Professors and projects selected by the Academy to the FiDiPro Programme

5 June 2012

**FiDiPro Professor:** Professor Hannes Jónsson, University of Iceland and Brown University, Iceland/USA

Professor Hannes Jónsson (b. 1957) is one of the world’s leading scientists in the field of theoretical and computational materials research.

**Research project:** Jónsson’s project focuses on the development and application of advanced simulation and computational techniques for nanoparticle-facilitated catalysis in solar cells. The project focuses on theoretical and computational studies of metal alloy nanoclusters on oxide surfaces and the use of such systems in catalysis, in particular solar cell reduction of CO2 to form fuel (methane or methanol) and reduction of N2 to form fertilizer.

**Finnish host and university:** Professor Tapio Ala-Nissilä, Finnish Centre of Excellence in Computational Nanoscience, Aalto University, tel. +358 9 470 25805, tapio.ala.nissila(at)aalto.fi

**FiDiPro Professor:** Professor Vladislav V. Verkhusha, Albert Einstein College of Medicine, Yeshiva University, USA

Professor Vladislav V. Verkhusha (b. 1944) is a leading expert in developing novel fluorescent proteins. The 2008 Nobel Prize in chemistry was awarded for the discovery of green fluorescent protein, after which this area has expanded rapidly. Professor Verkhusha develops red-shifted and photoswitchable fluorescent variants. These tools have broad applications in multichannel imaging, super-resolution and intravital imaging as well as in protein interaction studies and high-content screens.

**Research project:** The project will work to bring biophotonics technologies in Finland to the international forefront. The tools to be developed will enable the monitoring of complex functional information from living cells and tissues, and will therefore benefit the broad bioscience community, working on cell and organ physiology and pathophysiology. The project will develop three new types of biophotonics molecular tools based on fluorescent proteins that will complement the existing green and red protein probes. The project is strongly synergistic with the development of imaging infrastructures and research projects utilising imaging, not only at the University of Helsinki but also nationally via the Biocenter Finland National Imaging Infrastructure Network.

**Finnish host and university:** Academy Professor Elina Ikonen, University of Helsinki, tel. +358 9 191 25 277, elina.ikonen(at)helsinki.fi

**FiDiPro Professor:** Professor Vladimir Gel’man, European University at St. Petersburg, Russia.

Professor Vladimir Gel’man (b. 1965) is one of the leading scholars of Russia’s political system and an internationally highly recognised researcher of post-Soviet Russia.

**Research project:** The project will investigate why democracy, good governance and the rule of law have failed in contemporary Russia, and what contributes to the prospects for stability or
changes in political institutions. Through answering such questions, the project aims to understand the logic of political regimes and patterns of governance in Russia. The project focuses on the role of agency and the making of political institutions and traces the process of institution-building in Russia after the collapse of the Soviet system. To fully understand the nature of the Russian polity, the project will analyse the Russian experience within a broader theoretical and comparative cross-national perspective. It will also conduct within-nation comparisons of varieties of political regimes and patterns of governance on the sub-national level, and compare politics and governance of post-Soviet Russia with those in the pre- and late-Soviet periods.

**Finnish host and university:** Professor Markku Kivinen, Finnish Centre of Excellence in Russian Studies – Choices of Russian Modernisation, University of Helsinki/Aleksanteri Institute, tel. +358 9 191 23 654, markku.kivinen(at)helsinki.fi

**FiDiPro Professor:** Professor Leif Groop, Lund University, Sweden

Professor Groop (b. 1947) is among the foremost diabetes researchers in the world. He has made an exceptionally successful international career and has wide experience of extensive studies involving several partners. His work has significantly contributed to our understanding of the genetic background and disease mechanisms of type 2 diabetes.

**Research project:** Groop’s research project will combine state-of-the-art genetic methods with analyses of the special features of the Finnish population to tackle the mechanisms behind type 2 diabetes. It will greatly contribute to building a detailed map of genomes of Finns within the collaborative SISU project (Sequencing Initiative Suomi). The aim of the SISU project is to sequence the genomes of thousands of Finns and list the variants specific to the Finnish population. Based on these data, it will be possible to determine the genetic variation in existing epidemiological cohorts by means of cheap genotyping methods combined with novel computational tools. The research project is nationally important as it investigates the special features of disease mechanisms of diabetes in the Finnish population. Diabetes is one of the major diseases in Finland.

**Finnish host and university:** Professor Aarno Palotie, Institute of Molecular Medicine Finland FIMM, University of Helsinki, tel. +358 41 501 5915, aarno.palotie(at)helsinki.fi

**FiDiPro Professor:** Professor Gunther Uhlmann, University of California Irvine and University of Washington, USA

Professor Gunther Uhlmann (b. 1952) is widely recognised as the leader of the field of inverse problems and a driving force behind major recent developments in inverse problems with their many applications. In 2011, the American Mathematical Society awarded Professor Uhlmann the Bôcher Memorial Prize as recognition of his recent six-year research.

**Research project:** Uhlmann’s research project will focus on geometric inverse problems, inverse problems with partial data, and the applications of invisibility cloaking techniques in transformation optics. The project will also introduce the mathematical research of hybrid imaging methods into Finland. Inverse problems research is one of the most topical and significant research subjects in applied mathematics. Inverse problems research is widely applied by scientists in many fields,
instance by medical imaging researchers, earth scientists and electrical engineers.

**Finnish host and university:** Professor Lassi Päivärinta, Finnish Centre of Excellence in Inverse Problems Research, University of Helsinki, tel. +358 40 833 8532, lassi.paivarinta(at)helsinki.fi

**FiDiPro Professor:** Professor Nicola Fusco, University of Naples, Italy, and Carnegie Mellon University, USA

Professor Nicola Fusco (b. 1956) is an internationally highly recognised scientist in mathematical analysis.

**Research project:** Fusco’s project is in the field of mathematical analysis and will investigate geometric and functional inequalities, such as isoperimetric, Faber-Krahn and Sobolev inequalities, particularly via Fraenkel asymmetry.

**Finnish host and university:** Academy Professor Pekka Koskela, University of Jyväskylä, tel. +358 14 2602 706, pekka.j.koskela(at)jyu.fi

**FiDiPro Professor:** Professor Jacek Dobaczewski, University of Warsaw, Poland

Professor Jacek Dobaczewski (b. 1952) is a world-leading theoretician in the field of nuclear structure.

**Research project:** A poor description of low-energy correlations in nuclei is probably the principal source of errors and discrepancies in nuclear theory experiments. A possible way to proceed is to include the low-energy correlations explicitly, while maintaining the mean-field part at a manageable level. The aim of the research project is to define rigorous procedures and methods that would allow the inclusion of low-energy correlations in a consistent way. The goal will be reached by accomplishing a series of tasks that are split between immediate ones where the research direction is known, and far-reaching ones where the ambitious programme can be formulated in general terms only. The tasks will involve studying relations between mean-fields and low-energy-correlation effects through studies of symmetry breaking and symmetry restoration, multi-reference and symmetry conserving DFT, ground-state correlations, polarisation effects, and continuum mixing and open systems.

**Finnish host and university:** Professor Rauno Julin, Finnish Centre of Excellence in Nuclear and Accelerator-based Physics, University of Jyväskylä, tel. +358 50 591 9526, rauno.julin(at)jyu.fi

**FiDiPro Professor:** Professor Susan E. Quaggin, Toronto General Hospital and University of Toronto, Canada

Professor Susan E. Quaggin is a world-renowned researcher in complex biological systems. She is a leading scientist to apply and develop novel methods of functional genomics. The key focus of Professor Quaggin’s research is on kidney functions.

**Research project:** The extracellular matrix (ECM) is outside the cells and plays a key role in organisation and functions of organs. ECM transmits mechanical forces, binds cells and the ECM components serve as signals to regulate cell behaviour. The ECM is key in the renewal of organs
from residential and systemic stem cells. The ECM binds specifically secreted growth factors and regulates their action to determine cell fate during development. Altered ECM is transmitted to biochemical changes in the homeostasis of the tissues in organs and predisposes to diseases. The project will target the fundamentals of the ECM in the development and function of the mammalian kidney. It will further reveal how growth factors and the ECM transmit the hypoxia response to proper cell behaviour of a stem cell niche, cell reprogramming and kidney function. Novel disease models and therapies will also be developed.

**Finnish host and university:** Professor Seppo Vainio, University of Oulu/Biocenter Oulu, Finnish Centre of Excellence in Cell-Extracellular Matrix Research, tel. +358 8 537 6084, seppo.vainio(at)oulu.fi

**FiDiPro Professor:** Professor George Steven Bova, Johns Hopkins Hospital, Baltimore, USA

Professor George Bova (b. 1956) is a highly merited scientist in lethal metastatic prostate cancer and he has successfully commercialised his research innovations.

**Research project:** A barrier to achieving effective individualised cancer prevention and therapy is that most current studies do not have sufficient scope to distinguish critically important cancer subtyping observations from irrelevant ones. In order to identify important individual differences between patients with cancer, both the patient and the patient’s cancer and heredity and environment (incl. comorbidity) must be taken into consideration. The research project will work to establish molecular autopsy studies as a critical pillar enabling individualised cancer medicine. In this project, Professor Bova will continue and extend worldwide collaborations defining key molecular alterations in lethal prostate cancer, and will work to develop molecular autopsy studies of rare and common cancers in Finland to promote effective individualised medicine.

**Finnish host and university:** Professor Tapio Visakorpi, University of Tampere, tel. +358 40 717 4402, tapio.visakorpi(at)uta.fi

**FiDiPro Professor:** Professor Ian F. Akyildiz, Georgia Institute of Technology, USA

Professor Ian F. Akyildiz is a world-leading scientist in nanonetworks. He is internationally one of the most cited scientists in the field of electrical and computing engineering and has been granted a number of prestigious honours and awards.

**Research project:** Nanonetworks, i.e. networks of nano devices, under the Internet of Things (IoT) concept, will enable more advanced applications of nanotechnology in the biomedical, environmental, energy, military and other fields. The mission of the project is to conduct research on nanoscale machines networking and communications as a next step in modern communication technologies. In particular, this field is an unexplored area riddled with numerous research challenges. More specifically, many fundamental communication network requirements and functionalities will be redefined and redesigned (incl. network architectures, topologies, algorithms for nanoscale communication, coverage/connectivity, relay, broadcast, and medium access control mechanisms, synchronization, routing, addressing, reliable information coding, error control).

**Finnish host and university:** Professor Evgeni Kucheryavy, Tampere University of Technology, tel. +358 40 7710 619, evgeni.kucheryavy(at)tut.fi
**FiDiPro Professor:** Professor Pavel Jungwirth, Institute of Organic Chemistry and Biochemistry, Academy of Sciences, Czech Republic

Professor Pavel Jungwirth’s (b. 1966) research is characterised by interdisciplinarity and a wide range of topics, such as the effects of salts on proteins and cell membranes, the chemistry of atmospheric aerosols, and damage to DNA and lipids due to oxidative stress.

**Research project:** The research project focuses efforts to unravel questions related to molecular translocation across cell membranes. Particular attention is paid to effects due to oxidative stress, ions, and specific membrane-associated peptides and proteins that are involved in numerous human diseases. The research will promote health by providing better understanding of the underlying principles and mechanisms by which molecular engines (proteins) function under physiological conditions, thus proposing novel ideas and means to modulate their function with lipids, develop drugs for better health, and minimise effects due to oxidation. The scientific breakthroughs will pave way to biotechnological innovations in the development of drug and gene delivery techniques using completely new concepts.

**Finnish host and university:** Professor Ilpo Vattulainen, Tampere University of Technology, tel. +358 400 510 592, ilpo.vattulainen(at)tut.fi

**FiDiPro Professor:** Professor Masayuki Miyasaka, Osaka University, Japan

Professor Masayuki Miyasaka is one of the central figures in immunology studying different aspects of cell trafficking. For instance, he has identified new endothelial molecules responsible for cell entrance from the blood into the tissues and elucidated mechanisms controlling this process.

**Research project:** The project works to identify molecular mechanisms regulating tumour cell trafficking within lymphatics and aims at clarifying how immune cell trafficking within the lymphatics is regulated. The research results are expected to help find new targets for pharmaceutical development.

**Finnish host and university:** Professor Sirpa Jalkanen, Finnish Centre of Excellence in Host Defence Research, University of Turku, tel. +358 40 566 9611, sirjal(at)utu.fi