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ERC Consolidator Grants 2016

Examples of projects

Regenerative therapies for heart disease

More than 3.5 million new people are diagnosed with heart failure every year in Europe, with a long-term prognosis of 50% mortality within four years. There is urgent need for more innovative, regenerative therapies with the potential to change the course of the condition. Joost P.G. Sluijter at University Medical Center Utrecht is developing a promising therapy: stimulating cardiac repair with extracellular vesicles that are derived from progenitor cells. Membrane-encapsulated packages, containing a cocktail of stimulating factors, secreted by these early descendants of stem cells, could have a potent healing capacity. With the ERC grant, Dr Sluijter aims to improve delivery of these extracellular vesicles, better understand their mechanism of action, and design ways to stimulate their production and release by progenitor cells.

Project: Extracellular Vesicle-Inspired CArdiac Repair (EVICARE)
Researcher: Joost Sluijter
Host institution: University Medical Center Utrecht, Netherlands
ERC funding: 2 million

Rescuing cognitive disability with gene editing

Down syndrome is the leading cause of genetically-defined intellectual disability. Currently, treatment options are very limited, and early educational intervention is the cornerstone for the management of cognitive impairment. However, different pharmacological treatments targeting the genes responsible for the disease have shown promise in animal models. Laura Cancedda at IIT, using CRISPR-Cas9 gene-editing technology, will investigate whether prenatal manipulation of gene networks in mice neuronal cells may recover brain development and cognitive deficits later in life. The idea is to act at the early stages of brain development, and avoid the ethically controversial genetic editing of germline cells. Dr Cancedda will also develop safer, viral-free, technological approaches for genetic manipulations *in utero* in the view of potential future applications.

Project: Rescuing Cognitive Deficits in Neurodevelopmental Disorders by Gene Editing in Brain Development: the Case of Down Syndrome (GenEdiDS)
Researcher: Laura Cancedda
Host institution: Istituto Italiano di Tecnologia, Genova, Italy
ERC funding: 2 million

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New maths to predict elementary particle experiments

The discovery of the Higgs boson has attracted enormous public attention since 2012. This tiny particle, which helps us better understand the universe, was detected by physicists at CERN who smashed particles together and looked at the pieces. Yet these large practical efforts are based on theoretical calculations. The mathematics required to accurately predict what we expect to see during these experiments is highly complex. It is at the crossroads of arithmetic and algebraic geometry with high-energy physics that Prof. Francis Brown comes in. Working at the Mathematical Institute at the University of Oxford, his aim is to develop the Galois theory of periods and amplitudes. Prof. Brown hopes that this branch of mathematics will provide him with a platform with which to train young physicists, who will in turn equip the physics community with the next generation of techniques to break current bottlenecks in the predictions of particle collider experiments.

Project: Galois theory of periods and applications (GALOP)
Researcher: Francis Brown
Host institution: University of Oxford
ERC funding: 2 million

Survivable network design and other graph problems solved *en bloc*

Finding the shortest path to a destination, matching workers to jobs, or placing guards in a museum so that nothing can get stolen are simple examples of problems that can be modeled by the mathematical theories of graphs and networks. In order to be able to efficiently perform computations in these models and find solutions, scientists rely on a variety of different algorithms. Until now graph problems have been looked at individually, but Dániel Marx from the Hungarian Academy of Sciences will investigate whether it is possible to reach a unified understanding of a specific domain of graph problems. By developing a systematic and methodological framework for the computation of algorithmic graph problems Dr Marx and his team hope to demonstrate that such a complete classification is feasible for a wide range of graph problems coming from areas such as finding patterns, routing or survivable network design.

Project: Systematic mapping of the complexity landscape of hard algorithmic graph problems (SYSTEMATICGRAPH)
Researcher: Daniel Marx
Host institution: Hungarian Academy of Science, Institute for Computer Science and Control
ERC funding: 1.53 million

Treating psychological conditions and fixing memories in sleep

Sleep plays a crucial role in memory processes. When we sleep, our memories are replayed, and this repetition helps to consolidate them – this is the case in traditional learning. However, during the sleep replays, or reactivations, memories are not fixed and could be changed. Dr Karim Benchenane and his team at the Centre National de la Recherche Scientifique have shown that reactivations during sleep can be used to create artificial pleasant memories. The researcher now proposes to continue experiments with aversive memories, and examine whether the same technique could be applied to them. Dr Benchenane aims to develop a tool for modifying memories to treat psychological conditions, for example post-traumatic stress disorder.

Project: Brain computer interface to study and manipulate memories of aversive experience during sleep (MNEMOSYNE)
Researcher: Karim BENCHENANE
Host institution: Centre National de Recherche Scientifique (CNRS), France
ERC funding: 2 million

Shedding light on shady economy

Illegal markets make up a significant part of the world economy, with illicit substances and counterfeit markets reaching an annual value of up to $300 billion each. This economic activities, however, remain unobserved due to their criminal character. They are not incorporated in the economic models that policy makers rely on to make their decisions. Michelle Sovinsky from the University of Mannheim proposes to develop novel models that would account for unobserved economic behaviour. Her research will focus on three yet under-studied spheres: consumption of illicit drugs, counterfeit production, and illegal counter-competitive actions of legal firms. Prof. Sovinsky will propose and test new estimation methods to better analyse each of these three spheres. The research may provide policy makers with useful tools to understand the illicit markets despite their murky nature.

Project: Illicit Markets, Unobserved Competitors, and Illegal Behavior nature (FORENSICS).
Researcher: Michelle Sovinsky
Host institution: Universitaet Mannheim, Germany
ERC funding: 1.21 million

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How democracy spreads through migration

International migration and democratic development are issues of high concern in the modern world. Eva Østergaard-Nielsen's project at the Autonomous University of Barcelona will connect the two and look at the influence of migration on the politics of countries migrants come from. Existing research has linked the money the emigrants send home and the new ideas of democracy they acquire to democratic processes in their home countries. The proposed project will build on these findings and create new comprehensive datasets that will allow an analysis of political ideas and practices negotiated among migrants, non-migrants and returnees in the countries of origin. Prof. Østergaard-Nielsen will study how these processes intersect with economic, social and political transformations in Turkey, Morocco and Hungary on three levels: individual citizens, civil society and politicians. Using statistical research methods, surveys and in-depth interviews, this research project aims to deepen our understanding of democratic diffusion through migration.

Project: Migration and Democratic Diffusion: Comparing the Impact of Migration on Democratic Participation and Processes in Countries of Origin (MigraDEMO)
Researcher: Eva Ostergaard-Nielsen
Host institution: Autonomous University of Barcelona, Spain
ERC funding: 1.45 million