, are rapidly becoming the alternatives with efficiencies better than most conventional lightings, such as compact fluorescent tubes. The progress in developing such new light sources is highly dependent on the design of phosphors using rare earth and transition metal impurity ions as light converters. The current phosphor design is still in a trial and error experimental process, which causes a great strain on manpower, equipment and finances.

Therefore, the theoretical design of phosphors, i.e., the modelling of the impurity ion energy levels in different materials inducing the light con-

version behaviours of phosphors, has become very important and desirable. In addition, it is one of the frontier problems which lies on the border of quantum physics, solid-state theory and computational materials science.

Surrounding the aim above, I have developed a combination scheme of the semi-empirical crystal field theory and *ab initio* calculations to describe the impurity ions' optical properties in lighting phosphors in the past three years. The outcome of 15 SCI-indexed papers published in international journals, such as *Applied Physics Letters*, would make crucial contributions to knowledge required to engineer lighting phosphors and further be expected to have a remarkable impact on material science in Estonia.



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## Malgorzata E. Arlet

- ▶ Title: Socio-ecological determinants of demographic rates in a group-living, free-ranging primate
- ▶ Supervisor: Raivo Mänd
- ▶ Grant: MJD56, 1 Feb 2010 – 30 Apr 2013
- ▶ Partner institution: University of Tartu

**“** Presently, I am a postdoctoral researcher of primate communication in the Ethology group at the University of Rennes 1 (France). Part of my study will be built on mother-infant contact data collected during the Mobilitas grant. **”**

## Reproduction and Stress in Wild Population of Grey-Cheeked Mangabey Females

Grey-cheeked mangabey are arboreal monkeys that live in multi-male, multi-female groups. During this study, we analysed data from four mangabey groups, collected from 2004 to 2012 in Kibale National Park, Uganda. Our study shows that the mother's social position in the group and her age determines the infant's life from the birth. If the mother is a low-ranking female, and the infant is male, his chances to die are much bigger than those of the sons of high-ranking mothers. This may happen because sons (like human babies) need more energy to grow than daughters, and low-ranking females eat less quality food. Low-ranking females start to reproduce a year later than high-ranking females.

Our study also shows that the infants of older mothers survive better, possibly because of the

experience of the mother but also because older mothers themselves do not need to grow anymore. We also found that the presence of at least one female at the peak of sexual swelling in the group increased stress for all females. This may be the result of males' aggressive competition over females which results in frequent fights and also has a negative impact on infant survival, as more than 23% of infants died during males' chases.

Female reproductive success is very important for population subsistence and resilience. Reproductive rates that are low may be an early sign of population decline. Generally, understanding social conditions that affect reproduction is important in increasing our ability to effectively manage populations that are threatened with extinction.



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## Jaana Salujõe

- **Title:** Do cladoceran remains in lake sediment record climate and environmental change?
- **Supervisor:** Siim Veski
- **Grant:** MJD57, 1 June 2010 – 31 May 2013
- **Partner institution:** Tallinn University of Technology

**“** My next project would be about cladoceran ephippiums (resting eggs) and their proportions in different climate periods. **”**

## Cladocerans as Indicators in Sediment

Cladoceran remains preserve well and accumulate in lake sediments and are, therefore, excellent palaeolimnological research material. Littoral as well as planktonic species occur in this group, and they are sensitive to the changes of lake trophic status and to the fish predation. The planktonic/littoral species ratio reflects lake level fluctuations. The species composition and changes in the composition reflect the warm and cold climate periods in the past climate.

The aim of this project was to study species composition and changes in the composition, the proportion of oligotrophic and eutrophic species and changes in the proportions.

Lake Lielais Svetinu in Latvia was the main study lake. The results showed that the proportion of species who prefered colder climate conditions was higher in the colder climate and decreased in the warmer climate. The oligo-mesotrophic species proportion was high through the sediment, decreasing only in the warmer Holocene period. The most frequent species were *Alona affinis* and *Alonella nana*. The cladoceran abundance was lower in the older sediment and increased in the younger sediment.

The study's results were complemented and supported by microfossils (e.g., pollen, diatoms) results.



## Letizia Tedesco

- ▶ **Title:** The role and contribution of sea ice biogeochemistry to the Baltic Sea ecosystem state: a modelling study
- ▶ **Supervisor:** Urmas Raudsepp
- ▶ **Grant:** MJD62, 1 Apr 2010 – 31 Mar 2012
- ▶ **Partner institution:** Tallinn University of Technology

**“** *Currently, I am a senior scientist in the Marine Ecosystem Modelling group of the Finnish Environment Institute.* **”**

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## Sea Ice Biogeochemistry in the Baltic

Sea ice is a fundamental component of the climate system and plays a key role in polar trophic food webs, hosting diverse and abundant biological communities that live under extreme conditions. The presence of biota can also affect the magnitude of the phytoplankton bloom in under-ice and adjacent waters, leading to rising ecosystem-wide consequences on very large scales. The scattered measurements of sea ice properties limit our understanding of its qualitative and quantitative importance. Numerical models may, therefore, be suitable tools for integrating and overcoming the lack of observations.

This project was, firstly, devoted to process studies. The Biogeochemical Flux Model in Sea Ice was used to investigate the ecological coupling between sea ice algae and phytoplankton. The second part of the project focused, instead, on the large-scale

properties of sea ice biogeochemistry. A general methodology to develop a sea ice biogeochemical model directly deriving it from a generic model of pelagic biogeochemistry was introduced. This methodology is very flexible and considers different levels of ecosystem complexity and vertical representation, while adopting a strategy of coupling that ensures mass conservation.

The last part of the project focused on developing a model of high complexity to investigate the temporal and spatial variability of sea ice biogeochemistry in Bothnian Bay, a large area of the Baltic Sea, over a long time period (1991-2007), based on a new sea ice development within the NEMO and the BFM modelling networks.

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## Mukesh Chandra

► Title: Magnetic studies on doped dielectric oxides ( $ZrO_2$  and  $TiO_2$ ) for spintronic applications

► Supervisor: Raivo Stern

► Grant: MJD65, 1 Aug 2010 – 31 July 2013

► Partner institution: National Institute of Chemical Physics and Biophysics

“ After finishing this grant, I have joined an Assistant Professor position in India (Ajay Kumar Garg Engineering College Ghaziabad) and continue my current research in the fields of spintronics and multiferroic materials. ”

## Ferromagnetism in Non-Magnetic Oxides

In this project, I have synthesized various undoped as well as doped  $ZrO_2$  and  $TiO_2$  samples, aiming to get ferromagnetism in these non magnetic compounds for application in spintronics (spin-electronics).

It was found that  $ZrO_2$  samples doped with Ca and Mg ions have robust ferromagnetism at room temperature, whereas Mn doped  $ZrO_2$  and  $TiO_2$  exhibited weaker ferromagnetism. Those results have been presented in various international conferences in Australia, India and European countries.

The detailed studies on these materials were also published in peer reviewed international journals. Studies on Mn doped  $ZrO_2$  were published in *Physica status solidii (a)* and results on Ca/Mg doped  $ZrO_2$  have been published in *Journal of Physics D: Applied Physics*.

The robust magnetism found in these non magnetic oxides (with cubic crystal structure) will open the door to application in spin based electronic devices due to their compatibility with Si and Si-Ge based semiconductors.



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## Angela Ivask

- **Title:** High throughput bacterial screening for the characterization of toxicity of nanosized particles and materials
- **Supervisor:** Kenneth A. Bradley
- **Grant:** MJD67, 1 Mar 2010 – 28 Feb 2012
- **Partner institution:** National Institute of Chemical Physics and Biophysics
- **Receiving institution:** University of California, Los Angeles, Center for Environmental Implications of Nanotechnology

**“** My current work is focused on testing both environmental as well as human effects of nanoparticles. Based on the obtained data, smart nanoparticles for various applications can be designed. **”**

# Do Nanoparticles Pose Hazard to Living Cells?

Nanotechnology, i.e., the production and application of nanosized (1-100 nm) particles, is a rapidly expanding and advancing field that has already yielded a variety of commercially available products including cosmetics, suntan lotions, paints, self-cleaning windows and stain-resistant clothing.

By conservative estimates, the number of consumer products on the market containing manufactured nanoparticles now exceeds 1000. Most commonly, silver nanoparticles are added to various consumer products but nanoparticles of titanium dioxide, zinc oxide and silicon dioxide are also used. Due to their widespread use, nanoparticles need to be tested for their safety both to consumers as well as to the environment. In this project, we tested the safety of various nanoparticles, in-

cluding silver and titanium dioxide using various bacterial cells.

We found that, in case of bacterial cells, the effect of nanoparticles was determined by their direct interaction with the particles. Bacterial surface adsorbed silver nanoparticles damaged bacterial membranes and, thereby, also intracellular functions. Titanium dioxide nanoparticles that were deposited on bacterial surface damaged bacterial cells via photocatalytic reaction.

On the other hand, recent literature indicates that silver and titanium dioxide nanoparticles do not pose direct hazard to humans. All this indicated that environmental risks need to be considered with silver and titanium dioxide nanoparticles.



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## Terje Loogus

- **Title:** Translatability of culture – an integrated semiotic-functional approach
- **Supervisor:** Peeter Torop
- **Grant:** MJD70, 1 Apr 2010 – 31 Mar 2013
- **Partner institution:** University of Tartu

**“** Research on translation will be carried out at the Centre for Translation Studies at the Institute of Germanic, Romance and Slavonic Languages and Literatures, as well as at the department of German Studies in the University of Tartu. **”**

## Translatability of Culture

The purpose of the postdoctoral project was to study the translatability of culture. Culture is considered an orientation system which is typical for groups or societies. It implies shared common knowledge which serves as a collection of recipes for problem solving and enables people to behave and act in a culturally accepted manner and in accordance with rules and regulations. For the translation process to run smoothly, the translator has to be aware of the differences between his/her own and the other culture. Unawareness may lead to situations where culture-specific aspects are not recognised or cultural differences become cultural barriers.

In the course of the project, the semiotic approach, which dominates the traditions of Estonian and Anglo-American translation studies, was

integrated with the functional approach, which today is widely spread in German translation studies. Some of the most valuable results have been achieved by applying Juri Lotman's model of auto-communication to describing the translation process.

Translation is seen as both a pragmatic decision-making process and a teleological communication process. However, translation is not merely communication between different languages and cultures but also auto-communication which may be analysed on the intracultural as well as the intra-individual level. Translators do not only transmit one language and culture into another but also shape other languages so as to describe foreign languages and cultures.



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## Merilin Miljan

- ▶ Title: Case-marking in Estonian: Rethinking case-marking
- ▶ Supervisor: Helle Metslang
- ▶ Grant: MJD72, 1 June 2010 – 31 May 2013
- ▶ Partner institution: University of Tartu

**“** *The next step is to provide a fully-fledged theory of case and case-marking, which is backed up by empirical findings from psycholinguistic investigations (such as the effect of case on online sentence comprehension) in collaboration with colleagues in a language processing lab.* **”**

## An Inferential Approach to Case-Marking

When you hear a sentence, how do you know who does what to whom? Some of the clues come from morphological case-marking, a topic of great interest in theoretical linguistics. Although a vast amount has been written about case-marking in all linguistic traditions, the concept of case is still elusive, and many theoretical explanations offer only partial accounts, as they focus only on certain uses of case.

This project enabled me to work on an entirely new approach to morphological case-marking and, as a result, to offer not only a fresh view of the Estonian case system in the Estonian tradition but make a contribution to the renewal of grammatical

thought on a larger basis. I argued for a more semantic and context-based meaning of case where case is seen as an independent contributor of information to the unfolding interpretation of a sentence.

This contrasts with the currently prevailing view where case markers have no significance themselves and are defined, instead, on the basis of their syntactic functions. In my new approach, the primary function of case itself is the starting point, and the information it contributes is interpreted in terms of the syntactic functions it may perform.



# Mikko Leinonen

- ▶ Title: Rudolf Carnap's logical and ontological pluralism - a case study
- ▶ Supervisor: Daniel Cohnitz
- ▶ Grant: MJD77, 5 Apr 2010 – 4 Apr 2013
- ▶ Partner institution: University of Tartu

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**“** My new research project aims to make transparent Carnap's 1920s contribution to scientific philosophy. This would include studying many unpublished sources (e.g., manuscripts and diaries) to be researched in the philosophical archive at the University of Konstanz, Germany. **”**

## Investigating Carnap's Pluralisms

All sciences rely on the formation of concepts. Any area of scientific research includes various different conceptual systems and scientists often disagree about which among many one should prefer. This situation of many systems raises questions about the reasons for preferring one conceptual system to another. While agreeing with “anything goes” pluralism cuts out rational arguments, agreeing with some theoretical norms about such preferences can be criticized for intolerance and dogmatism.

My postdoc project belonged to “Critical analysis of relativism and pluralism regarding truth and knowledge, norms and values” led by professor Margit Sutrop. The research concentrated on Rudolf Carnap's (1892-1970) pluralist conceptions. Carnap is a pioneer of *logical* pluralism and often taken as an *ontological* pluralist, who subscribed to various optional scientifically acceptable conceptual sys-

tems, for example, in physics. Yet, his pluralism comes with the *caveat* that one should not ask questions about the *reality* of scientific objects. Accordingly, decisions between optional scientific conceptual systems will be made on *pragmatic* grounds: by comparing features like simplicity, efficiency and theoretical fruitfulness.

My research mainly took the course of investigating Carnap's pluralisms' intellectual backgrounds; this is a relevant topic, which several Carnap scholars are currently engaged in. These studies led me to assess, in particular, Hans Vaihinger's (1852-1933) and Heinrich Rickert's (1863-1936) neo-Kantian broad impacts. I also aimed to assess contemporary scholars' certain debates and conceptions about Carnap; you can read more about this in “On Early Carnap's Metaontology” (forthcoming).



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## Jaanus Karo

- ▶ **Title:** The theoretical study of mitochondrial energetic metabolism
- ▶ **Supervisor:** Marko Vendelin
- ▶ **Grant:** MJD80, 1 Sept 2010 – 31 Aug 2013
- ▶ **Partner institution:** Tallinn University of Technology

**“**Next, I am planning to improve the computer model of the mitochondria energy metabolism by introducing even more details and increasing the model in space- and time-scale.**”**

## Mitochondrial Energetic Metabolism

Living cells use chemical energy produced by changing ATP to ADP, PCr to Cr. ATP and PCr are regenerated in mitochondria. However, the exact mechanism is not known. The goal of this project is to create computer models to learn about the energetic metabolism pathways at atomistic level.

The coarse-grained type of molecular dynamics simulation (CG-MD) technique is used.

Several force fields were tested and, as a final result, a principal CG-MD model was built. The model contains water molecules, salt ions, membrane lipids, a transmembrane protein (ANT) and an enzyme (MtCK) on the membrane. The model membrane consists of three main components: phosphatidylcholine, phosphatidylethanolamine and cardiolipin (CL) in a 2:1:1 molar ratio.

The result of the project is the computer model

and the methodology to model a region between mitochondrial membranes with the relevant proteins. The model is tested with experimental data and it is even capable of simulating rare events like CL flip-flop jumps between membrane leaflets. The model shows for the first time at atomistic level, how ANTs are drifting inside lipids and in which condition they are clustering. The model reveals that CL plays a crucial role in binding ANT and MtCK proteins to lipids.

The model developed helps to understand the nature of energy metabolism, working together with experiments, and is the basis for further developments, e.g., to study ATP, PCr diffusions in the model environment. It will help study phenomena in time and space scales that are not reachable by current experimental tools.



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## Igor Pilshchikov

► **Title:** Juri Lotman's Structural Methods and Semiotics of Culture on a Global Scale: Their Historical Background, International Context and Recent Developments

► **Supervisor:** Rein Raud

► **Grant:** MJD84, 17 May 2010 – 16 May 2013

► **Partner institution:** Tallinn University

**“** I am going to continue my research in the chosen field. Together with my colleagues at Tallinn University, I designed several projects devoted to the international background of Estonian semiotics and the development of its most productive ideas in the context of contemporary humanities. **”**

## Lotman's Cultural Semiotics, Globally

My project was devoted to the literary theorist and semiotician of worldwide importance, Juri Lotman (1922-1993). Jewish by birth, he was a bearer of Russian culture but spent most of his professional life in Estonia, where he came in 1950, and in the end assumed Estonian citizenship; his children are well-known Estonian scholars and politicians. I graduated from the University of Tartu, where I defended my BA thesis under his supervision in 1991. Three years ago, I came to Estonia again to examine his rich archive which contains many important documents that have remained unknown to the academic world till today.

Lotman's intellectual career is conventionally divided into three periods: traditional historian of literature (1950s), literary structuralist (1960s), and the founder of the semiotics of culture (1970-1980s).

As a matter of fact, these periods intermingle and overlap. In particular, the formation of the globally acknowledged Tartu-Moscow School of Semiotics, of which he was the leader, took place in the mid-1960s. For more than two decades, it served as an intermediary between Western and Eastern intellectual communities.

The aim of my project was to investigate the School's theoretical and methodological basis and its role in the history of structuralist and semiotic thought worldwide. I believe I managed to demonstrate that the success of Lotman's lifelong research project was related to the specificity of Estonia's position at the crossroads of various cultures. Now, I intend to continue my studies in the history of Estonian semiotics.



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## Margit Kõiv

- **Title:** Treatment of fish farm sludge using sludge drying reed beds and phosphorus removal from percolate using reactive filter media
- **Supervisor:** Yves Comeau
- **Grant:** MJD93, 16 Aug 2010 – 15 Aug 2013
- **Partner institution:** University of Tartu
- **Receiving institution:** Polytechnique Montreal & University of Montreal

**“** Currently, I am working in the University of Tartu as a researcher on a project with the aim of using Estonian industrial by-product hydrated oil-shale ash for phosphorus removal and of studying the long-term performance of this material. **”**

## Ecological Cleaning of Fish Farm Wastewater

Freshwater fish farms are a significant source of water pollution. The main goal of the project in Canada was to develop an ecological and economical method for cleaning fish farm wastewater.

A common strategy to reduce pollutants in the fish farm wastewater is separating the solids (faeces, uneaten food, etc.) from water through physical settling. However, this settled sludge still presents problems mainly due to the lack of good management of the nutrient-rich (i.e., phosphorus and nitrogen rich) residual water, problems that we aimed to overcome with a novel waste water cleaning technology.

The developed cleaning technology consists of three efficient stages. The aim of the first stage is sludge removal from fish farm wastewater with vertical flow treatment wetlands. Next, organic mat-

ter and nitrogen is removed from residual water of sludge in aerated gravel filters. As the last stage, problematic phosphorus is removed from water with special filters filled with steel slag (by-product of steel industry). The treatment wetlands and gravel filters are sustainable and environmentally friendly systems that are already used for cleaning a variety of wastewaters. The use of the steel slag for phosphorus removal is important for reducing the pollution of lakes and rivers.

The results of this project showed that the technology developed has good potential to treat similar agricultural wastewaters and is a good basis for further studies. For example, additional full scale experiments are essential for optimising the technology developed.



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# Kajar Köster

- ▶ **Title:** Carbon turnover on disturbed areas
- ▶ **Supervisor:** Jukka Pumpanen
- ▶ **Grant:** MJD94, 1 Nov 2010 – 31 Oct 2013
- ▶ **Partner institution:** Estonian University of Life Sciences
- ▶ **Receiving institution:** University of Helsinki

**“** *I plan to do a similar study in Estonia in Vihterpalu fire disturbed areas and compare/combine the results with findings from the subarctic zone of boreal forests (Värriö, Finland).* **”**

## Carbon Turnover on Fire Disturbed Forests

Fire is one of the most important natural disturbances in the boreal forest, and it is expected that with future climate change the fire frequencies in boreal forests will increase. Fires strongly influence boreal forest structure and function and alter the microbial biomass and species composition structure (e.g., by significantly reducing the abundance of decomposing fungi).

In the current project, we measured carbon (C) stocks, estimated fungal and microbial biomass, soil enzyme activity, and soil C turnover in Scots pine stands on a fire chronosequence from 2 to 152 years after fire. The measurements were made in Värriö Nature Park, close to the Russian border in Finnish Lapland, in the northern boreal subarctic coniferous forests. The turnover time of soil C de-

creased by half from 70 to 35 years during the first 40 years following the fire, and the turnover time was associated with very slow recovery of fungal biomass, occurring over decades rather than years.

Common estimates of C turnover assume that, after fires, C turnover rates either remain constant or increase, thus, the outcomes of the current project allow us to suggest that the effects of increased fire frequencies on boreal C stocks may be less dramatic than previously thought. Changes in soil C turnover with time after fire must be taken into account in the projections of future boreal C balance. Estimations of boreal C balances with coupled climate-carbon cycle models are wrong if they do not take into account changes in turnover rates of soil C.



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## Anastassia Zabrodskaja

- ▶ Title: Transfer of morphosyntactic patterns in the Estonian-Russian contact setting
- ▶ Supervisor: Martin Ehala
- ▶ Grant: MJD96, 1 Sept 2010 – 31 Aug 2013
- ▶ Partner institution: University of Tartu

**“** *Studies on the identity of a second language learner are a novel direction. I decided to develop this field in the Estonian realities as a Professor of Estonian as a Second Language at the Institute of Estonian Language and Culture in Tallinn University.* **”**

## EST-RUS Language Contact and Change

To what degree is the Estonian context unique or representative of modern bilingual constellations? The starting point for analyzing the current Estonian-Russian language contact is the changed sociolinguistic situation in Estonia where, since 1991, Estonian has started to dominate, impacting on local Russian language morphosyntax. The main focus of this project was on the use of Estonian patterns in dominantly Russian speech among speakers of Russian as L1 and Estonian as L2 who attend Estonian-medium schools. Analyzed data included recorded interviews and spontaneous everyday language practices. I specified different types of Estonian-Russian transfer.

Lexical transfer forms were, to a great degree, connected with pragmatic needs and the sociolinguistic reality the informants live in. In their seemingly monolingual Russian speech, pupils employed Estonian lexical items from the school domain or

daily life. This phenomenon is conventionalized in sociolinguistically different regions: the transfer of Estonian lexical items is determined by the social networks and reality the informants live in. Verb government transfer as syntactic transfer is the second common transfer type. Estonian-Russian pragmatic transfer was used to communicate and negotiate interactional goals such as disagreement, firmness, seriousness, confrontation, authority, respect. It could be predicted that these contact-induced changes will contribute to the emergence of a new mixed grammar of the local variety of Russian that is a combination of both grammars.

Studies on the identity of a second language learner reveal that second language learning involves more than a mere addition of another language system to the existing one; moreover, the identity dynamics of a language learner can be an important issue for successful language acquisition.



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# Annekatrin Kaivapalu

- **Title:** Symmetry of the cross-linguistic influence in the acquisition of closely related languages
- **Supervisor:** Scott Jarvis
- **Grant:** MJD104, 1 Sept 2010 – 31 Aug 2013
- **Partner institution:** Tallinn University
- **Receiving institution:** University of Jyväskylä

**“** *I will continue my hitherto work as the head of the Department of Finnish Language and Culture, the associate professor of Finnish and editor-in-chief of the journal Lähivõrdlusi—Lähivertailuja (Close Comparisons), as the supervisor of 9 doctoral thesis, and more.* **”**

## Symmetry of Cross-Linguistic Influence

This project addressed the fundamental question of how cross-linguistic influence (CLI), especially first language (L1) influence, determines second and foreign language (L2) acquisition and learning. Language learning is a process which is affected by several factors; L1 influence is one of the factors and it interacts with others. When L1 is close to L2, more possibilities occur for interaction between L1 influence and L2 generalizations, as learners' L1 and L2 systems overlap partly. The starting point is what is similar between L2 and L1. As learning progresses, the learners' L2 begins to contain structures at least partially independent of L1, and the learners' L2 converges towards the target.

Most of the studies concerning CLI have focused on large Indo-European languages, particularly

English, and the results are not automatically applicable to structurally and typologically different languages. For this reason, positive L1 influence has received little attention. To fill this gap, the first languages and the target languages involved in the study were two closely related Finno-Ugric languages, Estonian and Finnish.

The study focused on the symmetry of CLI, on which very little research exists. The research done on the symmetry of processing Estonian and Finnish as target languages shows that Finns comprehend written texts better than Estonians, are more successful at perceiving objective similarity between Estonian and Finnish, and tend to rely on similarity more than Estonians during production.



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## Hendrik Voll

- Title: Investigation of Grey Water Irrigation and Energy Demand for Greenroofs
- Supervisor: Graig Spolek
- Grant: MJD107, 1 Jan 2011 – 31 Dec 2013
- Partner institution: Tallinn University of Technology
- Receiving institution: Portland State University, USA

**“** As to my future aspirations, in 2013, I was granted the position of professor at Tallinn University of Technology, Department of Environmental Engineering, Chair of Heating and Ventilation. **”**

## Effect of Grey Water Irrigation on Greenroof Performance

Greenroofs have the potential to self-cool buildings through evapotranspiration but typically cannot feasibly capitalize on this potential because potable water is too expensive for irrigation. One design concept is to collect the building's grey water and use it directly to irrigate a greenroof.

Greywater is the discharge from sinks and showers that normally is discharged into the sewer but is much cleaner than toilet and kitchen sink effluent. By using the greywater at the building, lower costs for cooling energy and sewage treatment could result. However, it is unknown whether greenroofs can withstand a steady diet of greywater and thrive as they do when irrigated with potable water.

An experimental study examined the effect of grey water on greenroof performance. Greenroof

samples were tested in side-by-side studies using either grey water or potable water for long-term irrigation. Greenroofs all had the same growing media with the same depth and were exposed to identical climatic conditions. Plantings included ryegrass (*Lolium perenne*) and periwinkle (*Vinca major*) that were mature. Evaporative cooling was measured in steady state laboratory conditions using a low-speed wind tunnel built specifically for measuring the thermal performance of greenroofs.

Results showed visible effects of greywater on periwinkle but not on ryegrass. Thermal performance for greenroofs irrigated with grey water was about 30% lower than those irrigated with potable water. Hence, greywater irrigation for greenroofs appears to incur problems.



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## Katre Talviste

- ▶ Title: Translations of French Poetry into Estonian: Their Creation and Functions in the Context of Estonian Literature
- ▶ Supervisor: Jüri Talvet
- ▶ Grant: MJD108, 1 Sept 2010 – 31 Aug 2013
- ▶ Partner institution: University of Tartu

**“** I am the managing editor of the academic journal *Interlitteraria* and a part-time senior researcher at the University of Tartu, focusing on typological characteristics of small literatures. **”**

## “Translated” Doesn’t Mean “Foreign”

Over the past decades, the history of translation has rapidly grown as a research field in the humanities, both in importance and results produced worldwide. As cultures increasingly perceive themselves not as isolated and independent entities but as participants in constant changes and exchanges, understanding the history of these exchanges is also of growing relevance.

The goal of my research project was to study a relatively small corpus of texts (poetry translated from French into Estonian) and determine to what extent any fundamental, qualitative differences exist between the translated and original literature.

A lot of discussion about translation is founded on the assumption that translation constitutes a contact between two otherwise independent cultures, two fully formed, stable and constant liter-

ary traditions that can both have an impact on the translation but exist independently from that contact. In other words, the assumption is that translation is somehow optional in a literary tradition.

The history of Estonian literature, as that of many other small literatures, easily disproves that assumption. But detailed empirical descriptions and models of how our “own” and “foreign” texts actually function as parts of the same collective tradition and as parts of the same individual creativity still need a lot of work to which this project has hopefully contributed, in an era where learning to rethink traditional oppositions by which cultural and political communities define themselves is an unavoidable task.



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## Kristjan Tabri

- ▶ **Title:** Coupled approach for numerical modelling of accidents in maritime transportation
- ▶ **Supervisor:** Tiit Koppel
- ▶ **Grant:** MJD110, 1 Sept 2010 – 31 Aug 2013
- ▶ **Partner institution:** Tallinn University of Technology

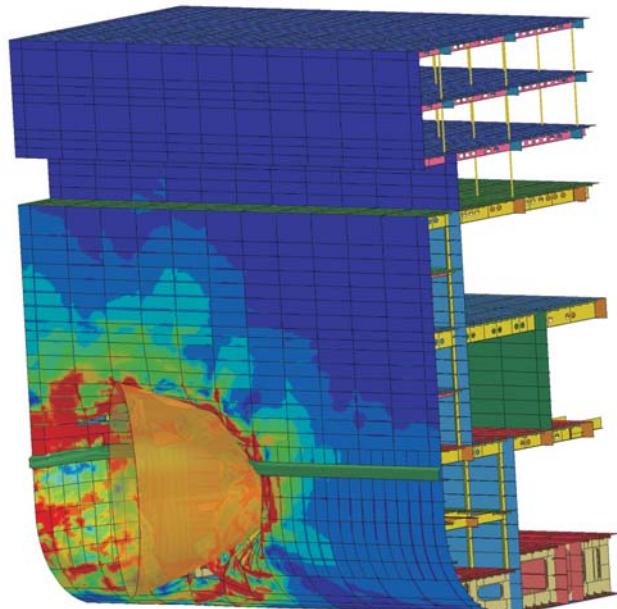
**“** My future aspiration is to develop a software tool that allows rapid analysis of maritime accidents and can be linked to softwares for the simulation of oil-spill propagation in the sea. **”**

## Numerical Simulation of Ship Accidents

Ship collisions and groundings are still one of the major types of accidents in maritime transportation, leading to significant consequences. In future, most ships will be designed with accidental loading as one design criteria. During the postdoctoral study, a numerical simulation method for the analysis of ship collision and grounding accidents was developed.

The method simultaneously evaluates ship motions and structural damage as a result of the accident. The description of the caused damage is used as input to methods evaluating the amount of oil spilled from damaged tankers and the residual strength of the damaged ship hull girder.

With these links, the results are positioned in the context of final consequences, such as the environmental damage through oil spill or the loss of ship. Such a combined analysis tool provides an instrument for ship engineers, classification societies and environmental protection agencies for the development of safer ship structures and the improvement of maritime safety.



Picture. Numerical simulation of a collision between a tanker and a passenger ship.



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## Francesco Orsi

- **Title:** Understanding Normative Cognition: Autonomy, Unity and Generality
- **Supervisor:** Margit Sutrop
- **Grant:** MJD111, 1 Sept 2010 – 31 Aug 2013
- **Partner institution:** University of Tartu

**“** After the grant period, my plan was to continue working in Tartu. I have been lucky to get the opportunity to do so thanks to a personal research grant I have received from the Estonian Research Council, which will allow me to continue here until 2016. **”**

## Behind Good and Bad

My Mobilitas project title was: Understanding Normative Cognition: Autonomy, Unity, and Generality. It was undertaken as part of the 2008-2013 project of the Philosophy Department of the University of Tartu, “Critical Analysis of Relativism and Pluralism”.

My aim was to continue my previous PhD research on the meaning and implications of value judgments: what do we mean when we call a certain action, outcome, character trait, policy, institution, etc. good or better than another, not just from my or your point of view but as such?

Such questions belong to what philosophers call *meta-ethics*, since the aim is not to issue value judgments or prescriptions but rather to explain and analyze what we do when we issue such judgments. In my postdoctoral work, I mostly addressed ques-

tions of autonomy and unity: What makes value judgments distinctive from judgments of matters of fact? Is there something common underlying all value judgments?

The grant has been crucial for my professional development, since it allowed me to pursue my research to the best of my abilities. My work resulted in various publications in respectable philosophy journals and in the foundations for a book in value theory, which I am currently writing.

Moreover, I have been able to present my work at many international conferences. Such occasions have contributed to the overall quality of my research. Finally, our Philosophy Department has also been a fertile ground for my work.



# Marina Toompuu

- **Title:** Studies on function of human RNase L inhibitor (RLI)
- **Supervisor:** Erkki Truve
- **Grant:** MJD121, 1 Nov 2010 – 31 Oct 2013
- **Partner institution:** Tallinn University of Technology

**“** *I would like to continue my research on human RLI by further looking at its interacting proteins and studying its potential role in the nucleus.* **”**

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## Novel Function of Human RNase L Inhibitor

RNase L inhibitor (RLI) proteins are highly conserved from archaea to eukaryotes. They are essential for the viability and development of several organisms. Human RLI was first characterized as an inhibitor of the antiviral 2-5A/RNase L system.

The RNase L pathway, however, is present only in vertebrates, which implies that RLI must have another specific function. Further studies revealed more diverse roles of RLI in eukaryotic protein synthesis, ribosome biogenesis and HIV capsid assembly but the vital function of RLI still remains unexplained.

The aim of my project is to provide further knowledge about the function of human RLI. As

a model, I use cultured human cells with depleted levels of RLI protein. I observed that these cells have a strong defect in proliferation but no significant change in total protein synthesis.

Next, I studied the involvement of RLI in cell growth control in more detail. I confirmed the association of RLI with selected proteins, which are also essential for cell cycle regulation. I suggest that their interaction with RLI may have a role in the co-regulation of the synthesis of specific proteins required for cell proliferation.

Cell growth control by RLI could be a novel mechanism of its involvement in organism development which needs further investigation.



## Lea Hallik

- **Title:** Influence of multiple co-occurring environmental stresses and the combination of structural and physiological traits on plant response to light availability
- **Supervisor:** Ülo Niinemets
- **Grant:** MJD122, 1 Sept 2010 – 31 Aug 2013
- **Partner institution:** Estonian University of Life Sciences

**“** *My future research topics will include the remote sensing of vegetation responses to the changing climate.* **”**

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# Plant Responses to Multiple Environmental Stresses

Multiple stresses in different combinations and severity co-occur in natural environment, and global climate change implies simultaneous modification of multiple environmental factors. The environmental factor of primary interest in this project was light availability.

The emphasis was placed on including a wide range of plant species with varying ecological potentials growing in different environmental conditions into the study of structural and physiological plant traits. The main approaches used were: (1) analysis of literature-based data, building a global database from published data around the world; (2) field measurements along a wide range of different natural conditions and (3) pot-experiments in controlled conditions. The South-North gradi-

ent of field measurements spanned from Chile in South America to the north of the Arctic Circle.

To study the diurnal changes of leaf physiological state under the conditions of extreme daylength, field measurements were made in polar stations of Abisko (Sweden) and Kiplisjärvi (Finland). To study the interactive effect of multiple stress factors, measurements were taken at climate change field experiment sites in Italy and in Denmark where climate manipulation treatments are superimposed on naturally fluctuating environmental conditions.

Extensive datasets collected during this project will allow a better understanding of plant responses to the changing climate, providing a good foundation for future research.



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# Jaak Tomberg

- **Title:** On the Contemporary Convergence of Realism and Science Fiction
- **Supervisor:** Virve Sarapik
- **Grant:** MJD129, 1 Sept 2010 – 31 Aug 2013
- **Partner institution:** Estonian Literary Museum

*I will follow up my project with an attempt to expand on the ideological implications of these conclusions: if science fiction has really “discovered the possibility” of collapsing into realism then what becomes of its utopian potential, its ability to project radical difference?*

## Science Fiction or Realism?

My postdoctoral grant allowed me to study the hypothesis that the late-capitalist, “globalized” cultural reality has become technologically saturated to the point where its realism, trying to plausibly reflect it “as it is”, has started to take on thorough science-fictional qualities.

I approached this hypothesis from a cultural, philosophical, poetical and genre theoretical perspective. I expanded upon the idea that the seemingly opposite literary genres of realism and science fiction have always shared a solid poetical common ground. I connected this idea with the empirical notion that, in a globalized “late capitalist” cultural environment, the pace of change is so fast that it is difficult to imagine a very elabo-

rate future society – it is merely possible to temporarily reflect our volatile present moment.

Science fiction has always been a “literature of change”, but change is exactly what now defines the present rather than the future. This way, the science fictional imagination has given way to realist reflection, but realist reflection, in order to be plausible, has to paradoxically rely on the science-fictional tool-kit.

On these grounds, it is possible to witness the contemporary convergence of realism and science fiction, as in the three latest novels by the Canadian-American author William Gibson.



## Triin Hallap

- ▶ **Title:** Effect of colloid formulation Androcoll-B on bull semen survival and quality
- ▶ **Supervisor:** Ülle Jaakma
- ▶ **Grant:** MJD134, 1 Sept 2010 – 31 Aug 2013
- ▶ **Partner institution:** Estonian University of Life Sciences

**“** *In the near future, the ability of colloid formulation Androcoll-X to separate X- and Y-bearing spermatozoa will be revealed.* **”**

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## Single Layer Centrifugation of Bull Spermatozoa

The possibility to process whole bull ejaculate in a simple one-step manner would allow separating spermatozoa from seminal plasma and dead sperm, all of which can lower the quality and lifespan of the remaining sperm population. Purified spermatozoa would potentially tolerate better freezing procedures and the number of spermatozoa in the insemination doses could be lowered, adding economic benefit to cattle breeding industry. During the current project, it has been proved that single layer centrifugation of bull semen through species specific colloid Androcoll-B™ allows the selection of highly motile and intact spermatozoa. However, the selection functions better in fresh semen and is modest when the selected sample is cryopreserved.

One of the restrictions that prevents the Androcoll-B™ from immediate and routine usage by bull stations is the highly variable recovery rate of spermatozoa post centrifugation (20–53%). Since the recovery rate plays an important role in the routine work of the bull station, determining the number of insemination doses that could be produced from an ejaculate of bulls with high genetic merit, this new selection method remains an optional tool when an improvement of semen quality/freezability is needed for bulls with high genetic merit but varying semen quality. However, we could see that single layer centrifugation could be preferred to swim-up as a preparatory method prior to *in vitro* fertilization due to its faster processing time and higher yield.



## Lorenzo Pecoraro

- Title: Mycorrhizal strategies in green orchids: diversity and functional aspects
- Supervisor: Tiiu Kull
- Grant: MJD135, 1 Jan 2011 – 31 Dec 2013
- Partner institution: Estonian University of Life Sciences

“ I wish to promote my research career through a strong collaboration with colleagues by establishing an independent research group. ”

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## Mycorrhizal Associations in Meadow Orchids

A relationship with mycorrhizal fungi is what all orchids need at some point in their life, at least in the early stages of their development, as they grow from extremely small seeds nearly devoid of nutritional reserves. Indeed, all orchid seedlings utilize mycorrhizal fungi for carbon and nutrient uptake.

Knowledge of the identities and roles of fungal associates is of primary importance for understanding the biology of orchids and contributing to their conservation. Recent advances in studying orchid mycorrhizae are linked to the development of molecular techniques that enable the identification of fungal symbionts. The recent application of stable isotope analyses has represented a powerful tool for understanding nutrient exchange between orchids and fungi.

The objective of my research project was to as-

sess the identities of fungi associated with the terrestrial orchids *Dactylorhiza fuchsii*, *D. incarnata*, *Gymnadenia conopsea* and *Ophrys insectifera*, using DNA sequencing, and to test whether organic nutrients are gained from the fungal symbiont by means of stable nitrogen and carbon isotope abundance analyses.

Data showed that the orchids investigated, growing in Estonian grasslands, associate with a range of fungi, forming dense intracellular coils in their cortical root cells. Among them, members of the basidiomycete family *Tulasnellaceae* are dominant. All orchid species depend on their fungal symbionts at least for nitrogen nutrition, since they were significantly enriched in  $^{15}\text{N}$  compared with neighboring non-orchid plants.



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# Kristjan Kannike

- ▶ **Title:** Properties of Dark Matter
- ▶ **Supervisor:** Riccardo Barbieri
- ▶ **Grant:** MJD140, 1 Oct 2010 – 30 Sept 2013
- ▶ **Partner institution:** National Institute of Chemical Physics and Biophysics
- ▶ **Receiving institution:** Scuola Normale of Pisa

**“** *I will continue to study the properties of the Higgs boson, dark matter, and the implications for experimental signals at the NICPB institute in Estonia.* **”**

## What is Dark Matter Like?

Only 5% of the mass in the Universe is accounted for – this is the ordinary matter of planets, stars and galaxies. Stars shine, they can be seen. The rest comprises of dark matter (and the even more mysterious dark energy) of which we only know indirectly because ordinary matter is gravitationally attracted to it. Dark matter is searched for in detectors where a dark matter particle colliding with an atomic nucleus could be seen.

If dark matter is made of some heavy particles, that only weakly interact with ordinary matter, there must be a symmetry that prevents them from decaying into ordinary particles. The simplest and well-studied possibility is a mirror symmetry that forbids dark matter decay but allows the annihilation of a pair of colliding dark matter particles into ordinary ones.

We have studied dark matter models with more complicated symmetries where different interactions, such as a pair of dark matter particles going into a dark matter particle and an ordinary one, are also possible. This could modify the cosmic density of dark matter and have implications for detector experiments – the signal could be weaker than expected, which could explain why dark matter is not yet seen.

The model contains an inert doublet and a scalar singlet, so there could be more than one species of dark matter particles with a rich set of interactions. The charged particle in the doublet could interact with the Higgs boson and change its properties in a way that could be seen at the LHC.



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## Alar Just

- ▶ **Title:** Structural fire performance of timber structures
- ▶ **Supervisor:** Birgit Östman
- ▶ **Grant:** MJD201, 1 Sept 2011 – 31 Aug 2013
- ▶ **Partner institution:** Tallinn University of Technology
- ▶ **Receiving institution:** SP Trätek (Sweden)

**“** *The extension of design methods to 90 minutes and more is one of the main challenges for the near future. New materials, e.g., bio-based insulation need a fire design concept.* **”**

## Timber Burns Safely

My postdoctoral research project at SP Wood Technology dealt with fire design methods for timber-frame assemblies.

The principles of the fire design of timber members are to predict the charred cross-section and the reduction of strength. In a fire situation, the protective role of claddings on the fire side and even insulation between the timber members is important.

Fire tests with timber frame assemblies with gypsum plasterboards on the fire exposed side and heat-resistant glass wool insulation inside were performed in a model scale furnace in Stockholm. Charring was followed by reading temperatures of the thermocouples inserted at different depths in the timber member.

Research within the collected database and the analyses of new test results showed a big scatter of

failure times among the products with the same standard classification. The failure times of gypsum plasterboards are affected by the edge distances of fixings, thickness of the boards and many other parameters.

The behaviour of the new type of mineral wool - heat-resistant glass wool - is completely different from the behaviour of usual glass wool. Especially in the phase of fire when cladding has fallen down from the construction. In that post protection phase, the heat-resistant glass wool will protect timber effectively. Normal glass wool insulation will undergo fast decomposition shortly after cladding failure.

The results of the current fire research are also regarded as background for the revision of Eurocode 5 – the European standard for the design of timber structures.



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# Reyna María Pérez Tiscareño

- Title: On Gelfand Mazur algebras
- Supervisor: Mati Abel
- Grant: MJD247, 10 Jan 2012 – 31 Dec 2013
- Partner institution: University of Tartu

**“** After the end of the grant, I plan to start working in a Mexican university. There, I plan to continue my research on topological algebras and my collaboration with my advisor (Mati Abel) in the Mobilitas project. **”**

## Inductive Limits of Topological Algebras

Topological algebras are one of the subfields of modern functional analysis. The study of topological algebras started in 1938, when S. Mazur gave the description of normed division algebras and I. M. Gelfand gave the description of Banach fields. In the end of the 1940s, the study of locally convex algebras and, in the beginning of the 1960s, the study of locally bounded algebras started.

By today, theory of these classes of topological algebras has been comparatively well built up, but the theory of more general classes of topological algebras, such as locally pseudoconvex algebras, lo-

cally m-pseudoconvex algebras, Gelfand-Mazur algebras, Fréchet algebras (with or without any kind of convexities) and others is still being created.

The locally convex inductive limit of locally convex algebras (in particular of normed algebras) has been studied in many papers and books. Several results of these papers and books are generalized to the case of the locally pseudoconvex inductive limit of topological algebras (in particular of locally pseudoconvex F-algebras). We also studied the internal duality between topological algebras and bornological algebras.



## Elin Org

- ▶ **Title:** The role of TMAO in cardiovascular diseases
- ▶ **Supervisor:** Aldons J. Lusis
- ▶ **Grant:** MJD252, 1 Nov 2011 – 31 Aug 2013
- ▶ **Partner institution:** University of Tartu
- ▶ **Receiving institution:** University of California, Los Angeles

**“** *I will continue to investigate the role of gut microbiota in complex diseases, focusing on the influence of host genetics on microbial community structure.* **”**

[elin.org@ut.ee](mailto:elin.org@ut.ee)

## How Gut Microbes Affect the Cardiovascular System

As with many other complex disorders, factors that contribute to cardiovascular diseases (CVD) are diverse and include multiple genetic and environmental/lifestyle components. One factor that has been recently connected to CVD etiology is the large and diverse community of microbes (termed microbiota) found in the gut. Our digestive system contains trillions of bacteria, which regulate our intestinal health, immune function and the bioactivation of critical nutrients and vitamins. The products of microbial metabolism are crucial for the host metabolic phenotype and, hence, to disease risk.

We have been exploring how altering gut bacteria might influence the risk of cardiometabolic dis-

eases. Our study detected certain bacteria in the digestive tract which convert choline and carnitine to another metabolite, called trimethylamine N-oxide (TMAO), that promotes atherosclerosis or the thickening of the arteries. Using over 100 different mouse strains, we showed how dietary conditions clearly shift microbial community and diversity and how specific bacterial species are correlated with plasma TMAO levels and influence the risk of cardiovascular and metabolic diseases.

In summary, our results have provided new knowledge about the mechanism by which novel metabolite-gut microbiota interplay contributes to the regulation of the cardiovascular system.

# Top Researcher Grants

Standing in December 2013

Grant	Top Researcher	Partner Institution	Research Field	Project Title	Com-
					pleted*
1	MTT1	Harry Alles	UT	MT	Manufacturing, processing and characterization of graphene-based nanostructures
2	MTT2	Anna-Karin Borg-Karlsson	UT	ET	Chemical Ecology
3	MTT3	Shinya Sugita	TLU	ET	Dynamic Landscape Analysis in Southern Estonia (DYLAN-Estonia): Spatial Dynamics of Vegetation and Land Cover through Time
4	MTT4	Teet Velling	TUT	BT	Co-operation of integrins and receptor tyrosine kinases in regulation of cell motility: role of filamin A and PKB/Akt
5	MTT8	Alessandro Strumia	NICPB	E	Astro particle physics and the Large Hadron Collider
6	MTT9	Mikael Brosche	UT	BT	Natural variation of plant stress responses - molecular tools for environmental research
7	MTT12	Thomas Fehmiger	TUT	BT	Biomarkers Measuring Inflammation
8	MTT16	Jan Johansson	TLU	BT	Exploiting Nature's solutions to complex biomedical problems
9	MTT50	Yury Orlovskiy	UT	MT	Design of advanced nanostructured materials with tailored properties for novel laser and light sources
10	MTT59	Andrea Giammanco	NICPB	ICT	Top quark physics and exotic searches with the CMS detector

Grant	Top Researcher	Partner Institution	Research Field	Project Title		Com- pleted*
11	MTT60	Emidio Gabrielli	NICPB	E	Search for New Physics beyond the Standard Model and astrophysical implications	
12	MTT63	Tomas Torsvik	TUT	ET	Numerical particle tracking modeling for inhomogeneous turbulent water basins	
13	MTT68	Raiker Witter	TUT	MT	Microwave and Scale enhanced NMR of Micro-Drops, -Leaflets, Cells and Nanoparticles	
14	MTT74	Jarek Kurnitski	TUT	E	Nearly zero energy buildings (nZEB) in Estonia: energy, durability and indoor climate performance analyses combined with cost optimality assessment for transformation	
15	MTT76	Rudolf Kiefer	UT	MT	New conductive polymer actuator design	
16	MTT77	Alexander Tsirlin	NICPB	MT	Spin-lattice coupling in magnetism: from quantum magnets to multiferroics	
17	MTT83	Dmitry Spasskiy	UT	MT	Advanced oxide-based scintillation materials for application in science and technology	
18	MTT84	Urmas Arumäe	TUT	BT	MANF neurotrophic factor: novel mode of action and therapeutic potential	

## Notes and the key

\* The note in the completeness column includes a page reference to the overview in the current booklet if applicable.

UT University of Tartu

TUT Tallinn University of Technology

TLU Tallinn University

NICPB National Institute of Chemical Physics and Biophysics

ICT information and communication technology

MT material technology

BT biotechnology

E energy

ET environmental technology

# Postdoctoral Research Grants

Standing in December 2013

Grant	Grantee	Partner Inst. / Supervisor	Project Title	Com- pleted*
1 MJD1	Vincent Perrier	UT/ Tõnu Meidla	Biodiversity changes across the Ordovician and Silurian environmental crises	✓ p6
2 MJD2	Katja Gehenn	TUT/ Peep Palumaa	New MS-based approaches for studies of conformation and aggregation of amyloidogenic peptides	✓
3 MJD3	Hugo Reinert	TLU/ Hannes Palang	Sacred Others in a Changing Landscape – Environmental Change and Animal Practice in the Norwegian Arctic	✓ p7
4 MJD4	Triin Reitalu	TUT/ Siim Veski	Unraveling the history of plant diversity patterns by means of pollen analyses: an interdisciplinary approach	✓ p8
5 MJD5	Athanasiос Giannitsis	TUT/ Mart Min	Development of a Microfluidic lab-on-chip for bio-impedance measurements on droplet-based bioreactors	✓ p9
6 MJD7	Sandra Zetterström Fernaeus	TLU/ Tiit Land	Studies of the neurotoxic mechanisms of mutated versions of APP related to Familial Alzheimer's Disease	✓ p10
7 MJD10	Anna Volkova	TUT/ Andres Siirde	Small-scale cogeneration plants in Estonian towns	✓ p11
8 MJD12	Mats Hansen	UT/ Ursel Soomets	Design and mitochondrial transport of novel antioxidant molecules	✓ p12
9 MJD14	Astrid Kännaste	EULS/ Ülo Niinemets	Plant defense reaction triggered by abiotic and chemical stressors	✓ p13
10 MJD17	Andres Marandi	TUT/ Rein Vaikmäe	Geochemical evolution of groundwater in Cambrian-Vendian aquifer system in Estonia	✓ p14
11 MJD18	Ulrike Rohn	UT/ Halliki Harro-Loit	Economic and cultural implications of Social Network Sites – A case study of Estonia and Germany	
12 MJD22	Toomas Kirt	UT/ Talis Bachmann	Computational Modelling of the Binding Problem	✓ p15
13 MJD23	Mart Anton	TUT/ Maarja Kruusmaa	Mechanical design and locomotion of an underwater vehicle	✓ p16
14 MJD25	Matthieu Chillaud	UT/ Eiki Berg	Controlling Frontiers and Mapping the field of European 'Freedom, Justice and Security'	✓ p17

<b>Grant</b>	<b>Grantee</b>	<b>Partner Inst. / Supervisor</b>	<b>Project Title</b>	<b>Com- pleted*</b>
15 MJD28	Sonia Sousa	TLU/ Peeter Normak	Activity patterns in informal virtual learning communities	✓ p18
16 MJD30	Hena Ramay	TUT/ Marko Vendelin	Systematic examination of arrhythmogenic calcium release in cardiac myocytes	
17 MJD31	Eve Avel	TLU/ Margus Pensa	Testate amoebae and water-table level fluctuation in NE-Estonian bogs	
18 MJD32	Bulent Cavas	UT/ Miia Rannikmäe	Modelling Teacher Needs for Competence and Confidence in Conducting Inquiry Based Science Activities	✓ p19
19 MJD34	Minkee Kim	UT/ Miia Rannikmäe	How industrial site visits influence students' career aspiration in S&T, scientific literacy, and relevance of science education: A structural equation model of the ew aims of science education	✓
20 MJD35	Michal Cagalinec	UT/ Allen Kaasik	Mitochondrial Dynamics in Models of Neurodegenerative Diseases	
21 MJD37	Tiina Kirsipuu	TUT/ Peep Palumaa	High-throughput screening of inhibitors of A $\beta$ peptide aggregation	✓ p20
22 MJD38	Satish Narayana Srirama	UT/ Eero Vainikko	Scientific Computing on the Cloud	✓ p21
23 MJD39	Yanina Timasheva	UT/ Maris Laan	Genetic variation in human growth hormone / chorionic somatomammotropin genes and susceptibility to cardiovascular disease	✓ p22
24 MJD42	Janis Zakis	TUT/ Juhan Laugis; Dmitri Vinnikov	Research and Development of Bi-Directional Power Converters for Energy Storage Applications	✓ p23
25 MJD43	Ringa Raudla	TUT/ Wolfgang Johannes Max Drechsler	Evolution of Fiscal Governance Institutions in Estonia from 1994 to 2009	✓ p24
26 MJD44	Rene Mõttus	UT/ Ian J. Deary	Predictors and mechanisms of successful cognitive ageing	✓ p25
27 MJD47	Jodi Price	UT/ Meelis Pärtel	The generality of assembly rules in herbaceous vegetation: a macroecological approach	✓ p26
28 MJD48	Liisi Keedus	UT/ Vello Andres Pettai	The Making of the Scientific Imagination: Debates on American Political Science, 1945-1965	
29 MJD51	Anu Kisand	TUT/ Atko Heinsalu	Application of sediment pore water fluorescence index in paleolimnological studies of a large shallow lake	✓ p27
30 MJD52	Andi Hektor	NICPB/ Alexandre Nikitenko	Data mining in the CMS experiment at CERN	✓ p28
31 MJD53	Meelis Kadaja	UT/ Elaine Fuchs	Deciphering the mechanisms governing stem cell maintenance in skin	✓

<b>Grant</b>	<b>Grantee</b>	<b>Partner Inst. / Supervisor</b>	<b>Project Title</b>	<b>Com- pleted*</b>
32 MJD54	Chong-Geng Ma	UT/ Mikhail Brik	<i>Ab initio</i> and semi-empirical modelling of optical properties of materials doped with rare-earth and transition metal ions	✓ p29
33 MJD56	Małgorzata E. Arlet	UT/ Raivo Mänd	Socio-ecological determinants of demographic rates in a group-living, free-ranging primate	✓ p30
34 MJD57	Jaana Salujõe	TUT/ Siim Veski	Do cladoceran remains in lake sediment record climate and environmental change?	✓ p31
35 MJD60	Maria Mälksoo	UT/ Andres Kasekamp	The Power Politics of Memory in Eastern Europe: Securitising the Legacy of Communism in the Baltic states, Poland, Ukraine, and Russia	
36 MJD62	Letizia Tedesco	TUT/ Urmas Raudsepp	The role and contribution of sea ice biogeochemistry to the Baltic Sea ecosystem state: a modelling study	✓ p32
37 MJD64	Dana-Maria Copolovici	UT/ Ülo Langel	Design, Synthesis and Applications of New Chimeric CPPs for Intracellular Delivery of Nucleic Acids and Drugs	✓
38 MJD65	Mukesh Chandra	NICPB/ Raivo Stern	Magnetic studies on doped dielectric oxides ( $ZrO_2$ and $TiO_2$ ) for spintronic applications	✓ p33
39 MJD67	Angela Ivask	NICPB/ Kenneth A. Bradley	High throughput bacterial screening for the characterization of toxicity of nanosized particles and materials	✓ p34
40 MJD70	Terje Loogus	UT/ Peeter Torop	Translatability of culture – an integrated semiotic-functional approach	✓ p35
41 MJD71	Lili Milani	UT/ Andres Metspalu	In-depth genetic and epigenetic analysis of the cytochrome P450 system by next-generation sequencing	
42 MJD72	Merilin Miljan	UT/ Helle Metslang	Case-marking in Estonian: rethinking case-marking	✓ p36
43 MJD77	Mikko Leinonen	UT/ Daniel Cohnitz	Rudolf Carnap's logical and ontological pluralism - a case study	✓ p37
44 MJD80	Jaanus Karo	TUT/ Marko Vendelin	The theoretical study of mitochondrial energetic metabolism	✓ p38
45 MJD84	Igor Pilshchikov	TLU/ Rein Raud	Juri Lotman's Structural Methods and Semiotics of Culture on a Global Scale: Their Historical Background, International Context and Recent Developments	✓ p39
46 MJD93	Margit Kõiv	UT/ Yves Comeau	Treatment of fish farm sludge using sludge drying reed beds and phosphorus removal from percolate using reactive filter media	✓ p40
47 MJD94	Kajar Köster	EULS/ Jukka Pumpainen	Carbon turnover on disturbed areas	✓ p41
48 MJD96	Anastassia Zabrodskaja	UT/ Martin Ehala	Transfer of morphosyntactic patterns in the Estonian-Russian contact setting	✓ p42
49 MJD99	Gemma Atkinson	UT/ Tanel Tenson	Origin and functional evolution of ribosome-associated environmental response enzymes	

<b>Grant</b>	<b>Grantee</b>	<b>Partner Inst. / Supervisor</b>	<b>Project Title</b>	<b>Com- pleted*</b>
50	MJD103	Liisa Rohtla	UT/ Samuel Purkis	Develop remote sensing tools for a monitoring and spatial planning of shallow coastal water environments
51	MJD104	Annekatrin Kaiva-TLU/ Scott Jarvis palu	TLU/ Scott Jarvis	Symmetry of the cross-linguistic influence in the acquisition of closely related languages ✓ p43
52	MJD105	Anu Ploom	TUT/ Margus Lopp	Structure-reactivity relationships in reactions at atoms of the third period elements
53	MJD107	Hendrik Voll	TUT/ Graig Spolek	Investigation of Grey Water Irrigation and Energy Demand for Greenroofs ✓ p44
54	MJD108	Katre Talviste	UT/ Jüri Talvet	Translations of French Poetry into Estonian: their Creation and Functions in the Context of Estonian Literature ✓ p45
55	MJD110	Kristjan Tabri	TUT/ Tiit Koppel	Coupled approach for numerical modelling of accidents in maritime transportation ✓ p46
56	MJD111	Francesco Orsi	UT/ Margit Sutrop	Understanding Normative Cognition: Autonomy, Unity and Generality ✓ p47
57	MJD113	Tsipe Aavik	UT/ Regula Billeter	Assessing the effectiveness of connectivity measures on gene flow and genetic diversity of wildflowers in agricultural landscapes – a landscape genetic approach
58	MJD115	Eve Kaurilind	UT/ Jaakko Kangasjärvi	Regulatory mechanisms of plant abiotic stress responses
59	MJD120	Vinay Choubey	UT/ Allen Kaasik	Multiple Roles Of Alpha-Synuclein In Origin of Mitochondrial Dysfunction And Neuronal Death
60	MJD121	Marina Toompuu	TUT/ Erkki Truve	Studies on function of human RNase L inhibitor (RLI) ✓ p48
61	MJD122	Lea Hallik	EULS/ Ülo Niinemets	Influence of multiple co-occurring environmental stresses and the combination of structural and physiological traits on plant response to light availability ✓ p49
62	MJD129	Jaak Tomberg	ELM/ Virve Sarapik	On the Contemporary Convergence of Realism and Science Fiction ✓ p50
63	MJD134	Triin Hallap	EULS/ Ülle Jaakma	Effect of colloid formulation Androcoll-B on bull semen survival and quality ✓ p51
64	MJD135	Lorenzo Pecoraro	EULS/ Tiiu Kull	Mycorrhizal strategies in green orchids: diversity and functional aspects ✓ p52
65	MJD140	Kristjan Kannike	NICPB/ Riccardo Barbieri	Properties of Dark Matter ✓ p53
66	MJD144	Lauri Peil	UT/ Juri Rappsilber	Ribosome dynamics analysed by advanced mass spectrometry ✓
67	MJD146	Jakub Novak	UT/ Rein Ahas	Individual daily mobility and transforming spatial structure of post-socialist metropolitan regions

<b>Grant</b>	<b>Grantee</b>	<b>Partner Inst. / Supervisor</b>	<b>Project Title</b>	<b>Com- pleted*</b>
68	MJD147	Toomas Silla	UT/ Mathijs Voorhoeve New Mutations in Old Genes: Discovering Cancer-Related Variations in Non-Coding Ultra-Conserved Genes	
69	MJD161	Triinu Remmel	EULS/ Ülo Niinemets Trade-offs in plant defense against herbivores	
70	MJD164	Mithu Guha	UT/ Pärt Peterson What Regulates the Autoimmune Regulator?	
71	MJD166	Eduard Aleksanyan	UT/ Marco Kirm Development of novel scintillators based on thin nanocrystalline films	
72	MJD167	Alexandr Popov	UT/ Ilmo Sildos Rare-earth ions doped nanoparticles for fluorescent medical diagnostics	
73	MJD173	Helen Tammert	UT/ Lise Øvreås The distribution and biodiversity of Flavobacterium genus in the salinity gradient and different productivity regions	
74	MJD198	Nasir Sohail	UT/ Valdis Laan Study of the flatness (homological) properties of S-posets in connection with the amalgamation of partially ordered monoids	
75	MJD201	Alar Just	TUT/ Birgit Östman Structural fire performance of timber structures	✓ p54
76	MJD213	Naidu Revathi	TUT/ Olga Volobujeva Cu <sub>2</sub> ZnSn(SSe) <sub>4</sub> thin films for solar cells	
77	MJD219	Sergey Omelkov	UT/ Marco Kirm Electronic excitations and their dynamics in functional fluoride and oxide based materials	
78	MJD228	Fernando Rodriguez-Castaneda	UT/ Mart Ustav Identification of the mammalian chromatin host factor involved in the segregation of the human papillomavirus genome	
79	MJD235	Sheila Gamut Oyao	UT/ Miia Rannikmäe Promoting multi-faceted approach to teaching and assessment for interdisciplinary science education incorporating cross-curricular topics	
80	MJD236	Katrin Kepp	UT/ Sonia Davila Analysis of genetic variation in p65 binding sites in a rheumatoid arthritis cohort of European descent	
81	MJD239	Vimala Huchaiah	UT/ Raivo Uibo Development of research and diagnostic tools for ZNT8, a new autoantigenic target in type I diabetes	
82	MJD241	Giuseppe Buono	UT/ Tõnu Meidla Paleoecological and Isotopic investigation on the Ordovician-Silurian of Estonia: a key to understand the dynamic of ecosystems	
83	MJD242	Imre Mäger	UT/ Matthew Wood Targeted exosomes for the delivery of splice-switching oligonucleotides (SSOs) to muscle and brain	
84	MJD247	Reyna María Pérez Tiscareño	UT/ Mati Abel On Gelfand Mazur algebras	✓ p55
85	MJD252	Elin Org	UT/ Aldrons J Lusis The role of TMAO in cardiovascular diseases	✓ p56

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86 MJD257	Arvo Tullus	UT/ Anu Sõber	Growth dynamics of deciduous trees under changing climatic conditions: physiological causes and implications for forest management	
87 MJD258	Virve Sõber	UT/ Satu Ramula	The role of floral herbivores in plant-pollinator interactions: a population level approach	
88 MJD259	Pauli Heikkilä	UT/ Olaf Mertelsmann	Foreign policy of exile Estonians, 1944-1972	
89 MJD262	Juha Matti Limnanto	UT/ Arvi Freiberg	Time Evolution of Electronic Excitation in Photosynthetic Complexes	
90 MJD266	Alla Piirsoo	Protobios/ Kaia Palm	Study on mechanisms of chemotactic migration and differentiation potency of adipose derived mesenchymal stem-like cells	
91 MJD270	Irina Nikolkina	TUT/ Tarmo Soomere	Statistics of extreme wave conditions and events for Estonian coastal waters	
92 MJD272	Elmo Tempel	NICPB/ Martti Raidal	Dark Matter search using astrophysical sources	
93 MJD280	Diana Santalova	UT/ Tõnu Kollo	Multivariate regression models in application for transport flows analysis and forecasting	
94 MJD284	Tõnis Org	UT/ Hanna Mikkola	Mechanisms of Scl/Tall dependent gene activation and repression during mesoderm diversification	
95 MJD285	Merit Nikol	TUT/ Rein Kuusik	Reuse of power plant ashes: development of continuous processes for abatement of emissions of acidic gases ( $\text{SO}_2$ and $\text{CO}_2$ ) and PCC production	
96 MJD298	Antonio Racioppi	NICPB/ Martti Raidal	Stückelberg Z' and scalar dark matter	
97 MJD305	Qiaoying Zhang	UT/ Kristjan Zobel	The adaptive value of kin recognition in herbaceous plant communities with contrasting species richness	
98 MJD309	Andis Kalvans	UT/ Tiit Hang	Studies of the dynamics of SE sector of last Scandinavian Ice Sheet by image analysis approach applied in relief analysis	
99 MJD310	Luis Estrada-Gonzalez	UT/ Daniel Cohnitz	Logical pluralism: Agreement, disagreement, and the possibility of communication	
100 MJD320	Nele Muttik	UT/ Horton Newsom	Mineralogical and isotopic evidence for the nature of the aqueous and hydrothermal processes affecting the martian meteorites: Insight for early environments on Mars	
101 MJD321	Karin Kogermann	UT/ Tanel Tenson	Effects of macrolide antibiotics on bacterial physiology - cell filamentation	
102 MJD322	Josep Soler-Carbonell	UT/ Martin Ehala	The role and perception of English as a 'global' language in academic research and higher education. Questions, policies and effects for "medium-sized" language communities	

<b>Grant</b>	<b>Grantee</b>	<b>Partner Inst. / Supervisor</b>	<b>Project Title</b>	<b>Com- pleted*</b>
103 MJD323	Triin Vahisalu	UT/ Hannes Kollist	Molecular mechanisms of plant guard cell regulation in response to ozone	
104 MJD327	Charly France Alexandre Mayeux	UT/ Peeter Burk	Alkali metal ion affinities in the gas phase	
105 MJD334	Maris Berzins	UT/ Tīt Tammaru	Domains of Interethnic Contact in Latvia	
106 MJD338	Jana Temelova	UT/ Tīt Tammaru	Social aspects of neighbourhood change in pre-1989 city space: The Case of Estonian and Czech Cities	
107 MJD340	Evely Leetma	UT/ Tom Lyche	Smoothing problems	
108 MJD341	Mari Palgi	TUT/ Tõnis Timmusk	Molecular studies of bHLH transcription factor daughterless and its mammalian homologue TCF4 in <i>Drosophila</i>	
109 MJD347	Lars Fredrik Stöcker	TLU/ Karsten Brüggemann	A gradual transition: Perestroika, opposition, secession and transformation in Estonia in the light of the border-crossing elite networks from the mid-1980s to the early 1990s	
110 MJD362	Larissa Kus	TLU/ Raivo Vetik	The impact of power reversal, social changes, and division between ethnic groups on intergroup relations and subjective well-being	
111 MJD376	Jaanis Juhanson	UT/ Sara Hallin	Spatial patterns of denitrifying microorganisms for improved mitigation strategies for nitrous oxide emissions from arable land	
112 MJD387	Luca Marzola	UT/ Stefan Groote	Exploring new Physics through Astro-Particle Physics	
113 MJD391	Oleksandr Husev	TUT/ Dmitri Vinnikov	Research, design and implementation of qZS-derived DC/DC and multilevel DC/AC converters	
114 MJD398	Anna Katarzyna Jasinska	UT/ Arne Sellin	Structure-function relationships of the water transport pathway of deciduous trees in light of global climate change: Effects of increasing atmospheric humidity	
115 MJD407	Petra Tonarová	TUT/ Olle Hints	Diversification and biogeography of Silurian jawed polychaetes	
116 MJD409	Martins Kaprāns	UT/ Eva-Clarita Pettai	Stability and dynamics of post-communist remembering: memory politics and agency in Eastern Europe	
117 MJD428	Kuno Kooser	UT/ Edwin Kukk	Vacuum-ultraviolet spectroscopy for homogeneous molecular clusters and mixed biomolecule-solvent clusters	
118 MJD433	Larissa Roots	UT/ Timon Rabczuk	Multiscale Methods for Fracture	
119 MJD435	Christian Spethmann	NICPB/ Emidio Gabrielli	Researching physics within and beyond the Standard Model	
120 MJD437	Alexandr Svetlicinii	TUT/ Tanel Kerikmäe	Transplantation of the EU competition rules and standards in a small market economy: case of Estonia from regional, EU and international perspective	

<b>Grant</b>	<b>Grantee</b>	<b>Partner Inst. / Supervisor</b>	<b>Project Title</b>	<b>Com- pleted*</b>
121 MJD438	Tiina Tosen	EULS/ Ülo Niinemets	Towards better understanding of mesophyll conductance: the third major player in the process of photosynthesis	
122 MJD447	Oleg Janson	NICPB/ Alexander Tsirlin	Microscopic modeling of magnetic materials using DFT+U and hybrid functionals	
123 MJD450	Aet Annist	TLU/ Hannes Palang	Mapping the migratory careers of transnational Estonians	
124 MJD455	Julija Gusca	TUT/ Andres Siirde	Integrated Assessment Analysis of Greenhouse Gases Emissions of Estonian Energy Production Sector	
125 MJD457	Helin Räägel	UT/ Marino Zerial	Identification of the role and function of polarity-generating and actin-modulating proteins in the formation of the peculiar hepatocytic polarity	✓
126 MJD458	Uwe Sperling	UT/ Valter Lang	Research in metalwork of Bronze Age Estonia - archaeometric and experimental methods applied	
127 MJD459	Sebastian Fiedler	TLU/ David Ribeiro Lamas	The development and re-instrumentation of learning activity in the context of creative work: potentials for systemic intervention into educational practise	

## Notes and the key

\* The note in the completeness column includes a page reference to the overview in the current booklet if applicable.

UT	University of Tartu
TUT	Tallinn University of Technology
TLU	Tallinn University
NICPB	National Institute of Chemical Physics and Biophysics
EULS	Estonian University of Life Sciences
ELM	Estonian Literary Museum

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