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- Examples of ERC Advanced Grant projects 2014 -

Stealing water's last secrets

We drink water, we bathe in water, we are made of water. It is the most important liquid, and we don't fully know it. Why does water increase density upon melting? Why does its viscosity decrease under pressure? Why does it have such a high surface tension? Can water really exist as two liquids? Professor Anders Nilsson of Stockholm University proposes to address some of the most important outstanding questions of a microscopic understanding of water. He will investigate the structure and dynamics of the hydrogen-bonding network, which gives rise to the unique properties of water, and how it is affected by temperature, pressure and interaction with solutes and interfaces. Prof. Nilsson will be studying water with new x-ray free-electron lasers. He plans to further develop fast cooling and ultrafast x-ray probing and novel experimental methods to reveal the mysteries of H_2O. The research has the potential to bring the most significant advances in the study of water in years.

Researcher: Anders Nilsson
Host institution: Stockholm University (Sweden)
Project: Probing the Structure and Dynamics of Water in its Various States (WATER)
ERC funding: €2.5 million

Making sense of the wobbly Earth and improving Galileo and GPS

Time and space. To measure the first one people have long used the rotation of the Earth. To locate themselves in space, travellers looked up to the stars as reference points. Today, there are atomic clocks for accurate timekeeping and advanced geodetic techniques to determine the position of objects. Yet, there is still a gap when it comes to precision of these measurements. The cause is the irregular rotation and orientation of the Earth. Our planet spins unevenly because of what happens with the mass in its core and mantle, and due to the gravitational pull of the Sun and the Moon. Mixing different approaches from astronomy, geophysics, geodesy and fluid dynamics, Professor Veronique Dehant of the Royal Observatory of Belgium aims to improve the model for the rotation and orientation of the Earth, and to make use measurements with sub-centimetre precision. This will be instrumental to European and international satellite missions and Global Navigation Satellite

Systems such as GPS and Galileo. At the same time, it will allow scientists to learn much more about the interior of the Earth.

Researcher: Veronique Dehant
Host institution: Royal Observatory of Belgium
Project: Rotation and Nutation of a Wobbly Earth (RotaNut)
ERC funding: €2.5 million

Good genes for young hearts

With some 400 000 cases every year, sudden cardiac death (SCD) is a leading cause of mortality in Europe. Among younger people it is mainly the inherited arrhythmogenic diseases that causes SCD. Professor Silvia G. Priori of the University of Pavia will pioneer gene therapy for prevention of SCD - a virtually unexplored field. Her project will target two inherited, life-threatening conditions: dominant catecholaminergic polymorphic ventricular tachycardia (CPVT) and long QT syndrome type 8 (LQT8).

The prevention of arrhythmias using gene therapy poses challenges: it is difficult to modify electrical properties of the heart without eliciting pro-arrhythmic side effects. Prof. Priori and her team will investigate strategies of gene-delivery, gene-silencing and gene-editing, comparing efficacy of different methods that could permanently correct the disorders. She expects that the results will not only improve treatment of CPVT and LQT8 but will foster development of gene therapy for other inherited and acquired arrhythmias.

Researcher: Silvia G. Priori
Host institution: University of Pavia (Italy)
Project: Molecular Strategies to Treat Inherited Arrhythmias (EU-RHYTHMY)
ERC funding: €2.3 million

Insects in the tropics: Why are they so many?

Most of the world's five to ten million insect species prefer to live in tropical, rather than temperate forests. Why is that, and how can so many species co-exist in the tropics? Professor Vojtech Novotny is planning to study this age-old, yet still unanswered, question in the Czech Republic, Gabon, Japan, Panama, Papua New Guinea and the United States. The findings may provide the key to predict changes in insect communities in tropical forests that are under severe logging pressure, and help design better strategies of insect pest management in the European forests. A 27-member-strong research team, spread in all study locations, will use canopy cranes, truck-mounted elevated platforms and forest felling to sample forest insects and plants. They will evaluate the importance of insects' plant resources and their natural enemies in maintaining a rich variety of herbivorous insects

in forest canopies. Prof. Novotny's project will enable researchers from six countries to establish long-lasting cooperation and give training to 11 PhD students. A canopy crane, a major research facility, will be built in Papua New Guinea at the New Guinea Binatang Research Center, named by the Science magazine one of "premier research outfits" in tropical ecology.

Researcher: Vojtech Novotny
Host Institution: Biology Centre CAS (Czech Republic)
Project: Ecological determinants of tropical-temperate trends in insect diversity (Diversity6continents)
ERC funding: €3.3 million

How to fight terrorism and not to turn evil

From the 9/11 attacks in the United States to the Charlie Hebdo murders in Paris this year, international terrorism shocks public opinion and has profound political, military and economic consequences. However, dealing with the terrorist threat is challenging both technically and morally. Not only does counter-terrorism involve numerous institutions and tactics, but it also puts the core values of democratic society to the test: right to life, freedom and privacy.

Professor Seumas Miller will examine key practical and ethical issues of counterterrorism in innovative approach on the interface of philosophy and security studies. He and his team will seek answers to several crucial questions. What is international terrorism? What is our collective moral responsibility in the context of counter terrorism? How effective and moral are targeted killings, mass personal data collection and other tactics? His main research question is what a morally permissible and efficacious structure of counter-terrorist institutions and tactics in a contemporary liberal democracy should be. The project also seeks to achieve major impact through sustained engagement with security agencies and relevant organisations.

Researcher: Seumas Miller
Host institution: Delft University of Technology (Netherlands)
Project: Global Terrorism and Collective Moral Responsibility: Redesigning Military, Police and Intelligence Institutions in Liberal Democracies (GTCMR)
ERC funding: €2.5 million

Understanding innovation to boost economic growth

One word has dominated political debates ever since the global economic crisis of 2008: growth. And the key to economic growth in developed countries is innovation. Professor John van Reenen of the London School of Economics and Political Science will look at innovation from two perspectives:

technological and managerial. The research promises to offer sound evidence-base for policies to boost growth. Professor van Reenen and his team will take a two-pronged approach. First, they will examine what is the effect of financial constraints, tax and schooling policies on entrepreneurial and innovative behaviour. They will use big-data techniques to match information on inventors' incomes, patents and citations, and private companies' data on productivity. Second, they will look into the impact of management practices on firm productivity and wealth of nations. In more general terms, the outcomes of this research might change the way we think about what drives prosperity and growth across firms and countries.

Researcher: John Van Reenen
Host Institution: London School of Economics and Political Science (UK)
Project: Getting back to Growth through Technological and Managerial Innovation (GGTMI)
ERC funding: €1.9 million