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Eesti Teadusagentuur
Estonian Research Council

Mobilitas COMPASS Grantees

2015

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Mobilitas
COMPASS
2015

Grantees

Tallinn
2015

Mobilitas
ESF programm

European Union
European Social Fund

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Proofreading: Pille Põiklik
Cover image: Shutterstock.com
Editing and layout: Meediaseire MTÜ

ISBN 978-9949-9512-9-1 (in print)
ISBN 978-9949-9663-0-1 (pdf)
Print: Ecoprint AS

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

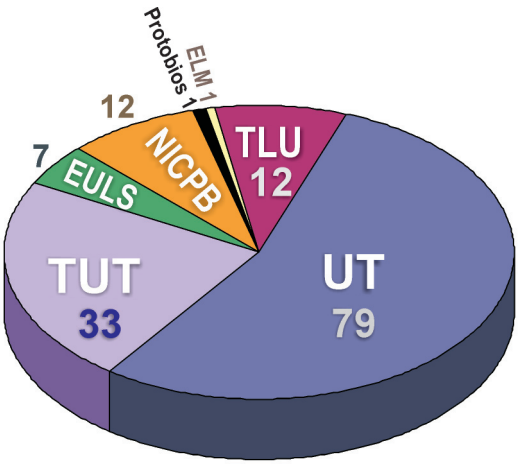
Intermediate Body

Ministry of Education and Research

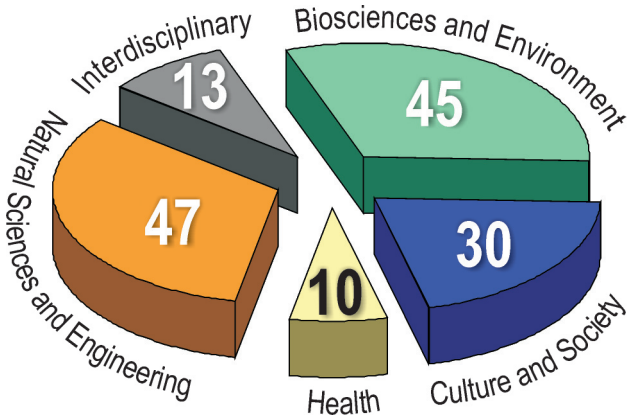
Implementing Agency

SA Archimedes

Mobilitas Mobilises Bright Minds



Breakdown of all Mobilitas grants by institutions.



Breakdown of all Mobilitas grants by disciplines.

The researcher mobility programme Mobilitas, co-funded from the European Social Fund, is running for eight years, from 2008 until the end of 2015. The programme aims to support researcher mobility and, through that, foster international collaboration. It is targeted at postdoctoral and top-level researchers.

The Estonian Research Council has awarded 127 postdoctoral grants and 18 top researcher grants. The grantees work in 7 different Estonian R&D institutions: the University of Tartu, the Tallinn University of Technology, Tallinn University, the National Institute of Chemical Physics and Biophysics, the Estonian University of Life Sciences, the Estonian Literary Museum, and Protobios.

The highest goal of the programme is quality research, and I am certain that we have achieved that. Two of our postdocs have been awarded the Young Scientist Award granted by the Cultural Foundation of the Estonian President – Elmo Tempel[1] in 2013 and Lili Milani[2] in 2014. Several grantees have received

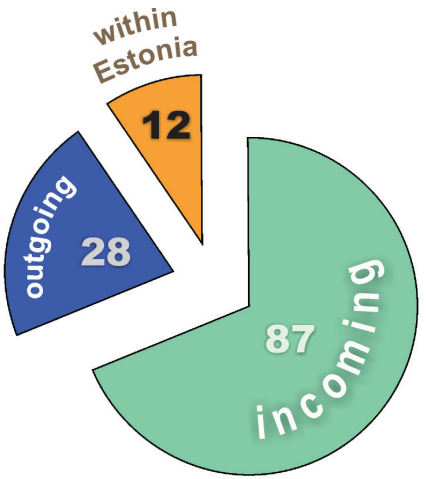
[1] Cf. Mobilitas Compass 2014, **p. 32**.
[2] Cf. Mobilitas Compass 2014, **p. 13**.

prominent grants and advanced their careers. What is more, the vast majority of grantees are well satisfied with the programme based on the satisfaction survey. So, despite all the technical difficulties and problems we have faced, we can call the programme a success.

In order to inform the public of the programme outcome, we have published 3 booklets containing the grantees' popular narrative texts on their research projects. The first booklet – "Mobilitas Compass 2013" – was published in 2014, and it was co-authored by 52 grantees. In 2015, "Mobilitas Compass 2014" and "Mobilitas Compass 2015" are published, the former containing 37 and the latter 46 project overviews. You find the full list of Mobilitas grants at the end of this booklet.

It would not have been possible to carry out the programme without the kind cooperation of the partner institutions, the Ministry of Education and Research, and the Archimedes Foundation. And I would like to extend my special thanks to all the grantees for their patience and involvement.

Tiina Loit
Mobilitas Programme Manager



Breakdown of Mobilitas postdoctoral grants by direction (127 in total).

Research field	Σ	By institutions
material technology	6	UT 4; TUT 1; NICPB 1
environmental technology	3	UT 1; TUT 1; TLU 1
biotechnology	5	UT 1; TUT 3; TLU 1
energy	3	TUT 1; NICPB 2
information and communication technology	1	NICPB 1
Total	18	

Breakdown of Mobilitas top researcher grants by research fields.

The key to the institutions' abbreviations:

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

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Teet Velling

Top Researcher in the field of biotechnology

- **Title: Co-operation of integrins and receptor tyrosine kinases in regulation of cell motility: role of filamin A and PKB/Akt**
- **Grant: MTT4, 1 Nov 2009 – 28 Feb 2015**
- **Partner institution: Tallinn University of Technology**

"After the end of the Mobilitas grant, I will join the group at the University of Tartu dealing with the molecular aspects of developmental biology and the regulatory role of integrins."

Proteins and Cellular Signals in Charge

Anything that happens to the cells in our body, and thus to ourselves, is regulated by protein-mediated cellular signals: proteins at the cell-surface – receptors – bind proteins outside the cell and, by doing it, transmit a signal to proteins inside the cell, i.e., the cytoskeleton. These tightly and dynamically regulated processes determine the fates of cells during embryonic development, inflammatory reactions, wound healing, tumorigenesis, etc., all of which involve the active movement of cells.

Members of a large family of transmembrane cellular receptors – integrins – are the prime molecules that mediate interactions and signals, which control cell motility. By binding, e.g., the extracellular protein collagen, integrins are directed to engage in contacts with intracellular actin cytoskeleton that are mediated by numerous adapter proteins, one of which – filamin (FLN) – is the focus of our studies.

We have shown that FLN selectively regulates the function of one specific integrin-type collagen receptor, integrin $\alpha 1\beta 1$, by increasing its expression on the cell surface and/or activity towards type I collagen. At the same time, FLN supports the epidermal growth factor-induced activation and the specific subcellular localisation of cytoplasmic enzymes PKB/Akt and ERK1/2. These results point to previously uncharacterised properties of the otherwise well-studied protein, FLN.

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Alessandro Strumia

Top Researcher in the field of energy

- **Title: Astro particle physics and the Large Hadron Collider**
- **Grant: MTT8, 1 July 2010 – 30 June 2015**
- **Partner institution: National Institute of Chemical Physics and Biophysics**

"The next years at CERN will be crucial for physics."

Mystery Behind the Higgs Boson

During the first run of the Large Hadron Collider, we discovered a new particle, which turned out to be the long awaited last missing piece of the Standard Model of fundamental interactions: the boson predicted by Higgs and others to give mass to all other particles.

This experimental result opens new theoretical questions. Who gives mass to the Higgs boson? According to the dominant theoretical paradigm developed in the past decades, the Higgs boson was expected to be accompanied by supersymmetric particles or by some other new physics able to cancel the large quantum corrections that would make the Higgs heavier by 16 orders of magnitude. The Higgs and nothing else is considered unnatural. But this is what was observed: no new physics was seen in the data.

While the situation might change in the future, this emerging paradox is already so significant that some physicists refer to it as a "crisis in physics". Similar past situations, where experiments contradicted our understandings, opened the road to fundamental developments. What is the important message that is hidden in the confusion today? We started to explore new non conventional ideas about the origin of masses. Assuming that nature is described by a theory where no mass exists, we showed how quantum corrections could generate dynamically from nothing the observed Higgs mass, together with the much larger energy scale of quantum gravity.

New experimental results about particle physics and cosmological inflation could clarify the situation in the next years.

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Mikael Johan Brosché

Top Researcher in the field of biotechnology

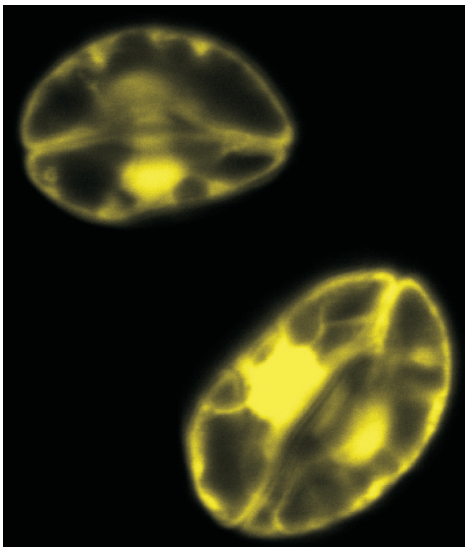
- **Title: Natural variation of plant stress responses — molecular tools for environmental research**
- **Grant: MTT9, 1 Mar 2010 – 28 Feb 2015**
- **Partner institution: University of Tartu**

"I thank the Estonian Research Council for this opportunity to work with very talented scientists in Estonia. This research will continue so that we can understand how plants respond to changes in the environment."

How Do Plants Sense Altered CO_2 Concentration?

Plants, like animals, need to accurately understand their environment. It would be suicide to germinate in soil with no water or to flower when winter is coming. Climate change causes new challenges for plants, including altered temperatures and increased CO_2. In this project, the model plant thale cress has been used to understand how plants respond to changes in CO_2 concentration.

To study these mechanisms and signaling pathways, we took advantage of the natural variation in plants. Thale cress grows at a very wide geographic growth area across the entire Northern hemisphere. By comparing plants from Cape Verde islands (outside Africa) and Germany, we could genetically map and identify a novel protein kinase that is a crucial regulator in the sensing of altered CO_2 concentration. This discovery opens up the possibility to breed plants that show increased yield in a changing environment.



Guard cells in thale cress expressing yellow fluorescent protein fused with a CO_2 sensing kinase.

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Jan Johansson

Top Researcher in the field of biotechnology

- **Title: Exploiting Nature's solutions to complex biomedical problems**
- **Grant: MTT16, 1 Aug 2010 – 31 July 2015**
- **Partner institution: Tallinn University**

"We will harness the BRICHOS chaperone for the treatment of amyloid disease, in particular Alzheimer's disease, and use artificial spider silk for regenerative medicine."

Exploiting Nature's Solutions in Biomedicine

Surfactant protein C (SP-C) is essential for the treatment of respiratory distress syndrome (RDS). We solved the problem of aggregation encountered when synthesizing SP-C by replacing all residues in SP-C with high β-sheet propensity, which yielded an analogue that can be synthesized in large amounts, and the treatment of >20 premature infants with RDS shows that it works well in clinical practice.

SP-C has residues with high tendency to form a β-sheet, like the amyloid β-peptide (Aβ) associated with Alzheimer's disease. We discovered that a BRICHOS domain in the SP-C precursor is a molecular chaperone. Intriguingly, mutations that segregate with human lung fibrosis are localized to the BRICHOS domain, and we have explained how mutations lead to amyloid disease. We have also found that BRICHOS blocks Aβ toxicity in fruit flies and in mouse hippocampal slices. We have elucidated the molecular mechanism behind the BRICHOS reduction of Aβ42 toxicity; it blocks secondary nucleation and, thereby, reduces the amounts of toxic Aβ42 oligomers by >80%.

The main components of spider silk are large and repetitive proteins with conserved terminal domains (NT and CT). We have explored in detail how NT and CT regulate spidroin solubility and silk formation under physiological conditions, explaining how precocious spidroin aggregation is prevented. These insights have enabled us to produce artificial spider silk scaffolds for the growth and differentiation of pluripotent stem cells.

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Yury Orlovskiy

Top Researcher in the field of material technology

- **Title: Design of advanced nanostructured materials with tailored properties for novel laser and light sources**
- **Grant: MTT50, 1 Aug 2011 – 31 July 2015**
- **Partner institution: University of Tartu**

"I plan to continue the current work in the Institute of Physics, University of Tartu, after finishing my Top Researcher grant in July 2015. However, it depends on being successful in searching for external European funding."

Optical Nanocrystals for Cancer Treatment

Crystalline dielectric nanoparticles (NPs) doped by rare-earth (RE) ions distributed in optically transparent amorphous, glass-ceramics or polymer matrix, are promising in developing photochromic coatings, chemical sensors, nonlinear optical devices and, primarily, highly effective luminescent and laser materials. However, the fundamental results obtained during the project on the intra- and inter-optical center fluorescence, quenching in the RE doped crystals with constrained geometry (NPs), can be applied for deep (up to 1 cm) and non-invasive near IR laser-induced fluorescence cancer tumors imaging and laser-hyperthermia treatment.

We used the microwave-hydrothermal technique for the synthesis of water dispersible NPs. The applied technique has many advantages, for example, a possibility to eliminate potentially harmful substances serving as capping agents, or stabilizers. We used a reliable method for the quality control of fluorescent NPs based on the analysis of the kinetics of impurity quenching, the so-called "energy transfer probe".

To improve the properties of NPs for photo-hyperthermia, we performed experimental and theoretical studies of the heating mechanisms in the RE doped NPs caused by multiphonon relaxation. As a result, we have submitted an international application for invention. The project is performed in the Institute of Physics of the University of Tartu together with the Laboratory of Laser Biospectroscopy of General Physics Institute, Moscow.

Andrea Giammanco

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Top Researcher in the field of information and communication technology

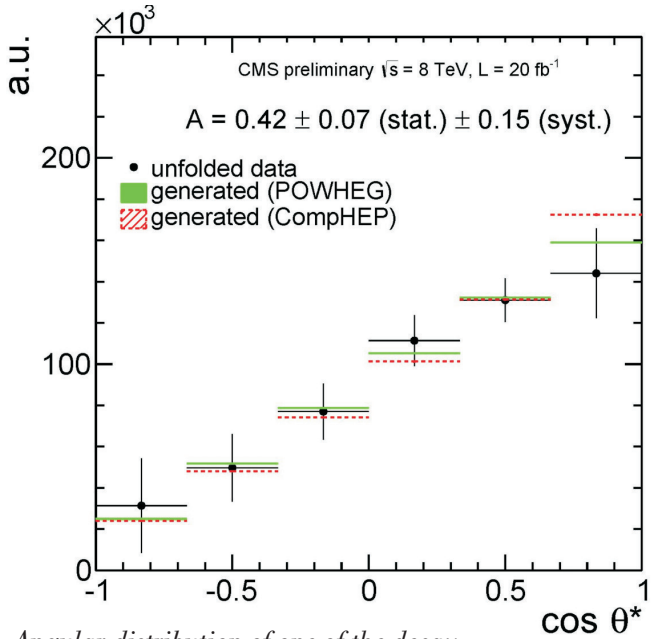
- **Title: Top quark physics and exotic searches with the CMS detector**
- **Grant: MTT59, 1 Aug 2011 – 31 July 2015**
- **Partner institution: National Institute of Chemical Physics and Biophysics**

"I have been appointed to a managerial position in the CMS Collaboration at CERN (Switzerland) as co-leader of the Top Quark Physics Analysis Group."

Single and Attractive Top Quarks

The top quark is the heaviest known particle, and from this fact follow some unusual properties. For example, it is the only quark whose decay is faster than the typical time scale for forming stable hadrons. As a consequence, by studying its decay products, we have unique access to the properties of a "naked" quark and, in particular, to its degree of polarization.

I assembled an analysis group in Tallinn that used LHC data at 8 TeV from the CMS experiment to study the special case of top quarks produced singly by the electro-weak interaction. We contributed to the measurement of the rate of this process, that we used to constrain a fundamental parameter of the Standard Model, and we had a leading role in the first measurement of its polarization, for which the Standard Model makes a very precise prediction (close to 100%) but deviations are expected in several new-physics models.



Angular distribution of one of the decay products of single top quarks. The observed slope is interpreted as coming from the polarization of single top quarks, here proven for the first time.

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Emidio Gabrielli

Top Researcher in the field of energy

- **Title: Search for New Physics beyond the Standard Model and astrophysical implications**
- **Grant: MTT60, 1 May 2011 – 31 July 2015**
- **Partner institution: National Institute of Chemical Physics and Biophysics**

"I have a plan to continue my research also in collaboration with my Estonian colleagues at the Department of Physics of the University of Trieste (IT) where I was granted the position of Senior Researcher."

Search for New Physics at the Large Hadron Collider

The long-awaited Higgs boson particle, responsible for the electroweak symmetry breaking and fermion mass generation in the Standard Model (SM) theory of elementary particles, was finally discovered in 2012 at the Large Hadron Collider (LHC) at CERN, with a mass of 125 GeV, showing a high compatibility with all SM Higgs boson features.

One of the main aims of this project was to investigate the phenomenological implications of new physics scenarios that could show up in the Higgs boson physics at the LHC and future colliders. In collaboration with the group led by Prof. Martti Raidal at the NICPB in Tallinn, we analysed the sensitivity at the LHC to anomalous Higgs boson couplings to the top-quark and to the weak gauge bosons mediators. We also proposed a new scenario that can naturally explain the large mass hierarchy of SM fermions or, analogously, in their corresponding Higgs Yukawa couplings. This scenario implies the existence of new stable heavy fermionic particles plus a massless dark photon that can play the role of Dark Matter candidates. In this framework, we show the existence of a new interesting Higgs decay channel into a photon plus a dark photon that is a striking signature of this scenario and might soon be observable at the LHC.

These studies could significantly contribute to our understanding of the Higgs boson properties and of the origin of Dark Matter in the universe, providing a new paradigm for a natural solution of the SM fermion-mass hierarchy problem.

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Tomas Torsvik

Top Researcher in the field of environmental technology

- **Title: Numerical particle tracking modeling for inhomogeneous turbulent water basins**
- **Grant: MTT63, 1 Aug 2011 – 31 July 2015**
- **Partner institution: Tallinn University of Technology**

"After the grant period, I plan to extend my work period at the Institute of Cybernetics at TUT where I will work on the transport of pollution in estuaries."

Identifying Surface Current Patterns

The aim of this research project was to examine transport processes subject to inhomogeneous turbulent motion and assess the need for further model development in this area. The research has focused on surface currents in the Gulf of Finland, making use of both numerical models and surface drifter experiments.

The Western part of the Gulf of Finland is a highly dynamic sea basin, residing in the transition zone between a shallow estuarine area to the East and the open Gotland Sea to the West. Although the long-term average drift direction is westward in this sea basin, driven by the inflow of river water in the Eastern part of the Gulf of Finland, the flow pattern is frequently dominated by episodes of strong currents spanning across the gulf. Numerical modeling of particle tracks shows that the shifting turbulence regimes have a strong influence on spreading rates. Therefore, the effect of small-scale turbulent motion is of importance when modeling, e.g., the extent of an oil spill over time.

However, the statistics of particles transported to coastal regions, the spatial distribution of particles reaching the coast and the average drift time showed only minor changes under shifting turbulence regimes.

These results indicate that the long-term exposure of coastal areas to offshore litter and pollution is more sensitive to large scale, semi-persistent current patters than to small-scale turbulent motion.

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Raiker Witter

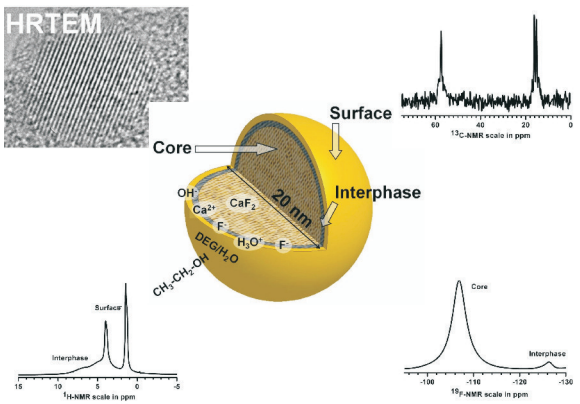
Top Researcher in the field of material technology

- **Title: Microwave and Scale enhanced NMR of Micro-Drops, -Leaflets, Cells and Nanoparticles**
- **Grant: MTT68, 1 July 2011 – 31 July 2015**
- **Partner institution: Tallinn University of Technology**

"My position as an associate professor at TUT has been settled until 2018. In the next years, I will drive to become a full professor or a lead scientist. Me and my group are focused on a new project related to sustainable energy, which needs to obtain sufficient financing for research."

Microwave and Scale Enhanced NMR of Micro-Drops, -Leaflets, Cells and Nanoparticles

The exploration and application of micro- and nanotechnology is becoming increasingly important in the 21st century innovation. In this project, micro- and nano-sized spectroscopic sensors were developed; nano-entities synthesized and their structure and function investigated/optimized, for instance, for hydrogen storage and battery materials. Related to and based on this research, it was possible to establish a new research topic – Fluoride Ion Batteries – intended to target the highest energy densities with a wide range of operating temperatures and mostly better safety than Li-based cells: aiming for industrial applications.



20 nm sized core/shell nano-particle.

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Jarek Kurnitski

Top Researcher in the field of energy

- **Title: Nearly zero energy buildings (nZEB) in Estonia: energy, durability and indoor climate performance analyses combined with cost optimality assessment for transformation**
- **Grant: MTT74, 1 Apr 2012 – 31 July 2015**
- **Partner institution: Tallinn University of Technology**

"Mobilitas brought me from Finland to the Tallinn University of Technology where I am happy to continue as recently elected professor in Energy performance and indoor climate of buildings."

Nearly Zero and Cost Optimal Buildings

My nZEB research group was established at the right time and place thanks to Mobilitas. In a great hurry in 2012, we contributed to the preparation of Estonian regulation introducing stringent energy performance requirements for new buildings and major renovation based on minimum life cycle cost. This regulation established requirements for nearly zero energy buildings (nZEB) for 2019/2021; Estonia was the second country after Denmark to officially launch nZEB requirements. We are also proud of the energy calculation methodology – based on dynamic energy simulation it is unique and advanced and followed already by Finland and has implications for other countries.

In the Estonian energy action plan ENMAK 2030+ development in 2013–14, our calculations showed that 50% of total final energy use occurred in buildings. As a research group, we faced a new challenge – instead of an opportunity to produce fascinating research on new buildings with great novelty, we had to focus on existing buildings with many limitations and constraintsfor their renovation is even more important for economy. This work drastically changed the understanding of renovation revealing that governmental renovation grants are not expenditure but fully paid back by tax return. We showed that renovation rates can be doubled to be an engine for economy, saving money and energy and resulting in better homes and workplaces.

Meanwhile, I had time to contribute on the European level as chair of REHVA nZEB task force, resulting in technical bases and definitions for a uniformed implementation of nZEB in EU.

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Rudolf Kiefer

Top Researcher in the field of material technology

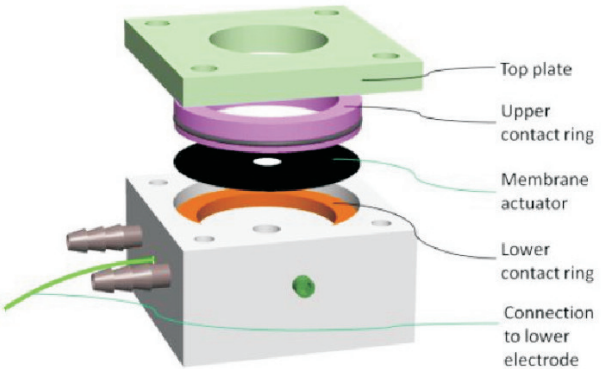
- **Title: New conductive polymer actuator design**
- **Grant: MTT76, 1 July 2012 – 31 July 2015**
- **Partner institution: University of Tartu**

"I thank the Estonian Research Council for the opportunity to work in Tartu. During my research, I became a part of the IMS lab and intend to continue my work by acquiring new projects after the Mobilitas funding ends."

New Conductive Polymer Actuator Design

Conducting polymers have been studied for decades, and their application in actuator devices are of great interest due to their exceptional properties at low voltage, no noise and simple preparation conditions. To implement actuator material based on ionic (conducting polymer) and electronic EAP (dielectric elastomer) in novel application, an autofocus fluid lens device (see the Figure) was fabricated with an implemented actuator membrane in the middle formed hole where the interface between oil/water (electrolyte) the meniscus (perfect lens) could be manipulated over actuation.

Lens changing properties have been found for actuator material based on ionic EAP (conducting polymers and ionic polymer metal composites) but best performance was established for encapsulated dielectric elastomer membranes (lens changing at applied 0.6 kV) in collaboration with the University of Darmstadt (Germany) with envisaged application in a new design of micro lens development for high resolution cameras embedded with novel wavelet transformation image processing technology.



Autofocus fluid lens device variable for membrane actuators (ionic or electronic) of different sizes.

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Alexander Tsirlin

Top Researcher in the field of material technology

- **Title: Spin-lattice coupling in magnetism: from quantum magnets to multiferroics**
- **Grant: MTT77, 1 Aug 2012 – 31 July 2015**
- **Partner institution: National Institute of Chemical Physics and Biophysics**

"Now that we know how magnetism couples to the lattice, we will try to follow the origin of this coupling."

Understanding Materials on Atomic Level

Gaining microscopic insight into the properties of matter is the ultimate goal of materials design. If we were able to understand what makes material a superhard solid, a high-temperature superconductor, or a good catalyst, a deliberate search for new advanced materials would become possible.

Properties of material hinge upon individual interactions that take place on the atomic and even sub-atomic scale. The goal of my research project in Estonia was to explore one particular type of these interactions: those that happen between electronic spins and the crystal lattice. When material becomes magnetic, it literally changes its dimensions, hence, magnetism and geometrical effects such as pressure or strain are intertwined. Although a weak effect in general, the spin-lattice coupling may play a decisive role in stabilizing particular types of the magnetic order and fragile electronic states, such as superconductivity.

During my stay in Estonia, I studied effects related to the spin-lattice coupling in several magnetic materials ranging from natural copper minerals to essentially artificial systems, including both newborn chemical compounds synthesized in the lab less than a year ago and very "traditional" systems, such as the copper pigment Han Purple that is used by humans since antiquity. By analyzing these materials from the perspective of their electronic structure, we were able to elucidate what makes crystal lattice respond to tmagnetism, and, in turn, how magnetism is affected by these changes in the crystal geometry.

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Dmitry Spasskiy

Top Researcher in the field of material technology

- **Title: Advanced oxide-based scintillation materials for application in science and technology**
- **Grant: MTT83, 1 Aug 2012 – 31 July 2015**
- **Partner institution: University of Tartu**

"I want to acknowledge the Mobilitas program for a substantial impact on my scientific carrier. I will proceed with my activities in M.V. Lomonosov Moscow State University in collaboration with my colleagues from the Institute of Physics, University of Tartu, Estonia."

Magic Crystals Visualizing the Invisible

The conversion of high-energy radiation into visible light is an actual task for various applications. The crystals used for the conversion are called scintillators. Scintillators are widely used for new particle physics experiments (e.g., for Large Hadron Collider in CERN), medical applications (e.g., for positron emission tomography), homeland security, etc. New crystals with improved characteristics are needed for various applications. At the Institute of Physics, University of Tartu, we have investigated novel oxide based crystals and powders with efficient conversion of high-energy radiation into visible light and studied the factors affecting the efficiency.

During the project, we have studied a very promising phenomenon of light output enhancement in mixed crystals. This is a non-linear effect observed when two different materials are mixed in one compound, whose energy conversion efficiency is higher than in the starting substances. We have shown how the engineering of the electronic band structure allows the tuning of the properties of the mixed crystals.

Another topic of our study was dedicated to the search for crystals which are suitable for application in cryogenic scintillating detectors. These detectors operate at very low temperatures; they are extremely sensitive and can be used for the search of very rare physical events, e.g., the registration of weakly interacting massive particles of dark matter. We have studied a novel class of molybdate scintillators and demonstrated its applicability with cryogenic detectors.

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Urmas Arumäe

Top Researcher in the field of biotechnology

- **Title: MANF neurotrophic factor: novel mode of action and therapeutic potential**
- **Grant: MTT84, 1 Aug 2012 – 31 July 2015**
- **Partner institution: Tallinn University of Technology**

"We are studying the intracellular cytoprotective mechanism of CDNF and the mode of action of the CKGC peptide from MANF."

Neuroprotective Mechanism of MANF

MANF (Mesencephalic Astrocyte-Derived Neurotrophic Factor) and CDNF (Cerebral Dopamine Neurotrophic Factor) are novel pro-survival proteins that potently reduce the symptoms of Parkinson's disease in animal experiments when injected into the brain as extracellular proteins. MANF is also an intracellular protein that is located to the endoplasmic reticulum (ER). Its intra- and extracellular modes of action are, however, poorly known.

We addressed the intracellular mode of action of MANF by expressing it in the sympathetic neurons. MANF protects these neurons against death induced by etoposide and was, indeed, located to the ER. MANF has a RTDL motif in its C-terminus that carries it to the ER. When this motif was deleted, MANF was located to the Golgi instead of ER and lost its survival-promoting properties. Thus, MANF can protect the cells in the ER but not in the Golgi. MANF has also a CXXC motif (CKGC) whose mutation (CKGS) completely inactivates it in the sympathetic neurons.

We also tested both mutants in the rat model of cerebral stroke where MANF, injected to the cerebral cortex, reduces the volume of infarction. The RTDL deletion mutant was still active in that model, showing that the intra- and extracellular modes of action of MANF differ considerably. However, the CKGS mutant was still inactive.

We found that the tetrapeptide CKGC is cytoprotective itself since it protects the Jurkat cells against three different cell death models.

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Liisa Rohtla

- **Title: Develop remote sensing tools for the monitoring and spatial planning of shallow coastal water environments**
- **Supervisor: Samuel Purkis**
- **Grant: MJD103, 1 Sept 2010 – 31 Mar 2015**
- **Partner institution: University of Tartu**
- **Receiving institution: Nova Southeastern University, USA**

"Since the remote sensing tools and methods are under constant change, it is important to continue my research on mapping the Baltic Sea bottom types in Estonian Marine Institute."

Learning from Corals

Coastal zone is a region with a high population density, urban development, economic activities and tourist facilities, therefore, it is one of the most exploited and developed regions in the world. Benthic vegetation and coral reefs are an important component of the coastal zone ecosystem and give a great contribution on many levels (primary production, habitats for fish, prevent coastal erosion, etc.). The species composition of benthic habitats and shifts in them are indicators of the ecological state of the coastal zone. Therefore, it is important to map benthic habitats and monitor shifts in them.

Remote sensing tools (instruments onboard of a satellite or an aircraft) can give a good overview of the environmental changes in large areas, with a reasonable time step. Remote sensing of the Baltic sea bottom types (is it algae, rocks, sand, etc.?) has involved only the optical signature measurements and needs complementary methods for further development.

In coral reef mapping, a method that also allows the recognition of bottom types based on their texture (spatial morphology) has been used. Combining spectral information and spatial texture was found to provide greater details about the shallow water bottom types than using a single method. Also, the experience in planning and managing marine protected areas was achieved through a study of the Red Sea coral reef resilience and can be adapted to the Baltic Sea in some senses.

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Tsipe Aavik

- **Title: Assessing the effectiveness of connectivity measures on gene flow and genetic diversity of wildflowers in agricultural landscapes – a landscape genetic approach**
- **Supervisor: Regula Billeter**
- **Grant: MJD113, 12 July 2010 – 11 Feb 2015**
- **Partner institution: University of Tartu**
- **Receiving institution: Swiss Federal Institute of Technology**

"In the future, I would like to continue studying genetic patterns in relation to habitat fragmentation and to broaden my focus on the genetic diversity of adaptive relevance."

Restoration Genetics of Grassland Plants

Natural and semi-natural habitats have experienced a drastic loss in their area and connectivity due to land use changes. Various restoration activities have been initiated in order to reverse this process.

The aim of this project was to evaluate the effectiveness of restoration measures in a fragmented agricultural landscape in Switzerland with the help of novel molecular tools. For this, I examined the genetic and fitness patterns of a grassland plant Ragged Robin in recently restored (sown) and natural grasslands.

I found that sown populations were genetically less diverse than natural populations. Furthermore, plants originating from restored grasslands or from seed mixtures showed slightly lower reproductive fitness compared to plants from natural populations. Thus, more attention should be paid to the genetic quality of seed mixtures used in restoration.

In addition, I evaluated the movement of pollen and seeds among sown and natural populations of the study plant by assessing recent gene flow. I detected little gene flow, which suggests low spatial connectivity between grassland patches in this landscape despite restoration efforts. Further landscape genetic analysis showed that the forest is the most important barrier for the gene flow of Ragged Robin.

In conclusion, the project demonstrated that ecological restoration should incorporate genetic information to guarantee the success of restoration measures. Furthermore, we showed that genetic methods offer a valuable tool for assessing the success of restoration activities.

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Eve Kaurilind

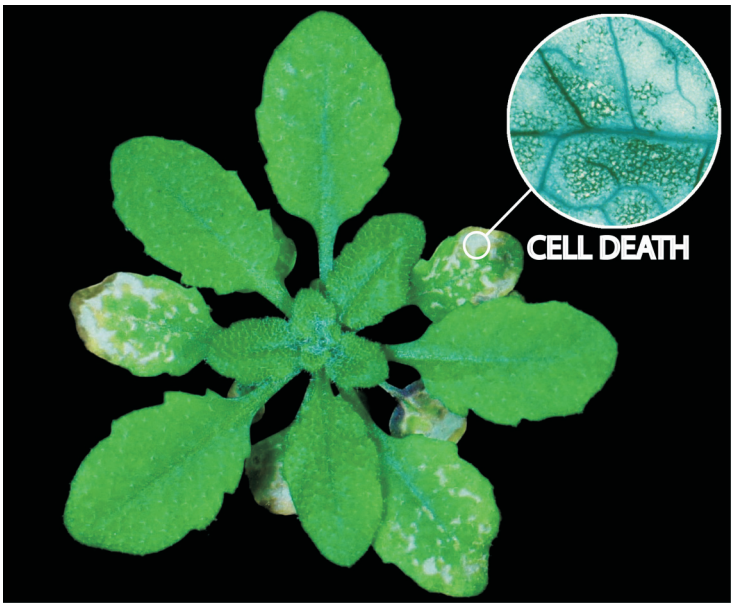
- **Title: Regulatory mechanisms of plant abiotic stress responses**
- **Supervisor: Jaakko Kangasjärvi**
- **Grant: MJD115, 1 Oct 2010 – 31 Jan 2015**
- **Partner institution: University of Tartu**
- **Receiving institution: University of Helsinki**

"After postdoctoral studies, I will continue my research on stress biology, and I will interpret my results from Arabidopsis to tree species."

To Die or not to Die

Plants can experience multiple stress conditions during growth – ranging from abiotic stresses (including altered temperature, water availability and light intensity) to biotic stresses (pathogen infection, insect attack). One of the early events after stress perception is the enhanced production of reactive oxygen species that are used as signaling molecules, activating plant defense mechanisms. The activation of immunity initiates a multitude of signaling pathways, which in some cases culminates with programmed cell death.

This project aimed to identify regulators of cell death in plants and the associated stress hormones. We were able to find some unique and common genes which regulate cell death and, hence, plant innate immunity. Furthermore, there seems to exist a constant recalibration of different signaling pathways and the outcome is achieved through balance.



triinu.remmel@emu.ee

Triinu Remmel

- **Title: Trade-offs in plant defense against herbivores**
- **Supervisor: Ülo Niinemets**
- **Grant: MJD161, 1 Aug 2012 – 31 Dec 2015**
- **Partner institution: Estonian University of Life Sciences**

"I will continue the study of plant defense against herbivory in the context of climate change, asking how the changing conditions will influence the struggle between plants and insects."

Plants against Herbivores: Defense Strategies

Plants have two main strategies of defense against herbivores: resistance and tolerance. Neither of these lines of defense come cheap; they both have a cost. Therefore, it is assumed that there must be a trade-off between the two: if a plant invests in one, it has a lower amount of resources left for the other. However, such trade-offs have turned out to be hard to prove.

Negative genotypic correlations between resistance and tolerance – considered to be the most reliable indicators of trade-offs – have been found in some studies, while others have yielded positive or no correlations. The problem may lie in the use of negative genotypic correlations: if some genotypes have inherently higher fitness in a given environment than others, they may be able to invest in both defense strategies more than others, thus, producing a positive correlation even if the trade-off exists. We demonstrate that accounting for genotypes' average fitness in statistical models that test for genotypic correlations may shift the resultant correlations towards more negative values.

The plants' investment in resistance or tolerance is not fixed and can be adaptively modified depending on signals from the environment. As proof of this, we found that indicators of both resistance and tolerance of Silver birch (*Betula pendula*) depend on the identity of the herbivore chewing it: an insect specialized on birch, a generalist insect, or a mammal.

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Helen Tammert

- **Title: The distribution and biodiversity of Flavobacterium genus in the salinity gradient and different productivity regions**
- **Supervisors: Lise Øvreås**
- **Grant: MJD173, 1 Sept 2011 – 31 Dec 2015**
- **Partner institution: University of Tartu**
- **Receiving institution: University of Bergen**

"After completing this project, I will continue with methanotrophic bacteria and their consumption in the food web."

Genus *Flavobacterium* in the Baltic Sea

Flavobacterium species belong to a group of microorganisms that are free-living in the water or pathogenic to aquaculture as well as wild fish. In this project, we estimated the genetic diversity, biogeography as well as adaptability of genus *Flavobacterium* to salinity and organic matter gradients in the Baltic Sea. This one of the largest brackish water environments has an extensive salinity gradient from East to West of ~2 to 35. The salinity of brackish water is usually too low for marine organisms, while being too high for freshwater organisms.

Water samples for this research were obtained on cruises along 2000 km transects in the Baltic Sea. For the quantification of genus *Flavobacterium* cells, newly designed primers were tested and applied.

Flavobacterium cells were more abundant at the surface of the Baltic Sea compared to deeper layers which were suboxic or anoxic in most cases. The elevated abundances were observed in regions where salinity conditions changed. This suggests that most *Flavobacterium* species are aerobic heterotrophs in the Baltic which benefit from changing salinity conditions and resulting effects on terrigenous dissolved matter. *Flavobacterium* members might be immigrants from the catchment area, carried into the Baltic along the rivers, but are adapted to the conditions in certain regions of the Baltic Sea. They play a role in mineralizing various types of organic matter such as carbohydrates, amino acids, proteins and polysaccharides.

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Revathi Naidu

- **Title: $Cu_2ZnSn(S/Se)_4$ thin films for solar cells**
- **Supervisor: Olga Volobujeva**
- **Grant: MJD213, 1 Feb 2012 – 31 Jan 2015**
- **Partner institution: Tallinn University of Technology**

"After the completion of the postdoctoral grant, I continue my research in TUT with the same group on the novel thin film photoabsorber materials in photovoltaic device applications."

Novel Cost-effective Solar PV Materials

Solar energy is the biggest source of energy for mankind. Used for conversion, solar energy to electricity Photovoltaic cell performance is measured in terms of its efficiency at turning sunlight. With forecasts of over 30 TW of new power needed by 2050, the carbon emissions associated with the expansion or even continuation of the current fossil-fuel-based electricity generation would make maintaining atmospheric CO_2 concentrations near their current levels of 379 ppm an insurmountable challenge.

Historically, the development of the PV technologies has followed a path of consumption scarce materials such as crystalline silicon solar cells that are by far the most common material at the moment, maintaining a market share of almost 80%. Such wide use of silicon in solar energetics is based on the fact that crystalline silicon is widely available, has a proven track-record in reliability and material physical characteristics that are well researched and understood due to the wide use of Si in microtechnologies. The remainder of the PV market is principally provided for by different thin film technologies. Thin films use can potentially result in lower production and produced energy costs.

My research during the postdoc period was studying the regularities and formation of thin films novel absorber materials like kesterites and SnS in relation with deposition conditions. Systematic characterization of the layers reveals their crystalline structure, stoichiometry, chemical and phase composition, electrical and optical properties. Special emphasis was put on finding "tools" for tailoring the defect and phase composition of deposited absorber thin films.

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Virve Sõber

- **Title: The role of floral herbivores in plant-pollinator interactions: a population level approach**
- **Supervisor: Satu Ramula**
- **Grant: MJD258, 1 Dec 2011 – 31 May 2015**
- **Partner institution: University of Tartu**
- **Receiving institution: University of Turku**

"Together with the entomologists at the University of Tartu, I will investigate the different evolutionary aspects of plant-insect interactions."

How do Flowering Plants Cope with Insects?

Plant-pollinator interactions are crucial in the functioning of most terrestrial ecosystems. These interactions can be altered or even terminated by herbivores. Among these herbivores, insects who consume flowers can considerably affect pollination.

However, it is poorly known how different aspects of plant reproduction respond to floral herbivory. We studied the effect of floral herbivory on pollen limitation experimentally (a plant is pollen limited when its seed production is reduced due to inadequate pollen receipt). We also wanted to know how the effects of floral herbivory manifest in natural plant populations.

Plants seem to be able to compensate for herbivore damage to their reproductive organs better than expected: we showed that, in short-lived species, floral herbivory has only a minor effect on seed production and pollen limitation. Long-lived species may use other strategies to cope with their enemies: in natural populations with a variable degree of floral herbivory, we found relatively large variation in the number of lifetime reproductive events.

Our results imply that appropriate conservation strategies for rare plant and pollinator species should be based on simultaneous analyses of all important ecological interactions.

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Alla Piirsoo

- **Title: Study on mechanisms of chemotactic migration and differentiation potency of adipose derived mesenchymal stem-like cells**
- **Supervisor: Kaia Palm**
- **Grant: MJD266, 1 Nov 2011 – 31 Dec 2015**
- **Partner institution: Protobios OÜ**

"After finishing the postdoc project, I would like to continue my current investigations as an independent researcher."

Useful Fat

Over the last 15 years, an explosion of novel knowledge about stem cells has led to hopes of using these cells to regenerate tissues and treat various diseases. Mesenchymal stem cells (MSCs) are of particular interest since they are numerous and one can get them from various tissues. One of the promising sources of MSCs is adipose or fat tissue since it yields large numbers of stem cells without major complications for the donor.

My project tackles the molecular networks in adult human adipose tissue stem cells (ASCs). One of the major aims of my project is to understand if and how inflammation mediators, chemokines, can affect these cells. I have found that only a limited number of chemokines can regulate ASCs, and signals induced by chemokine called CCL5 are the ones affecting these cells. I have further shown that CCL5 via its receptor CCR1 induces the migration and increased multiplication of ASCs while stem cell properties are retained. Based on my data, it is feasible to speculate that CCL5 can be used as an efficient growth stimulant if large numbers of ASCs are needed to be grown *ex vivo*.

I have also found that ASCs possess intact signalling axis for the growth factor Sonic Hedgehog (Shh). Moreover, I have demonstrated that Shh induces the differentiation of ASCs towards bone cells. These data allow us to manipulate ASC differentiation properties and might have implications for medical applications involving bone repair.

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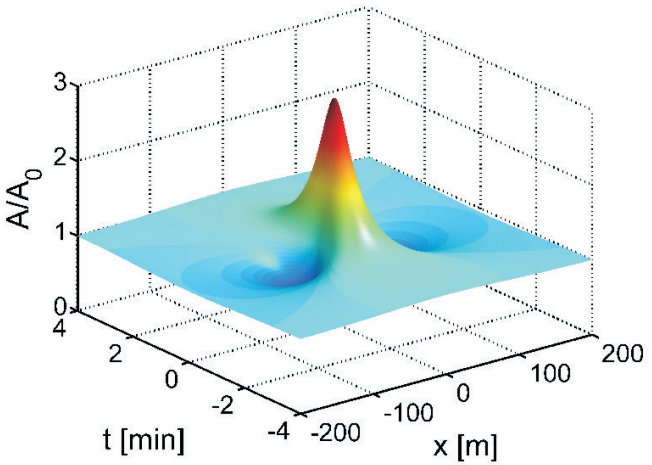
Irina Nikolkina

- **Title: Statistics of extreme wave conditions and events for Estonian coastal waters**
- **Supervisor: Tarmo Soomere**
- **Grant: MJD270, 1 Feb 2012 – 31 Jan 2015**
- **Partner institution: Tallinn University of Technology**

"In the future, I plan to continue the research on rogue wave events that frequently terrify shallow-water areas nearshore of the Baltic Sea with depths of 5–10 m in order to understand and communicate the related risks."

Revealing Hidden Dangers in Shallow Waters

Extremely high and steep waves that unexpectedly emerge from a stormy sea and disappear within a few dozens of seconds are one of the mysteries of our world. They appear in basically all environments that support wave propagation, from the ocean surface down to microscopic optical connections. They are particularly dangerous when surrounded by massive storm waves. The challenge of understanding their nature and predicting their appearance is long from met. It starts from the analysis of historical visual wave observations at single sites and numerical reconstructions of wave properties for the entire sea for a longer time interval. Next, this knowledge is merged with fundamental theories that describe subtle processes of energy redistribution between and along single wave crests, and the formation of high solitary waves with properties radically differing from the interacting counterparts.



A freak wave (so-called Peregrine breather) that seemingly hits out of the blue.

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Merit Kindsigo

- **Title: Reuse of power plant ashes: development of continuous processes for abatement of emissions of acidic gases (SO_2 and CO_2) and PCC production**
- **Supervisor: Rein Kuusik**
- **Grant: MJD285, 1Mar 2012 – 31 Oct 2015**
- **Partner institution: Tallinn University of Technology**

"I currently work on reasoned schemes of pilot-scale devices with engineering input to develop a whole technological scheme for industrial scale in the future."

Getting PCC from Waste Oil Shale Ash

The production of heat and power in Estonia is based on local low-grade oil shale, which is characterized by a high content of mineral matter (60–70%) presented mainly by limestone and dolomite. Production is followed by the formation of waste residue – fly ash (5–7 million tons a year) which consists 10–30% of free lime. The lime content allows considering the ash a sorbent for acidic flue gases and, therefore, enables to follow the actual worldwide trend – from waste to goods.

In my study, waste oil shale ash is utilized as raw material for the production of new valuable material – precipitated calcium carbonate (PCC). The general goal of the research was to develop the basics of the most suitable process steps for continuous PCC production – leaching, filtration and carbonation technology. The current study focused on the carbonation of the leachate in a continuous flow disintegrator-type reactor with increased intensity. In earlier studies, the development of batch carbonation process in a barboter-type reactor has been successfully carried out.

As a result, calcite crystals with a content of 92–99% $CaCO_3$ and mean particle size in the range of 3.7–7.5 µm were produced at ambient temperature and atmospheric pressure. The effect of operating conditions (mainly gas flow rate and stoichiometric access of CO_2) on the forming crystalline product was examined in terms of particle size, morphology and textural properties. Several characteristics of the obtained solid materials suggest high potential for a wide range of industrial applications.

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Qiaoying Zhang

- **Title: The adaptive value of kin recognition in herbaceous plant communities with contrasting species richness**
- **Supervisor: Kristjan Zobel**
- **Grant: MJD305, 19 Mar 2012 – 18 Mar 2015**
- **Partner institution: University of Tartu**

"After the project, I am going back to China and will work in a university. Research on neighbour recognition will be continued with invasive plants as the focal species."

Neighbour Recognition in Plant Communities

Plants can reduce or intensify root competition with neighbours by changing their own root growth. This shows that plants, like many animals, may be capable of recognizing and responding to neighbouring plants in a species-specific fashion. The changing patterns of root growth towards neighbours may involve root signalling, which is likely to be mediated by root exudates.

This project attempted to find evidence that root exudates mediate neighbour interactions in co-evolved communities but lose signaling function in assemblages of plants with no history of co-existence. Two microcosm experiments were conducted. One experiment was established, using seeds originating either from the same community or geographically distant communities (three communities from Estonia). The seed origin treatment was combined with activated carbon addition and soil sterilisation. Another was performed with the same design but used communities separated by greater geographic distances (from Estonia, Sweden and the UK). Plant above- and belowground productivity and species abundances were measured at the end of each growing season.

Results showed that root exudates promote productivity and species co-existence in co-evolved plant communites and that this effect is mediated by soil microbes. In communities assembled from genotypes originating from two locations, lower community diversity was observed and root exudates lost their positive effect on productivity and species co-existence.

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Andis Kalvāns

- **Title: Studies of the dynamics of SE sector of last Scandinavian Ice Sheet by image analysis approach applied in relief analysis**
- **Supervisor: Tiit Hang**
- **Grant: MJD309, 1 Aug 2012 – 31 July 2015**
- **Partner institution: University of Tartu**

"A strange mix of hydrogeology, sedimentology and phenology is the thing I hope to keep myself occupied with in the upcoming years at the University of Latvia."

A Long Time Ago, There Was a Lot of Ice

This was the Ice Age: a huge kilometres thick sheet of glacial ice was slowly flowing from Scandinavia across the Baltic Sea to cover territories to the South and East. At the end of the Ice Age, lands at the margins of the ice sheet were gradually freed from the ice cover. The meltwater pounded in the depressions left behind, the ice forming glacial lakes. One of these has transformed into the modern Baltic Sea.

Each summer, meltwater loaded with soil particles rushed to the glacial lakes. Each summer, a layer of silts and fine sands were deposited on the lake bottom. Each winter, under the lake-ice, fine clays settled down.

We see a strange event recorded in these sediments in a time when the ice margin was near Pärnu. We see that the further South we go, away from the ice margin, the thicker summer layers get. That is exactly the opposite of what we were expecting to see. There should be more summer sediments closest to the ice margin, not the other way round.

How to explain this? We can imagine that, at some point, the ice started to surge into the Pärnu Bay, forming floating icebergs. Along with ice, loads of meltwater with extreme loads of suspended soil particles were entering the Pärnu Bay. The soil particles in meltwater made it much denser than clear water would be. This muddy water moved down to the deepest parts of the Pärnu Bay where it dropped the sediment load. After three long decades, the power of the ice sheet was exhausted. The ice margin quickly melted away to the North.

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Nele Muttik

- **Title: Mineralogical and isotopic evidence for the nature of the aqueous and hydrothermal processes affecting the martian meteorites: Insight for early environments on Mars**
- **Supervisors: Horton Newsom; Francis McCubbin & Carl Agee**
- **Grant: MJD320, 1 Aug 2012 – 31 July 2015**
- **Partner institution: University of Tartu**
- **Receiving institution: University of New Mexico, USA**

"I will continue my work at the University of New Mexico by studying different meteorites. Special attention will be paid to hydrous alteration minerals."

Fe Hydroxides: Important Hosts for H_2O on Mars

Substantial efforts have been made over the last several decades to identify and characterize the presence of aqueous activity at or near the surface of Mars. The first crustal sample from Mars, that has recently been identified (Martian meteorite Northwest Africa 7034), is an excellent match for surface rocks and soils measured by recent Mars rovers and orbital missions and give us the first opportunity to directly investigate the mineralogy and secondary chemical processes that occur in Martian surface materials and how these processes may have changed through time.

The results suggest that most of the H_2O released from NWA 7034 originates from Fe-rich oxide phases and clay minerals, with approximately equal contributions from both phases. This shows that hydrous Fe oxide phases are as important to the inventory of H_2O in NWA 7034 as are clays. If NWA 7034 is an analogue of an ancient Martian surface, it suggests that Fe oxide phases could be important hosts for H_2O over broad expanses of the Martian surface, adding to the amount of H_2O that has been previously accounted for in other hydrous phases (e.g., clay and zeolites).

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Karin Kogermann

- **Title: Effects of macrolide antibiotics on bacterial physiology – cell filamentation**
- **Supervisor: Tanel Tenson**
- **Grant: MJD321, 1 Aug 2012 – 31 July 2015**
- **Partner institution: University of Tartu**

"Future activities include the development of novel antimicrobial nano-formulations as drug delivery systems and the investigation of their in vivo *performance at the single-cell level."*

Bacterial Persisters in Recurrent Infection

Persisters are multidrug-tolerant bacteria that are a likely cause for many recurrent infections. As opposed to resistant cells, the persisters cannot grow in the presence of drugs, and they are genetically identical to drug-susceptible cells. Their existence has been shown in several *in vitro* studies, but their emergence during *in vivo* infections is less reported.

Uropathogenic strains of *Escherichia coli* (UPEC) are able to spread throughout the body, and the infection location is not only limited to the urogenital tract (UT). Furthermore, nearly 70% of recurrent UT infections are persistent even when antibiotics are used. In this study, we asked whether UPEC bacterial persisters (non-dividing cells) can be detected during *in vivo* systemic infection development in mice using single-cell level methods.

A mouse systemic infection model was developed by injecting UPEC CFT073 cells carrying two fluorescent reporter proteins into the peritoneal cavity. Single-cell level methods (flow cytometry, confocal microscopy) and cell counting were used for analysis. In the mouse infection model, bacteria disseminated from the intraperitoneal liquid to all internal organs as well as to the bloodstream. We were able to successfully detect bacterial persisters from different organs in infected mice. Persister levels depended largely on the infection time and location.

Further studies will assess the location and frequency of persisters during antibiotic treatment. Our model system allows developing better dosing regimens for current antibiotics and the development of new antibiotics.

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Josep Soler-Carbonell

- **Title: 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**
- **Supervisor: Martin Ehala**
- **Grant: MJD322, 1 Aug 2012 – 31 July 2015**
- **Partner institution: University of Tartu**

"In the future, I aim to develop the same research line with a particular comparative outlook to see how institutions in nearby countries tackle similar challenges."

The Role of English in Academia

It is a fact that all over Europe, higher education institutions are offering a higher number of courses and programmes taught through the medium of English. The increase in that sense in the last decade has been tremendous, particularly in Northern Europe, and the Baltic states have not been immune.

In this Mobilitas project, I have attempted to understand better how universities and scholars adapt themselves to such a new reality, marked by increased mobility flows (of students and researchers) and a need to engage with different languages for different purposes and in different situations. More particularly, I aimed to find out more about how institutions look for solutions in order to find a balance between a national, local, language (in this case Estonian), on the one hand, and English, on the other hand.

In that respect, I have analysed the different policy regulations that universities and state level institutions in Estonia have drafted to tackle such a challenge. In parallel to that, I have also conducted fieldwork to find out more about how researchers and scholars adapt themselves to this renewed scenario of higher sociolinguistic complexity.

The project has been successful in highlighting that there tends to be a disconnect between policy regulations and speakers' daily linguistic realities and needs, and that there is an important degree of variability in terms of different disciplines and different career stages that policymakers should try to consider in greater detail.

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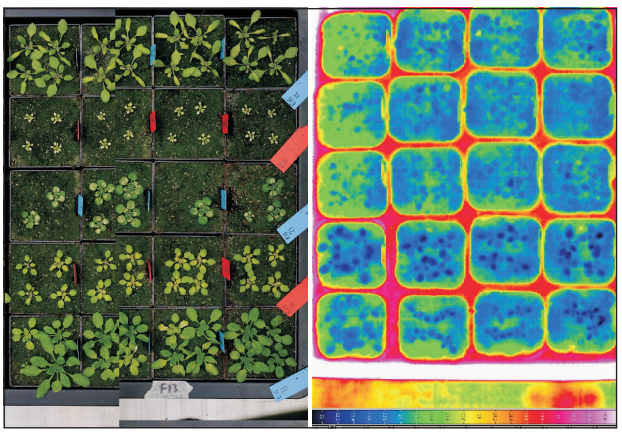
Triin Vahisalu

- **Title: Molecular mechanisms of plant guard cell regulation in response to ozone**
- **Supervisor: Hannes Kollist**
- **Grant: MJD323, 1 Oct 2012 – 31 Dec 2015**
- **Partner institution: University of Tartu**

"I thank the Estonian Research Council for the opportunity to initiate this very large-scale project. This project will continue to identify new components which are responsible for sensing changes in the environment."

How Do Plants Sense Changes in the Environment?

It is crucial for plants to sense and react adequately to changes in environmental conditions; their sessile lifestyle makes it especially challenging. Since plants are the basis of all animal and human life on earth, it is essential to understand how plants adapt and survive unfavorable climate conditions at the molecular level. The aim of the current project is to discover still unknown components which are responsible for sensing changes in the environmental conditions. We have undertaken a large-scale mutant screen (380,000 individuals have been analysed) based on ozone sensitivity, waterloss and thermal imaging, using the model organism thale cress. 3200 individual lines were chosen for further analysis. Informative lines are being analysed by gas-exchange. Whole genome sequencing will be applied to identify mutations in the informative individuals.



Different mutant lines after ozone treatment (left) and thermal imaging (right).

Charly Mayeux

- **Title: Alkali metal ion affinities in the gas phase**
- **Supervisor: Peeter Burk**
- **Grant: MJD327, 1 Apr 2012 – 31 Mar 2015**
- **Partner institution: University of Tartu**

"My future research topics will utilise the skills I acquired in Estonia."

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Alkali Metal Ion Affinities and Basities

The reactivity of metal ions in the gas phase has been the subject of intense interest in the last decades. Alkali metal ions were studied for their coordinating properties in the gas phase. Moreover, the possibility of measuring alkali metal cation affinities with good accuracy has stimulated a growing interest in the study of these interactions.

The measurements of alkali metal cation affinities generate a collection of data which helps the understanding of the fundamental interactions involved in analytical chemistry (e.g., mass spectrometry), catalysis in organic synthesis, lithium battery electrochemistry, and cation transport in living systems (e.g., biological role of potassium and sodium). The direct outcome of alkali metal cation affinity/basicity scales for neutral and anionic bases also leads to a better understanding of the cooperative effects of complex formation.

The main objective of my postdoctoral research was to establish alkali metal cation affinity/basicity scales for anionic bases and, also, more accurate and consistent scales for neutral bases. We have established a method to calculate accurate and consistent thermodynamic values for both neutral and anionic compounds: the complete basis set (CBS) extrapolation approach. This method was successfully utilized to anchor experimental basicity scales for the interactions of anionic bases with alkali metal cations. Besides this work, we have achieved consistent equilibrium measurements in the high basicity range which were previously considered impossible.

maris.berzins@lu.lv

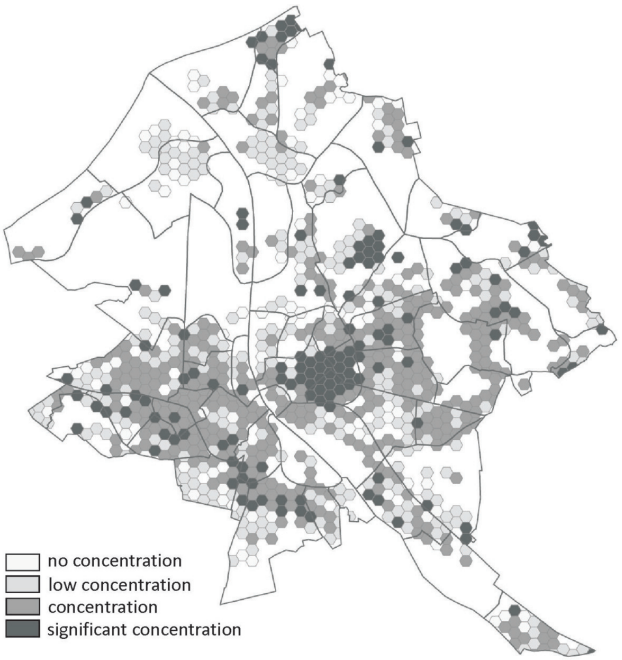
Māris Bērziņš

- **Title: Domains of Interethnic Contact in Latvia**
- **Supervisor: Tiit Tammaru**
- **Grant: MJD334, 1 Aug 2012 – 31 July 2015**
- **Partner institution: University of Tartu**

"My postdoctoral research was a positive experience. As regards the scientific contribution, the conducted research and applied methodology is completely new in Latvia since it offers an innovative (census based) and integrated approach for comparative urban studies in the future."

Cities Have Always Been Diverse

Over the past decades, cities have become more diverse with respect to population groups, to housing and to functions. Socioeconomic disparities have been rising in many Central and East European cities. However, less is known about the ethnic dimensions of urban change, despite the existence of often sizeable ethnic minority populations in some post-socialist countries. The aim of my case study was to clarify how growing socioeconomic disparities in the light of systemic changes and economic restructuring relates to patterns of socioeconomic and ethnic segregation. Residential segregation has been on the urban research agenda for almost a hundred years. Studies that focus on urban spatial segregation are valuable because they draw attention to the patterns of residential segregation and the concentration of various ethnic or socioeconomic groups. Latvia and Riga is a very interesting case study area for analysing ethnic differences in residence since mass immigration during the Soviet period strongly contributed to the multi-ethnic character of the country's population.



Residential concentration of the higher socio-occupational categories in Riga, 2011.

mari.palgi@ttu.ee

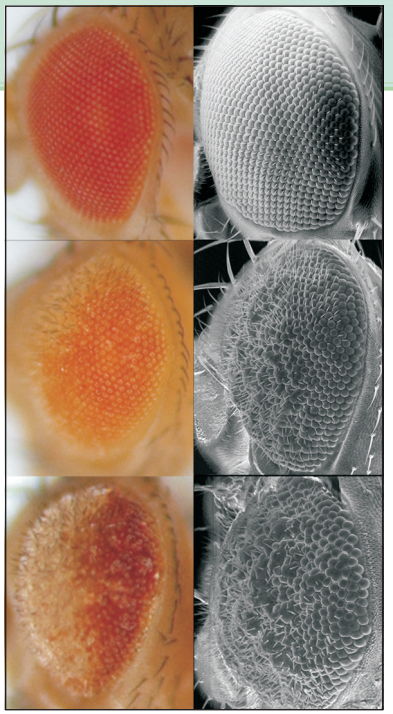
Mari Palgi

- **Title: Molecular studies of bHLH transcription factor daughterless and its mammalian homologue TCF4 in Drosophila**
- **Supervisor: Tõnis Timmusk**
- **Grant: MJD341, 1 July 2012 – 30 June 2015**
- **Partner institution: Tallinn University of Technology**

"In the future, I would like to continue working with Drosophila neurobiology and further develop this novel animal model for Pitt Hopkins syndrome."

Modeling Pitt Hopkins Syndrome in a Fruit Fly

Pitt Hopkins syndrome (PTHS) is a severe mental disability syndrome. Children born with PTHS never learn to speak. PTHS is caused by defects in TCF4 gene. TCF4 belongs to the family of basic helix-loop-helix transcription factors. For transcriptional activation, TCF4 dimerizes with other members of the family and regulates the genes, e.g., the genes involved in nervous system development. The available treatment for PTHS patients has been relieving the secondary symptoms like breathing difficulties. Finding the specific targets of TCF4 and underlying pathways is of great importance. The fruit fly has been successfully exploited to model human diseases. We characterized the ortholog to TCF4 in a fly – daughterless (da). Point mutations found in PTHS patients were introduced to the da gene. The expression of the mutated da during fly eye development resulted in a distinctive phenotype. This phenotype enables us to carry out a screen for genetic interactions. To complete the fly model of PTHS, the establishment of behavioral assays is essential to measure the output of TCF4/daughterless imbalance.



Upper row: wild type mosaic eye of Drosophila melanogaster. *Central and lower rows: overexpression of daughterless with two different PTHS mutations resulting in a rough eye phenotype. Color images are stereo-micrographs, black and white images – scanning electronmicrographs.*

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Larissa Kus-Harbord

- **Title: The impact of power reversal, social changes, and division between ethnic groups on intergroup relations and subjective well-being**
- **Supervisor: Raivo Vetik**
- **Grant: MJD362, 1 Aug 2012 – 18 Dec 2015**
- **Partner institution: Tallinn University**

"After finishing the grant, I will continue with a research project about the determinants of an inclusive integration context, and, upon further successful funding, I would like to conduct more research into the justification and de-legitimization of different social orders."

Justification versus De-legitimization of the *status quo*

Societal changes are known to elevate the significance of the legitimacy of status changes and differences, creating possible inequalities. Endorsing system legitimacy is curial for the stability and peace of the society; it also promotes positive outcomes for individuals and relationships between societal groups. The legitimacy of the societal system is often supported or defended by the accounts of history.

This project investigated the psychological basis for the justification versus de-legitimization of the *status quo* in a context of recent major societal changes in Estonia. Specifically, it examined the relationships between system justification/legitimacy and the social representations of history and collective memories that remain.

The results showed that mutually mismatching representations of history and narratives of identity provide the lenses through which the legitimacy of the new societal arrangements following the major social change is interpreted. Experiences of alternative societal order in the past were actively deployed by minority Estonian Russians to give voice to experiences of present relative deprivation. A struggle for positive social identity motivated Estonian Russians to use the past as an essential reference to judge the present situation as unfair, delegitimizing the *status quo*. By contrast, the recent Soviet past was represented as unjust by Estonians, whereas the present system was depicted as fair and equitable.

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Luca Marzola

- **Title: Exploring new Physics through Astro-Particle Physics**
- **Supervisor: Stefan Groote**
- **Grant: MJD387, 1 Dec 2012 – 31 July 2015**
- **Partner institution: University of Tartu**

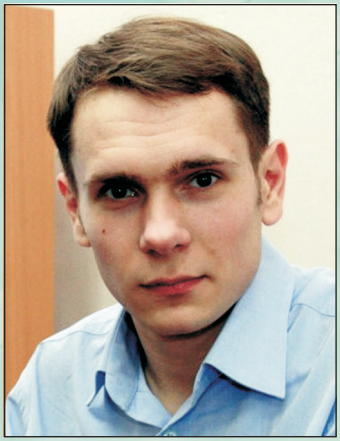
"I plan to continue my research within Particle Physics and Cosmology in the future, pursuing an academic career."

Going beyond the Current Paradigms

The recent discovery of the Higgs boson at the Large Hadron Collider can be regarded as the latest triumph of the Standard Model of Particle Physics. This theory, which characterises the constituents of our Universe and their interactions, has successfully passed the dedicated experimental investigations of the last fifty years, becoming for this reason the paradigm of contemporary Particle Physics. Yet, despite its appealing mathematical structure and the many experimental confirmations received, the Standard Model remains to date an incomplete description of Nature. The change came during the last decades, after the observations of the Cosmic Microwave Background, galaxies, supernova explosions and the large scale structure of the Universe dramatically improved.

As a result, another important branch of contemporary Physics, Cosmology, entered its precision era crowned by the formulation of the Λ-CDM model. The latter describes the evolution of the Universe since only moments after its birth and, surprisingly, the computation performed in this model revealed that only about 5% of the total energy content of the Universe is in the particles described by the Standard Model. The biggest contributions are brought by two unknown agents, Dark Energy and Dark Matter, which account respectively for 68% and 27% of the energy budget.

With my research, I intend to shine a light on this "dark side"of the Universe, building models that characterise these mysterious components in order to achieve a greater understanding of the Universe in which we live.



oleksandr.husev@ieee.org

Oleksandr Husev

- **Title: Research, design and implementation of qZS-derived DC/DC and multilevel DC/AC converters**
- **Supervisor: Dmitri Vinnikov**
- **Grant: MJD391, 1 Nov 2012 – 30 Sept 2015**
- **Partner institution: Tallinn University of Technology**

"Based on the research done and the experience got, we already obtained a PUT grant. It means that the next two years will be connected with Estonia as well. At the same time, our group has very strong international cooperation that makes our research activity fruitful and interesting."

qZS-derived DC/AC Converters

This topic belongs to the power electronics field of research. I was actively involved in the research program of the Dept. of Electrical Drives and Power Electronics of TUT since 2011.

At the moment of application, I had experience and achieved several preliminary results in the proposed field that were published in peer-reviewed journals.

During my PhD studies at my home university, I had been involved in the research activities connected to the control and protection systems for different kinds of power converters. All the mentioned results created together an excellent motivation to continue my research towards the optimization of efficiency and the extension of the flexibility and applicability of the qZSI-based converters in TUT.

Finally, I got a PostDoc position at TUT. The postdoctoral research project is devoted to the comprehensive theoretical and experimental study of qZS-derived DC-DC and multilevel DC-AC converters. Since the qZSI represents a brand new integrated boost-buck converters family, the main research efforts will be concentrated on the optimization of efficiency and flexibility. The research is performed in two main directions: optimization and synthesis of new qZS-derived DC-DC and DC-AC converter topologies and elaboration of special control and protection algorithms for the qZS-derived converters. Such a topic is especially interesting for renewable energy application.

jasiak9@wp.pl

Anna Katarzyna Jasinska

- **Title: Structure-function relationships of the water transport pathway of deciduous trees in light of global climate change: Effects of increasing atmospheric humidity**
- **Supervisor: Arne Sellin**
- **Grant: MJD398, 1 Sept 2012 – 31 July 2015**
- **Partner institution: University of Tartu**

"I plan to go back to Poland to the Institute of Dendrology and apply for a new grant there."

Elevated Humidity Affecting Trees

Climate change scenarios predict an increase in air temperatures and in the frequency and amount of precipitation and, therefore, higher atmospheric humidity for the future compared to the current climate in Northern Europe. Knowledge about the influence of increasing air humidity on trees' performance and forest condition is still insufficient, as regards possible changes in plant structure and function in particular.

We work at the Free Air Humidity Manipulation (FAHM) site, a unique research infrastructure on a global scale. We examine plant structural responses to artificially elevated atmospheric humidity in the saplings of hybrid aspen (*Populus tremula* × *P. tremuloides*) and silver birch (*Betula pendula*) in field conditions. The project is focussed on the structure-function relationships of the water transport pathway. The central aim is to estimate the contribution of plant structural changes to the acclimation of water relations, hydraulic capacity and gas exchange in altered environmental conditions.

We hypothesize that reduced sap flow in trees growing under elevated relative air humidity will induce changes in both leaf (smaller leaf blade thickness, lower vein density, larger stomata, lower stomatal density) and wood anatomical characteristics (smaller diameter and density of vessels, changes in wood density, etc.). These changes should have an influence on the trees' functional traits, including hydraulic properties. Humid conditions should lead to higher xylem functional vulnerability and lower stomatal sensitivity to vapour pressure deficit, thus, making the plants more susceptible to environmental fluctuations.

tonarova.petra@gmail.com

Petra Tonarová

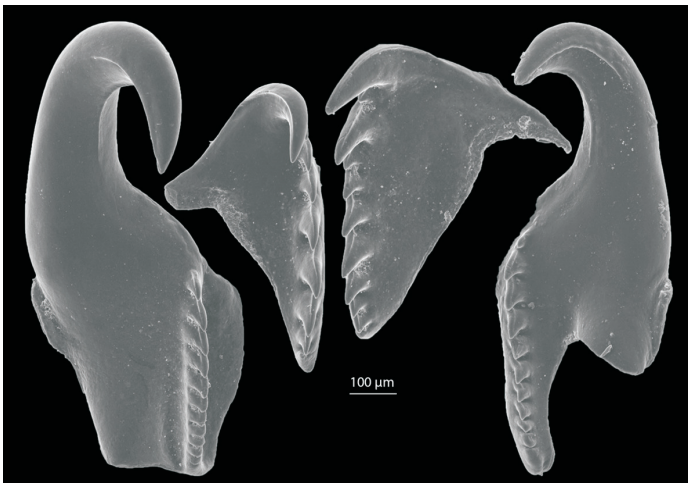
- **Title: Diversification and biogeography of Silurian jawed polychaetes**
- **Supervisor: Olle Hints**
- **Grant: MJD407, 1 Jan 2013 – 30 June 2015**
- **Partner institution: Tallinn University of Technology**

"I plan to continue on the same path and test the gained results in other regions, primarily in the Prague Basin (Czech Republic)."

Deep Time Worms Survive Mass Extinctions

The important position of polychaete worms in deep time marine ecosystems is proven by their jaws, the scolecodonts, which constitute the main fossil evidence of these otherwise soft-bodied creatures. This project aimed at reconstructing the evolutionary history of jaw-bearing polychaetes during the Silurian Period (443 to 419 million years ago) and understanding how their communities responded to rapid environmental perturbations and mass extinctions.

Careful examination of scolecodonts extracted from sedimentary rocks of the Baltic region revealed that even one of the largest crises in the history of life, the Hirnantian mass extinction 443 Ma ago, had a relatively minor impact on polychaetes. Unlike the vast majority of taxa that were severely affected or became extinct, polychaetes prospered, seemingly at the expense of overall biodiversity loss, which opened new ecospace for them.



Early Silurian species Atraktoprion mirabilis *Kielan-Jaworowska, 1966 (first and second maxillae), survivor of the Hirnantian extinction.*

These results help to predict the potential long-term impacts of climate and environmental change in modern oceans.

mkapran@yahoo.com

Mārtiņš Kaprāns

- **Title: Stability and dynamics of post-communist remembering: memory politics and agency in Eastern Europe**
- **Supervisor: Eva-Clarita Pettai**
- **Grant: MJD409, 1 Jan 2013 – 28 Feb 2015**
- **Partner institution: University of Tartu**

"I am planning to continue the research on collective memory in CEE. The focus, however, will change from the communist period to World War I and World War II."

Stability and Dynamics of Post-communist Remembering

The goal of my research project was to explore how Central and Eastern European (CEE) societies remember their communist past. The previous decade has shown a fluctuation in the popular attitude towards the official condemnation of the communist period in CEE countries. Many studies of post-communist nostalgia, for example, have addressed these shifts.

To understand the conditions and forces which shape the perception of the communist period, I particularly focused on four countries: Ukraine, Moldova, Poland, and the Czech Republic. In the first stage of my research, I mapped the strategies of major political and civic actors who were engaged in promoting critical or positive stances towards the communist era. Subsequently, I interviewed experts and people who were publicly involved in framing the communist regime as either a repressive or progressive system. This research revealed a rather low consensus about the Soviet past in Ukrainian and Moldovan societies. In particular, I was surprised about the volatility of the official historical narrative in Ukraine and Moldova; this volatility reflected the ongoing identity problems of both post-Soviet countries.

It was also fascinating to observe the role of the communist past in the Czechs' voting behavior as well as to explore the strong link between religion and anti-communist stances in Poland, which one can notice even in the stained-glasses of Polish Catholic churches.

kuno_k@ut.ee

Kuno Kooser

- **Title: Vacuum-ultraviolet spectroscopy for homogeneous molecular clusters and mixed biomolecule-solvent clusters**
- **Supervisor: Edwin Kukk**
- **Grant: MJD428, 1 Aug 2013 – 31 July 2015**
- **Partner institution: University of Tartu**
- **Receiving institution: University of Turku**

"The next challenge is to continue the study of microcluster's fragmentation dynamics at more advanced X-ray free-electron lase facilities."

Creation of Microclusters and Study of Their Electronic Properties

The evolution of the electronic states and properties in microclusters has drawn great attention in fundamental research also because of the possibility to construct nanostructured materials and devices using clusters as building blocks. The main aim of the cluster research is to gather information about the unique chemical and physical properties of the clusters, which have an intermediate nature compared to the single atoms and solids. One of the central questions in cluster physics is how the number of atoms in a specific cluster determines its electronic properties. Despite the existence of different cluster formation methods, the study is usually complicated because of the fact that cluster beams cannot be generated in a single adjustable cluster size.

During the last few years, the Materials Science Lab group of Turku University has studied vacuum evaporated molecules and microclusters by using the PhotoElectron-Photoion Coincidence (PEPICO) setup.

In different biological environments, the hydrogen bonded systems play a larger role than the van der Waals, covalent or ionic bonding. The experimental data of different clusterized samples like methanol, acetic acid, and acetamide has been acquired. The aim of this work is to accurately explore (by using the PEPICO technique) the evolution of the electronic structure and fragmentation dynamics of molecular microclusters produced by the supersonic expansion technique as a function of the cluster size. The analysis of experimental data is still an ongoing process.

larissa.roots@ut.ee

Larissa Roots

- **Title: Multiscale Methods for Fracture**
- **Supervisor: Timon Rabczuk**
- **Grant: MJD433, 1 Sept 2012 – 31 July 2015**
- **Partner institution: University of Tartu**
- **Receiving institution: Bauhaus Universität Weimar, Germany**

"I have a dream: to continue work in the interdisciplinary laboratory of computer mechanics at the University of Tartu."

Mechanical Characteristics of Molecular Level

The aim of the project was to gain a better understanding of the phenomena involved in material failure by contributing to the first set of experimentally validated computational methods capable of predicting material failure from the atomistic to the continuum level.

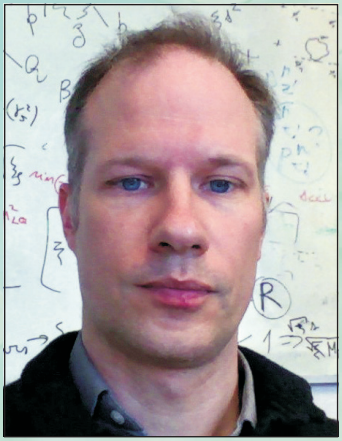
Two interesting examples visualize the extent of atoms, molecules and their quantity in a certain volume of substance:

1) the smallest sizes of particles available for consideration in an optical microscope contain about 10 billion atoms;

2) if all the atoms contained in 1 mm^3 of aluminium were arranged in one line densely next to each other, the length of such a chain of atoms would be about 172.1 million kilometers. It is appr. 43 times greater than the Earth's circle on the equator.

The role of an atom or a small group of atoms on the behavior of a solid body, in general, significantly depends on the scale. In particular, within this project, the dependence of the Young's modulus from the quantity of the molecular layers of a cylindrical shell is investigated. When the sizes of a body become small, commensurable with molecular sizes (nano-dimensional), the influence of near-surface area becomes considerable, and the properties of substance qualitatively change. Therefore, at the nano level, it is preferable to consider the layered model of a material.

For solving the given tasks, software programs *Mat Lab R2012a*, *Ansys R14.5* and *LS-DYNA* were applied.



christian.spethmann@kbfi.ee

Christian Spethmann

- **Title: Researching physics within and beyond the Standard Model**
- **Supervisor: Emidio Gabrielli**
- **Grant: MJD435, 1 Oct 2012 – 31 July 2015**
- **Partner institution: National Institute of Chemical Physics and Biophysics**

"I have successfully applied for a grant from the Estonian Research Council to continue my research here in Tallinn, so I will stay in Estonia for the moment."

Dark Matter and the Origin of Mass

One of the goals of this theoretical particle physics project was to better understand the properties of the Higgs field, which gives mass to the particles that make up ordinary matter. The existence of the Higgs boson has been confirmed by experiments at the Large Hadron Collider (LHC), but many questions remain open. For example, it is presently not understood why the gravitational interactions of elementary particles are so much weaker than the other fundamental interactions. To explain this hierarchy of forces (and their associated energy scales), we have theories such as supersymmetry, but so far no proof of supersymmetric particles has been found in collider experiments.

In my research, I investigated new approaches to this problem, such as classical scale invariance. This would mean that, without quantum effects, the universe should look the same at all distance scales, and all particles would be massless. It is already known that 99 percent of the mass in ordinary matter is produced by quantum effects, so it would be natural to assume that the remaining one percent can also be explained this way.

My work on this project has also led me to search for connections between the Higgs field and the existence of dark matter in the universe. It is possible that the Higgs field is the only way for ordinary matter and dark matter to interact with each other (besides gravitation). If this is true, one could predict how to observe dark matter in the galaxy and also understand how it could be artificially produced in collider experiments.

tiina.tosens@emu.ee

Tiina Tosens

- **Title: Towards better understanding of mesophyll conductance: the third major player in the process of photosynthesis**
- **Supervisor: Ülo Niinemets**
- **Grant: MJD438, 1 Sept 2012 – 31 July 2015**
- **Partner institution: Estonian University of Life Sciences**

"After the postdoc grants, the studies on plant stress will continue with evolutionary old species and fossil leaves."

Mesophyll Conductance as an Important Limiting Factor of Photosynthesis

Leaf photosynthesis is determined by biochemical limitations (photosynthetic capacity) and diffusion limitations, including stomatal conductance and CO_2 diffusion conductance from sub-stomatal cavities to the carboxylating enzyme, Rubisco, in the chloroplasts (mesophyll conductance). After entering the leaf through the stomata, CO_2 faces a relatively long and tortuous pathway through gas and liquid phases before it finally reaches the carboxylating enzyme Rubisco. First, CO_2 must diffuse through the intercellular airspaces to a mesophyll cell which has its chloroplast surface adjacent to the airspace. Diffusion across cell walls is slow if the walls are lignified and porosity is low, or if the walls are thick. Further, CO_2 diffuses through the cytoplasmic layer between the cell wall and through chloroplast until RUBISCO. Any of these anatomical features can potentially limit the CO_2 diffusion rate through mesophyll. In sclerophyll species, mesophyll cell walls exert the strongest limitation to CO_2 diffusion.

The goal of this project was to investigate mesophyll conductance in relation to mesophyll structural parameters across species having contrasting adaptation mechanisms.

The results of this project have shown that the physical diffusion of CO_2 from surrounding air to the chloroplast is an important limiting factor of photosynthesis and should be considered in photosynthesis models.

aannist@gmail.com

Aet Annist

- **Title: Mapping the migratory careers of transnational Estonians**
- **Supervisor: Hannes Palang**
- **Grant: MJD450, 1 Sept 2012 – 31 July 2015**
- **Partner institution: Tallinn University**

"Next, I will bring together the topic of the fragmentation of social connections and migratory responses to this. I am also seeking new field sites for comparative research."

Migrating across Global Hierarchy of States

I set out to understand how state institutions respond to the rapid loss of citizens across state borders in interaction with the migratory careers of transnational Estonians in the UK. One aspect that I became interested in was the meaning of being a migrant in relation to the global hierarchies of states, rather than ethnic identity, the classic topic in migration research.

Migration to the UK is in itself experienced as empowering, even if the work, living conditions and social relations of many migrants often become worse abroad. In such cases, empowerment is perceived in relation to the loss of the value of the home country or region. Living in a country higher in the global hierarchy enables migrants to move up the social scale due to higher income and in associating with supposedly prestigious locations. Such experiences are particularly clear when visiting home and also in encounters with compatriots whilst abroad. Depending on the moment in the life course of the migrant, foreignness can also become a value in itself, easing social life and allowing dissociations from both the sending and receiving state.

From the point of view of the state, those processes signify a loss of the value of diasporic ethnic capital. Such migrants have stopped taking moral responsibility for the survival of the ethnic identity and, thus, being useful for state branding exercises that extend the state out of its own retracting sphere of influence. The state and public response to this has often been moralising, pushing these citizens further away.

julija.gusca@rtu.lv

Jūlija Gušča

- **Title: Integrated Assessment Analysis of Greenhouse Gases Emissions of Estonian Energy Production Sector**
- **Supervisor: Andres Siirde**
- **Grant: MJD455, 1 Oct 2012 – 19 Oct 2015**
- **Partner institution: Tallinn University of Technology**

"After completing my postdoc grant, I will definitely continue my successful cooperation with Estonian science institutions and industries through regional and international cooperation projects."

Analysis of Greenhouse Gases Emissions

Estonian national resource – oil shale – plays a significant role in securing energy needs at the national level. In addition, motor fuel produced from oil shale is exported to other countries, thus, generating incomes to the Estonian budget. Besides the defined economic and social advantages of the resource, its fossil origin imposes further environmental burdens.

My objective was to develop a methodological framework based on integrated assessment models for the analysis of the reduction potential of greenhouse gases emissions from the Estonian energy production sector. The sustainability aspect was targeted as a first priority point, selecting the suitable methods for the analysis of the oil shale processing sector. Due to the rapidly changing Estonian legislation in the field of energy, the transparency and flexibility of the model was defined as a second priority.

A combined life cycle and multi-criteria analysis model was built for the definition of the environmental effects of Estonian oil shale based energy production sector. Due to the interest of the oil shale processing industries and the Ministry of Environment, an additional module of the model was created for the calculation of greenhouse gas intensities of the oil shale processing products – shale oil, retorting gas and coke.

The developed models are practical and significant tools for the national industries moving towards sustainable energy production: they show what to improve and give the environmental and economic effects of such improvements. Model approbation, using real oil shale processing industry data sets, showed great potential for the minimization of the generated greenhouse gas emissions through the optimization of by-products management and the introduction of advanced oil shale pyrolysis technologies.

Sebastian Fiedler

- **Title: The development and re-instrumentation of learning activity in the context of creative work: potentials for systemic intervention into educational practise**
- **Supervisor: David Ribeiro Lamas**
- **Grant: MJD459, 1 Feb 2013 – 31 Jan 2015**
- **Partner institution: Tallinn University**

"I am planning to continue my work on the transformation of teaching and learning practices in higher education and the workplace."

SebastianFiedler@hotmail.com

Emergent Forms of Networked Learning Activity

The unfolding digital transformation of a wide range of human practices has a profound impact on how individual and collective learning activity is developing and changing beyond the confines of formal education.

My project has focused on documenting the emergence of historically new forms of learning activity in the creative economy. To this end, I carried out field research in the context of micro-company settings in Estonia and Germany.

My main analytical interest was gaining insights into how professionals go about their "self-education" and "self-development" in such settings and to what extend they make use of networked instruments and practices to form their own environments for personal learning. Through this type of research, it becomes increasingly visible that the forms of learning activity that might be described as "networked autodidaxy" are gaining ground. These forms of learning activity and their instrumentation show considerable qualitative differences in comparision to the practices that are dominating most mainstream enviroments of higher education.

A second aspect of my work, thus, focuses on distilling insights from emergent, new forms of learning culture that could be used to inform and orientate the further development of educational practice in higher education – in particular, in the transition zone from post-graduate studies to professional work.

Mobilitas
ESF programm

Top Researcher Grants

Final Standing

	Grant	Top Researcher	Partner Institution	Research Field	Project Title	Text*
1	MTT1	Harry Alles	UT	MT	Manufacturing, processing and characterization of graphene-based nanostructures	
2	MTT2	Anna-Karin Borg-Karlson	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 Brosché	UT	BT	Natural variation of plant stress responses - molecular tools for environmental research	
7	MTT12	Thomas Fehniger	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	Text*
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 inhomo geneous 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 *Text* column denotes project summaries that are included in the current or previous Mobilitas Compasses:

● 2013 ● 2014 ● 2015

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

Mobilitas
ESF programm

Postdoctoral Research Grants

Final Standing

	Grant	Grantee	Partner Inst. / Supervisor	Project Title	Text*
1	MJD1	Vincent Perrier	UT/ Tõnu Meidla	Biodiversity changes across the Ordovician and Silurian environmental crises	
2	MJD2	Katja Gehenn	TUT/ Peep Palumaa, Mihkel Kaljurand	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	
4	MJD4	Triin Reitalu	TUT/ Siim Veski	Unraveling the history of plant diversity patterns by means of pollen analyses: an interdisciplinary approach	
5	MJD5	Athanasios Giannitsis	TUT/ Mart Min	Development of a Microfluidic lab-on-chip for bio-impedance measurements on droplet-based bioreactors	
6	MJD7	Sandra Zetterström Fernaeus	TLU/ Tiit Land	Studies of the neurotoxic mechanisms of mutated versions of APP related to Familial Alzheimer's Disease	
7	MJD10	Anna Volkova	TUT/ Andres Siirde	Small-scale cogeneration plants in Estonian towns	
8	MJD12	Mats Hansen	UT/ Ursel Soomets	Design and mitochondrial transport of novel antioxidant molecules	
9	MJD14	Astrid Kännaste	EULS/ Ülo Niinemets	Plant defense reaction triggered by abiotic and chemical stressors	
10	MJD17	Andres Marandi	TUT/ Rein Vaikmäe	Geochemical evolution of groundwater in Cambrian-Vendian aquifer system in Estonia	
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	
13	MJD23	Mart Anton	TUT/ Maarja Kruusmaa	Mechanical design and locomotion of an underwater vehicle	
14	MJD25	Matthieu Chillaud	UT/ Eiki Berg	Controlling Frontiers and Mapping the field of European 'Freedom, Justice and Security'	

	Grant	Grantee	Partner Inst. / Supervisor	Project Title	Text*
15	MJD28	Sonia Sousa	TLU/ Peeter Normak	Activity patterns in informal virtual learning communities	●
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	●
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 Aβ peptide aggregation	●
22	MJD38	Satish Narayana Srirama	UT/ Eero Vainikko	Scientific Computing on the Cloud	●
23	MJD39	Yanina Timasheva	UT/ Maris Laan	Genetic variation in human growth hormone / chorionic somatomammotropin genes and susceptibility to cardiovascular disease	●
24	MJD42	Janis Zakis	TUT/ Juhan Laugis; Dmitri Vinnikov	Research and Development of Bi-Directional Power Converters for Energy Storage Applications	●
25	MJD43	Ringa Raudla	TUT/ Wolfgang Johannes Max Drechsler	Evolution of Fiscal Governance Institutions in Estonia from 1994 to 2009	●
26	MJD44	René Mõttus	UT/ Ian J. Deary	Predictors and mechanisms of successful cognitive ageing	●
27	MJD47	Jodi Price	UT/ Meelis Pärtel	The generality of assembly rules in herbaceous vegetation: a macroecological approach	●
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	●
30	MJD52	Andi Hektor	NICPB/ Alexandre Nikitenko	Data mining in the CMS experiment at CERN	●
31	MJD53	Meelis Kadaja	UT/ Elaine Fuchs	Deciphering the mechanisms governing stem cell maintenance in skin	

	Grant	Grantee	Partner Inst. / Supervisor	Project Title	Text*
32	MJD54	Chong-Geng Ma	UT/ Mikhail Brik	*Ab initio* and semi-empirical modelling of optical properties of materials doped with rare-earth and transition metal ions	●
33	MJD56	Malgorzata E. Arlet	UT/ Raivo Mänd	Socio-ecological determinants of demographic rates in a group-living, free-ranging primate	●
34	MJD57	Jaana Salujõe	TUT/ Siim Veski	Do cladoceran remains in lake sediment record climate and environmental change?	●
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	●
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	●
39	MJD67	Angela Ivask	NICPB/ Kenneth A. Bradley	High throughput bacterial screening for the characterization of toxicity of nanosized particles and materials	●
40	MJD70	Terje Loogus	UT/ Peeter Torop	Translatability of culture – an integrated semiotic-functional approach	●
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	●
43	MJD77	Mikko Leinonen	UT/ Daniel Cohnitz	Rudolf Carnap's logical and ontological pluralism - a case study	●
44	MJD80	Jaanus Karo	TUT/ Marko Vendelin	The theoretical study of mitochondrial energetic metabolism	●
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	●
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	●
47	MJD94	Kajar Köster	EULS/ Jukka Pumpanen	Carbon turnover on disturbed areas	●
48	MJD96	Anastassia Zabrodskaja	UT/ Martin Ehala	Transfer of morphosyntactic patterns in the Estonian-Russian contact setting	●
49	MJD99	Gemma Atkinson	UT/ Tanel Tenson	Origin and functional evolution of ribosome-associated environmental response enzymes	●

	Grant	Grantee	Partner Inst. / Supervisor	Project Title	Text*
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-palu	TLU/ Scott Jarvis	Symmetry of the cross-linguistic influence in the acquisition of closely related languages	
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	
54	MJD108	Katre Talviste	UT/ Jüri Talvet	Translations of French Poetry into Estonian: their Creation and Functions in the Context of Estonian Literature	
55	MJD110	Kristjan Tabri	TUT/ Tiit Koppel	Coupled approach for numerical modelling of accidents in maritime transportation	
56	MJD111	Francesco Orsi	UT/ Margit Sutrop	Understanding Normative Cognition: Autonomy, Unity and Generality	
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 Kangas-järvi	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)	
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	
62	MJD129	Jaak Tomberg	ELM/ Virve Sarapik	On the Contemporary Convergence of Realism and Science Fiction	
63	MJD134	Triin Hallap	EULS/ Ülle Jaakma	Effect of colloid formulation Androcoll-B on bull semen survival and quality	
64	MJD135	Lorenzo Pecoraro	EULS/ Tiiu Kull	Mycorrhizal strategies in green orchids: diversity and functional aspects	
65	MJD140	Kristjan Kannike	NICPB/ Riccardo Barbieri	Properties of Dark Matter	
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	

	Grant	Grantee	Partner Inst. / Supervisor	Project Title	Text*
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	
76	MJD213	Revathi Naidu	TUT/ Olga Volobujeva	$Cu_2ZnSn(SSe)_4$ 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-Castañeda	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 toolsa 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	
85	MJD252	Elin Org	UT/ Aldons J Lusis	The role of TMAO in cardiovascular diseases	

	Grant	Grantee	Partner Inst. / Supervisor	Project Title	Text*
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 Linnanto	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/Tal1 dependent gene activation and repression during mesoderm diversification	
95	MJD285	Merit Kindsigo	TUT/ Rein Kuusik	Reuse of power plant ashes: development of continuous processes for abatement of emissions of acidic gases (SO_2 and 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 Kalvāns	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	

	Grant	Grantee	Partner Inst. / Supervisor	Project Title	Text*
103	MJD323	Triin Vahisalu	UT/ Hannes Kollist	Molecular mechanisms of plant guard cell regulation in response to ozone	●
104	MJD327	Charly Mayeux	UT/ Peeter Burk	Alkali metal ion affinities in the gas phase	●
105	MJD334	Māris Bērziņš	UT/ Tiit Tammaru	Domains of Interethnic Contact in Latvia	●
106	MJD338	Jana Temelova	UT/ Tiit 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 Drosophila	●
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-Harbord	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	Mārtiņš 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	●

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121	MJD438	Tiina Tosens	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	Jūlija Gušča	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 - archaeo-metric 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 *Text* column denotes project summaries that are included in the current or previous Mobilitas Compasses:

● 2013 ● 2014 ● 2015

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

Mobilitas
ESF programm

Index of Grantees

Three Volumes of Mobilitas Compass

2013

(2014) Tallinn: Estonian Research Council
ISBN 978-9949-9512-0-8 (in print)
ISBN 978-9949-9512-1-5 (pdf)

2014

(2015) Tallinn: Estonian Research Council
ISBN 978-9949-9512-7-7 (in print)
ISBN 978-9949-9512-8-4 (pdf)

2015

(2015) Tallinn: Estonian Research Council
ISBN 978-9949-9512-9-1 (in print)
ISBN 978-9949-9663-0-1 (pdf)