



European Research Council

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- Examples of ERC Consolidator Grant projects 2013 -

Countdown to eruption: a geochemical clock for volcanoes

Volcanic eruptions, and their aftermath, have scarred human history – from the explosion of Vesuvius in 79 AD to the outpouring of Eyjafjallajökull in Iceland (2010). The main event that triggers such eruptions is the re-filling of a sub-volcano magma chamber and the mixing of magmas within it. Dr Perugini and his team hope to use these processes to analyse the exact timescales of eruptions. When the different magmas mix, they cause chemical elements to undergo changes which are recorded in the volcanic rocks, as if frozen in time. The researchers will use this geochemical record to measure the time elapsed between mixing and eruption, much like a broken clock at the scene of a crime. They will focus on two active volcanic regions - Southern Italy, including Mt Vesuvius, and the Soufriere Hills volcano in the Caribbean, which became active in 1995 with catastrophic effects. The team will also conduct the first experimental 'magma mixing' in a laboratory. If successful, their project could allow very precise prediction of volcanic eruptions, in order to mitigate their huge social and environmental impact.

ERC grantee: Diego Perugini

Host institution: Università degli Studi di Perugia, Italy

ERC project: A geochemical clock to measure timescales of volcanic eruptions (CHRONOS)

ERC funding: € 1.9 million

What can the Dark Sector teach us about the Cosmos?

This project tests the assumptions of the governing theory of gravity, Einstein's General Relativity: asking whether it holds all the answers. Dr Skordis and his team are exploring the effects of the Dark Sector and gravity on the evolution of the cosmos. The Dark Sector is made up of Dark Matter and Dark Energy. This ERC-funded research aims to test current paradigms further, and in the process to revise our knowledge of the Dark Sector. Specifically, the TheMoDS project will work towards a more accurate assessment of Dark Matter and Dark Energy and attempt nothing less than a testing of gravitational theories against cosmological evidence. They will draw chiefly on cosmic microwave radiation data from ESA's Planck Surveyor and the Atacama Cosmology Telescope (established in the desert in Northern Chile). Data from the Planck Surveyor, as well as other available observations of the solar system, will allow them to test theoretical models and in doing so reach a more accurate understanding of the workings of Gravity and the role of the Dark Sector in cosmology.

ERC grantee: Constantinos Skordis

Host institution: University of Cyprus (Cyprus)

ERC project: Theories and Models of the Dark Sector: Dark Matter, Dark Energy and Gravity (TheMoDS)

ERC funding: € 1.2 million



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Machine responsibilities: not just science fiction

Intelligent systems are now used throughout our daily lives, but sometimes the boundary between our responsibility and theirs can become lost. Who is responsible if a self-driving car has an accident? Is it safe to place over 45% of financial trading in the hands of intelligent systems? Jan Broersen aims to tackle these issues by developing the theoretical groundwork for an automated prototype to check responsibility, liability and risk in situations where tasks are delegated to intelligent systems. Combining aspects of philosophy, legal theory and computer science, his inter-disciplinary project will bring together logic-based input models and algorithms to perform computational checks and help us keep track of our indirect moral and legal responsibilities. In the end, only the human operators or designers can be accountable for the actions of these devices and we need a way to monitor this accountability. Future applications for Dr Broersen's prototype checking system could include robots in medicine, the military and transportation, financial trading agents and automated surveillance.

ERC grantee: Jan Broersen

Host institution: Universiteit Utrecht, The Netherlands

ERC project: Responsible Intelligent Systems (REINS)

ERC funding: € 1.9 million

Wiring the brain in the embryo: the role of genetic and environmental factors

This project explores the anterior of the brain and the functions of forebrain wiring. This neuronal network controls sensory perception, motor control and our cognitive functions. Specifically, the NImO project examines this circuitry in the developing embryo. Dr Garel and her team are attempting to define a relatively unknown area, but a very significant one. They are questioning how embryonic cerebral programming and maternal signals control forebrain wiring. This is important because a better understanding of this process could teach us a great deal about the relationship between the neural and immune systems of the developing embryo. Inflammation of the brain in the pregnancy, through infection for example, is known to put the embryo at a higher risk of developing schizophrenia or autism. This ERC-funded research aims to improve our grasp of the mechanisms that determine brain wiring in both normal and pathological development. The results should illuminate the interplay between cerebral development and neuropsychiatric disorders, and in doing so offer a basis for further clinical work.

ERC grantee: Sonia Garel

Host institution: Institut National de la Santé et de la Recherche Médicale (INSERM), France

ERC project: Neural and Immune Orchestrators of Forebrain Wiring (NImO)

ERC funding: € 1.9 million



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Predicting the persistence of chemicals in the environment

Waste chemicals released into the environment are detrimental both to humans and the natural world. Fortunately, microbial communities in the environment can reduce the problem by breaking down the chemicals – a process called biotransformation. We know little about this process, with the result that for many chemicals released we do not know the extent to which they will be transformed. Kathrin Fenner's project will study the timescale and products of biotransformation for different chemicals, locations and microbial populations, and derive predictive methods from these observations. This is ground-breaking research, as previous prediction methods have mainly focused on the structure of the chemicals, without directly considering differences in environmental conditions. Dr Fenner's study could be the first to establish accurate methods for predicting the success of biotransformation in diverse settings. Her results should have a major impact: not only on chemical risk assessments, but also on the recovery of contaminated sites and development of green chemical alternatives.

ERC grantee: Kathrin B. Fenner

Host Institution: Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz (Eawag), Switzerland

ERC project: Predicting environment-specific biotransformation of chemical contaminants (PROduCTS)

ERC funding: €1.9 million

Does our perception of risk affect how we save?

Prof. de Nardi's work explores the many reasons why people save money, or fail to. Central to this research is an analysis of the relationship between saving behaviour and the perception of risk. The hypothesis of this project is that different categories of risk affect us at different stages of our lives. The young are exposed to the possibility of lower wages, the threat of unemployment, or the potential financial fallout from a divorce. Older people face the financial costs of higher medical bills, the monetary shocks of bereavement and, quite simply, the need to support themselves for longer if they live longer. Prof. de Nardi looks at how our perception of the value of saving to insure against risk is affected by the existence, and the absence, of public insurance. This insurance can be anything from government-backed social security or health insurance to a broader government guarantee of a certain standard of living. More widely, her research explores the effects of risk-based choices on patterns of welfare, inequality and wealth distribution. Her findings should inform public policy, and particularly the design of more efficient and effective public insurance in both the EU and the US.

ERC grantee: Maria Cristina de Nardi

Host institution: University College London, UK

ERC project: Savings and Risks over the Lifecycle (Savings and Risk)

ERC funding: € 2 million