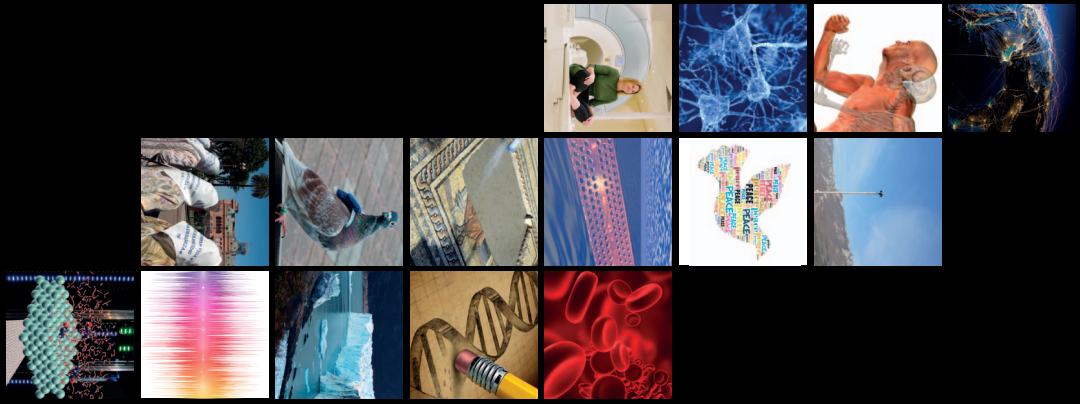

Vibrant examples of ERC projects

European Research Council

Established by the European Commission

The European Research Council

In a nutshell

The European Research Council (ERC) is the first pan-European funding body supporting the **best frontier research** in Europe. It aims to provide attractive, **long-term funding** to **excellent scientists** and their research teams to pursue ground-breaking, high-risk/high-gain research **in any field**. Excellence is the sole criterion for selection; there are neither thematic priorities, nor geographical quotas for funding.

Created by the European Commission in 2007 with a total budget of €7.5 billion (2007-2013), the ERC received a major budget increase to around €13 billion under the new EU research programme "Horizon 2020" (2014-2020).

By the end of 2013, some **4 000 projects** will have been selected for funding in more than 500 host institutions and in **29 countries** across Europe. Each ERC grantee employs on average six team members: they will have offered cutting-edge research training for nearly 7 000 doctoral students and 9 000 postdoctoral researchers, thus contributing to the training of a new generation of excellent scientists.

The ERC expects that its grants will help bring about new and unpredictable scientific and technological discoveries - the kind that can form the basis of future industries, markets, and social innovations.

This folder gathers examples of projects from all three domains funded by the ERC: life sciences; physical sciences and engineering; and social sciences and humanities.

ERC core grant schemes

- **ERC Starting Grants** for early-career, emerging research leaders (up to €2 million per grant);
- **ERC Consolidator Grants** for excellent researchers who are already independent (up to €2.75 million per grant);
- **ERC Advanced Grants** for established top researchers (up to €3.5 million per grant).

Two additional funding initiatives: the **ERC Synergy Grants**, introduced on a pilot basis to support a few small groups of researchers working together on the same project (up to €15 million per grant); and the **ERC Proof of Concept** funding, open only to ERC grantees to help them establish the innovation potential of ideas arising from their frontier research projects (up to €150 000 per grant).

More information

http://erc.europa.eu

ERC stories

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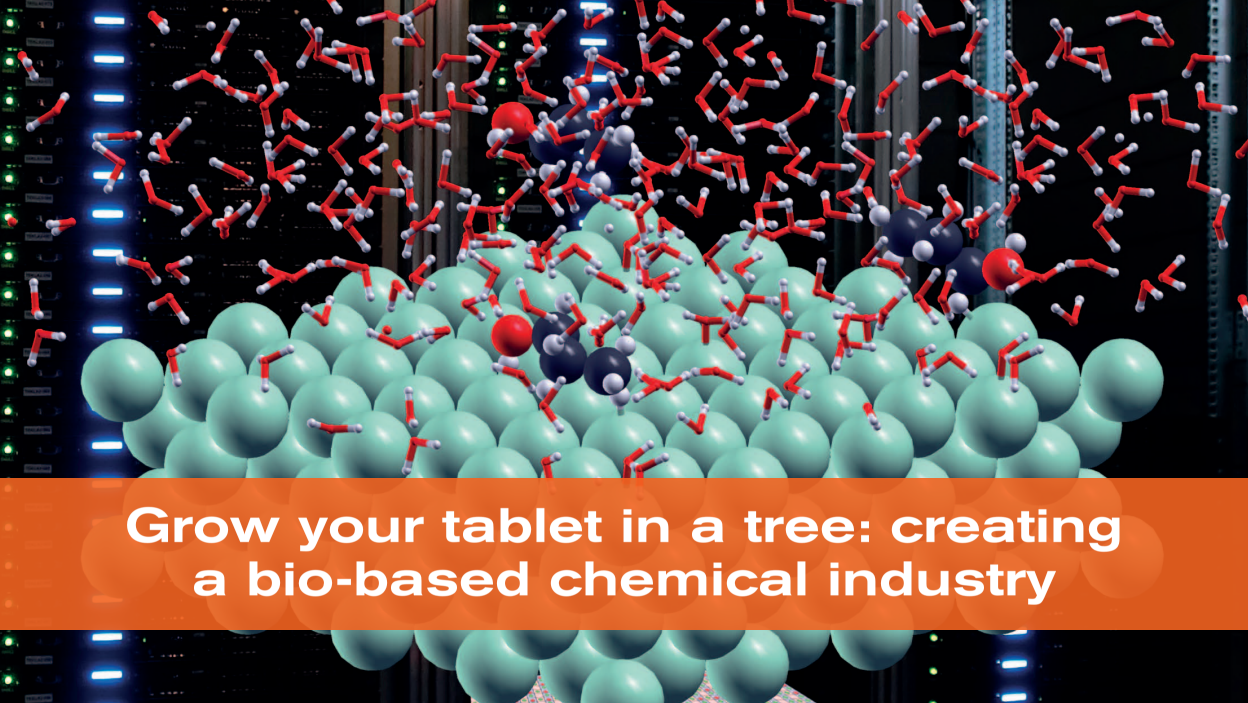


Grow your tablet in a tree: creating a bio-based chemical industry

Grow your tablet in a tree: creating a bio-based chemical industry

Glasses, detergents, anti-freeze, carpets, pens and aspirin. All these products come from our chemical industry, which is currently using up precious fossil fuels to make them. But there is an alternative – we can produce the same chemicals from renewable biomass sources, such as plant matter. We just need the right techniques to transform them.

Converting biomass into useful industrial materials is more difficult than converting oil. Before it can be put into practice, scientists must identify a range of new and effective catalysts to speed up the chemical reactions. The traditional trial-and-error approach for finding catalysts is both slow and expensive. Dr Núria López aims to solve this problem by using a new large-scale computational analysis. Her innovative project will combine complex mathematical techniques to quickly identify stable catalysts for biomass conversion.

The team's results will support the move from petroleum-based to bio-based chemical production. Going back 100 years most chemical products came from biomass, but this was later replaced by petroleum, as it was cheap and easy to convert. Now, with oil in shorter supply and growing environmental concerns, the move back to biomass is gaining momentum. Dr López's team hope their success will help lead to new 'biorefineries', optimized for energy efficiency and resource sustainability.

Project details

Principal investigator: Núria López

Host institution: Fundació Privada Institut Català d'Investigació Química (Spain)

ERC project: Biomass to chemicals: Catalysis design from first principles for a sustainable chemical industry (BIO2CHEM-D)

ERC call: Starting grant 2010

ERC funding: €1.5 million for five years

Understanding and enhancing empathy and compassion

Understanding and enhancing empathy and compassion

Can we enhance our ability to understand our own and others' feelings and show more compassion? At the frontiers of neuroscience, psychology and economics, Prof. Singer investigates whether empathy and compassion training could have lasting changes to our brain structure, our health and everyday behaviour.

Empathy, the ability to understand and share the feelings of another, and compassion, the concern for the welfare of another, are crucial for successful social interactions and cooperation. Yet little is known on cortical plasticity, the potential to change our brain structure, of these social emotions and motivations.

Prof. Singer examines brain differences between individuals with high and low empathy (including people with autistic disorders and socio-affective deficits) and meditation experts who have cultivated compassion for years. Using real-time imaging (fMRI) among other techniques, she observes the changes in brain structure and functioning and the behaviour of patients, compassion experts and non-trained subjects while they engage in different mental training techniques aiming at enhancing one's awareness, attention, empathy, compassion or emotion regulation.

Prof. Singer's results could determine whether affective and cognitive mental training programmes can improve pro-social behaviour (e.g. increase cooperation and helping), subjective wellbeing or health-related variables such as stress. They could also lead to new treatment of social deficits for autistic and psychopathic patients.

Project details

Principal investigator: Tania Singer

Host institution: Max Planck Gesellschaft zur Förderung der Wissenschaften e.V. (Germany)

ERC project: Plasticity of the Empathic Brain: Structural and Functional MRI Studies on the Effect of Empathy Training on the Human Brain and Prosocial Behaviour (EMPATHICBRAIN)

ERC call: Starting grant 2007

ERC funding: €1.5 million for five years

Tackling the illegal traffic of cultural goods

Tackling the illegal traffic of cultural goods

The looting of ancient artefacts not only compromises historical knowledge and social memory, but also deprives communities of an important cultural and economic resource. Dr Simon Mackenzie studies international trafficking to inform policies aimed to control this criminal market.

There are no reliable estimates yet on the size of the global market in looted cultural objects. Dr Mackenzie gathers evidence-based data on the trafficking routes, the ways to properly measure and control this illicit activity and its ethnographic characteristics. The research includes discovering and analysing the motives and methods of the actors in the illegal supply chain, including criminal looters and smugglers as well as middle-men who attempt to insert stolen artefacts into the public international marketplace, for sale to legitimate institutional and private collectors.

At the crossroads of criminology and archaeology, the project also covers law, anthropology, international relations, politics and economics - with particular case-studies in Central and Eastern Europe, Asia, and South America. Emerging findings are already allowing Dr Mackenzie's team to answer key questions about this type of criminal trade, such as whether it is linked to local or transnational organised crime groups. A clear picture is also being developed of the historical link between regional armed conflict and the widespread looting of cultural sites with archaeological importance.

This brings attention to the risks to cultural heritage inherent in current conflict zones, and the relationship of 'trafficking culture' to other types of traffic like illicit trade in drugs and arms.

Project details

Principal investigator: Simon Mackenzie

Host institution: University of Glasgow (United Kingdom)

ERC project: Global traffic in illicit cultural objects: developing knowledge for improving interventions in a transnational criminal market (GTICO)

ERC call: Starting grant 2011

ERC funding: €990 000 for four years

GPS flight tracking to reveal rules of collective motion

GPS flight tracking to reveal rules of collective motion

What do tissue cells, pigeons and robots have in common? According to Prof. Tamás Vicsek, it's all in the way they move. By observing the movements of living and non-living systems, his team are defining new unifying principles to describe group motion.

Collective motion is an important phenomenon, both for our understanding of the natural world and the development of new technologies that work and move together. Flocks of birds, for example, often appear to fly as if they were one animal by changing direction simultaneously - an effort of coordination barely matched by well-rehearsed ballet dancers.

How, where and why this is possible is the focus of Prof. Vicsek's research. He and his team are involved in discovering the underlying social and physical rules which allow individuals to change their behaviour to a common pattern.

With this aim, Prof. Vicsek's project brings together a host of different fields, including statistical physics, network theory, cell biology and collective robotics. His diverse team have worked extensively on GPS tracking of flocking pigeons and intend to reproduce their observations about collective motion with a group of autonomous aerial robots. For the first time these machines will move together freely in a 3-dimensional outdoor space.

With innovative experiments and complex statistical modelling the project could have a widespread impact: from the future of aerial devices to studies of group behaviour; and from cell biology to Artificial Intelligence.

Project details

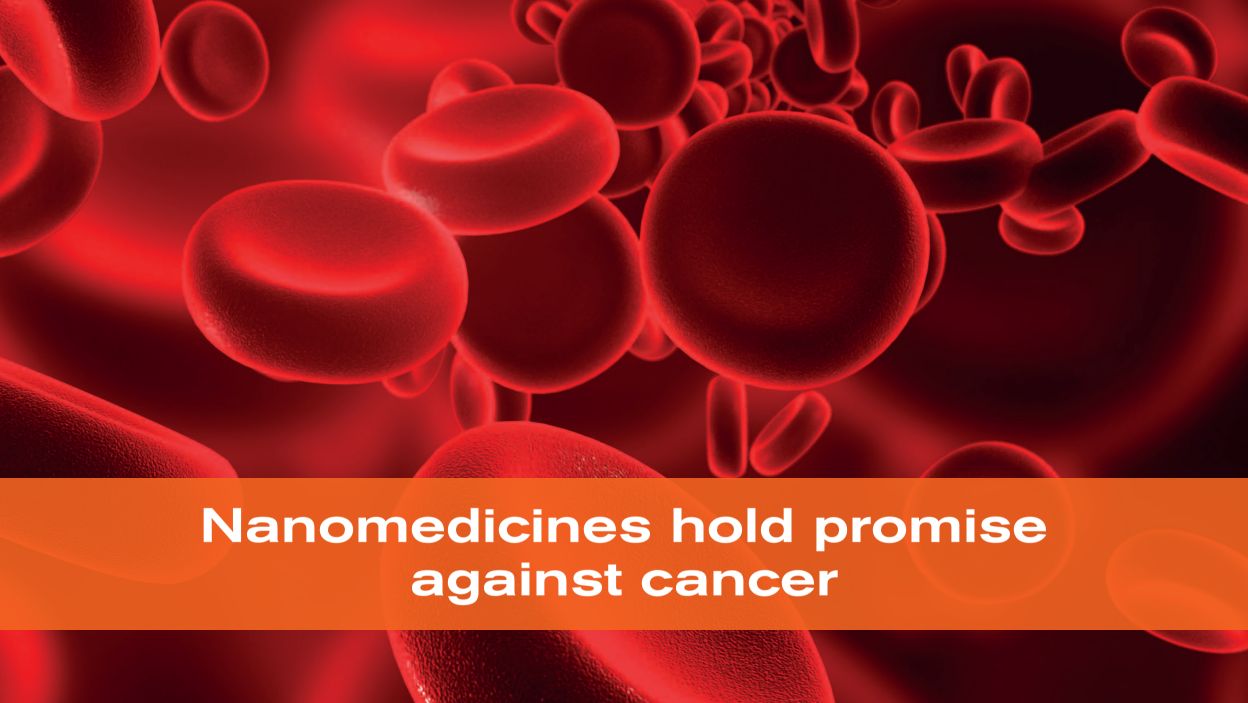
Principal investigator: Tamás Vicsek

Host institution: Eötvös Loránd University, Budapest (Hungary)

ERC project: Complex structure and dynamics of collective motion (COLLMOT)

ERC call: Advanced grant 2008

ERC funding: €1.24 million for five years



Nanomedicines hold promise against cancer

Nanomedicines hold promise against cancer

Pharmacist Prof. Patrick Couvreur investigates how to use nanotechnologies to improve the delivery of drugs to targeted diseased cells. With his ERC grant, he works on a new generation of natural and biocompatible drug carriers using "terpenoids".

The objective of his project is to improve the loading of the drug onto the terpenoid carriers, thereby better controlling its delivery within the body. This could mean much smaller dosages for the rest of the body and greatly reduce the side effects from drugs such as chemotherapeutics.

Prof. Couvreur aims to chemically link drugs with several terpenoids, including "squalene", a natural lipid molecule found in shark liver oil, vegetable oils and human skin. Terpenoids are natural polymers that are flexible enough to adapt to various biologically active substances: the molecular building blocks of the drug and the carrier can self-assemble as nanoparticles. This innovative approach has never before been used for drug delivery.

By combining physicochemistry, cellular and molecular biology and pharmacology, Prof. Couvreur hopes to improve the treatment of cancers and severe infectious or neurological diseases; especially when these are resistant to current therapies. The project has already demonstrated that nanoparticles can overcome the drug resistance of pancreatic cancers, for which survival rates are very low.

Project details

Principal investigator: Patrick Couvreur

Host institution: University Paris-Sud XI (France)

ERC project: Terpenoylation: an original concept for the discovery of new nanomedicines (TERNANOMED)

ERC call: Advanced grant 2009

ERC funding: €2.2 million for five years

Argentina's haunted collective memory

Argentina's haunted collective memory

The Mothers of the Plaza de Mayo have been rallying weekly since the mid-1970s to seek justice for their missing ones in Buenos Aires. ERC grantee Kirsten Mahlke investigates the connections between the fantastic narrative and the historical terror that took place during the military dictatorship in Argentina (1976-1983).

The remnants of the Argentinean violent past have persisted into present times of democracy; the uncertain status of the Disappeared ("los Desaparecidos") still evokes a painful collective memory. Around 30 000 militants, suspected of terrorist activities against the state, were kidnapped, tortured, murdered and made to disappear during the dictatorship. This historical case created an unspeakable trauma in the Argentinean society and forms the basis of this ERC project.

Prof. Mahlke combines literary studies with political science and social anthropology to examine the different ways in which the Disappeared shaped the Argentinean society. For the first time, the Disappeared are analysed as figures of the transition between the reality and the fiction.

By using tools such as interviews, novels, artistic and social performances, films and documentaries, she questions the limits between the historical reality and the fantastical imagination that are closely linked to the tragic episode. Prof. Mahlke is confident that her results would bring new insights to understand and re-evaluate the current war against terrorism led by Western democracies.

Project details

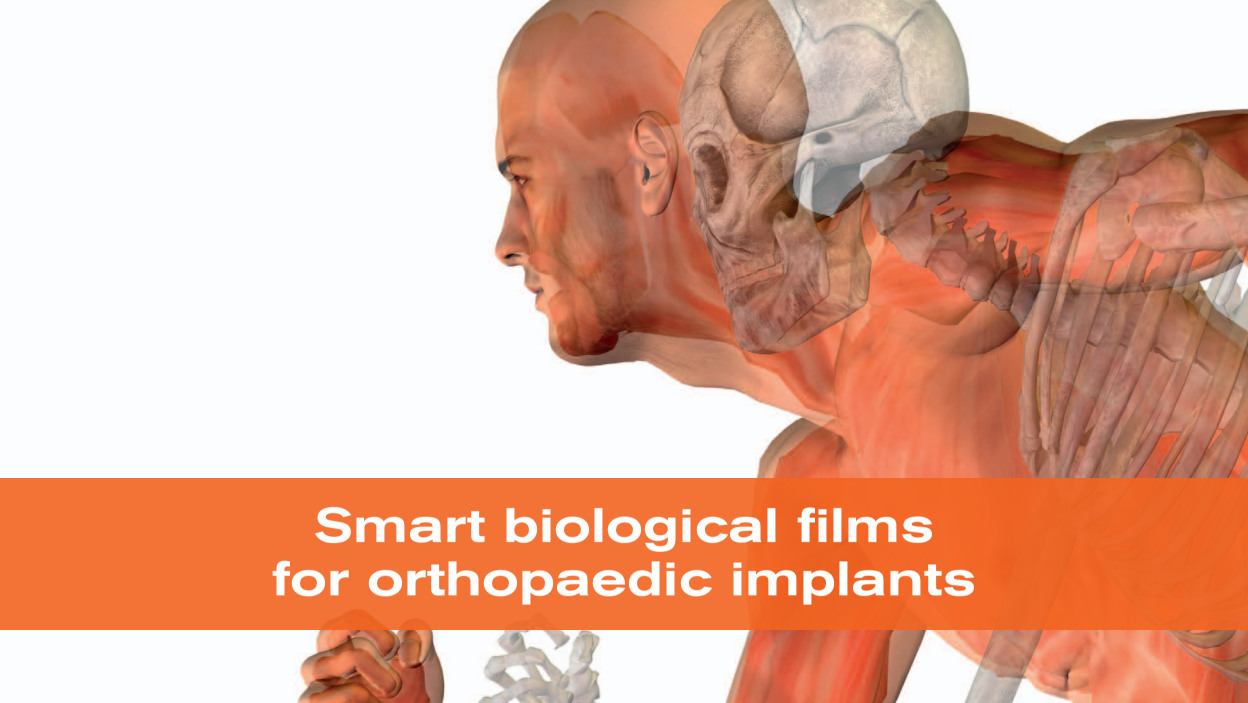
Principal investigator: Kirsten Mahlke

Host institution: University of Konstanz (Germany)

ERC project: Narratives of Terror and Disappearance. Fantastic Dimensions of Argentina's Collective Memory since the Military Dictatorship (NOT)

ERC call: Starting grant 2009

ERC funding: €1.2 million for five years



Smart biological films for orthopaedic implants

Smart biological films for orthopaedic implants

Prof. Catherine Picart develops biomaterials to speed up the regeneration of bone and muscles tissues. In the long term, they could help to limit the inconvenience of bone fractures for patients and cut related healthcare costs.

Biopolymers naturally exist in the human body. With her ERC project, Prof. Picart designs nanomaterials inspired by natural membranes and tissues. She shapes biopolymers in very thin layers (or films) to better control their mechanical properties and their "bioactivity", i.e. their ability to induce a particular reaction in the cells they are in contact with.

Her research team aims to understand how cells organise and finally develop into muscular or skeletal tissues and how they are affected by the biomaterials. The films could accelerate cellular regeneration after fractures, potentially reducing the need for surgery; the length of hospital stays; and the suffering of patients.

Following her first results, Prof. Picart received an additional 'Proof-of-Concept' grant to explore the market potential of a new generation of orthopaedic and dental implants. Demand for these implants rises steadily due partly to the increased number of sports injuries, but also to the larger proportion of elderly citizens in the European population, an age group more susceptible to fractures.

Project details

Principal investigator: Catherine Picart

Host institution: Institut Polytechnique de Grenoble (France)

ERC projects: Biomimetic films and membranes as advanced materials for studies on cellular processes (BIOMIM), Osteo-inductive coating of orthopedic and dental implants (OSCODI)

ERC calls: Starting grant 2010, Proof-of-Concept 2012

ERC funding: €1.5 million for five years + €150 000

Before Babel: tracing the evolution of languages

Before Babel: tracing the evolution of languages

Language is a powerful tool allowing humans to communicate, cooperate and learn from each other. Yet it is also diverse: the 7 000 languages spoken today are constantly changing and adapting to the societies they belong to. Prof. Mark Pagel searches for general rules that govern this evolution of languages.

An evolutionary biologist, Prof. Pagel compares the cultural evolution of languages to the transmission of our genetic heredity. He designs statistical models of linguistic development both at the micro and macro-evolutionary level to reconcile his evolutionary theory with the mainstream view that linguistic changes are so rapid and common that laws describing their histories cannot be found.

Prof. Pagel expects to get insights into the drivers which influence the rates and patterns in the evolution of languages - such as cultural selection of words, competition between synonyms and bilingualism. As geneticists look for highly conserved genes, Prof. Pagel's team endeavours to identify the probability of certain sound changes in historically related language families, allowing him to reconstruct their ancestors, or 'protolanguages'.

First findings have enabled Prof. Pagel and his team to draw up a super-family tree of seven distinct European and Asian language families that all emerged from a common tongue around 15 000 years ago, and split off into separate language families over the next 5 000 years. Words such as *I*, *you*, *we*, *who*, *what*, and *mother* might be ancient sounds that descend from a common source to many of the languages in this super-family.

Project details

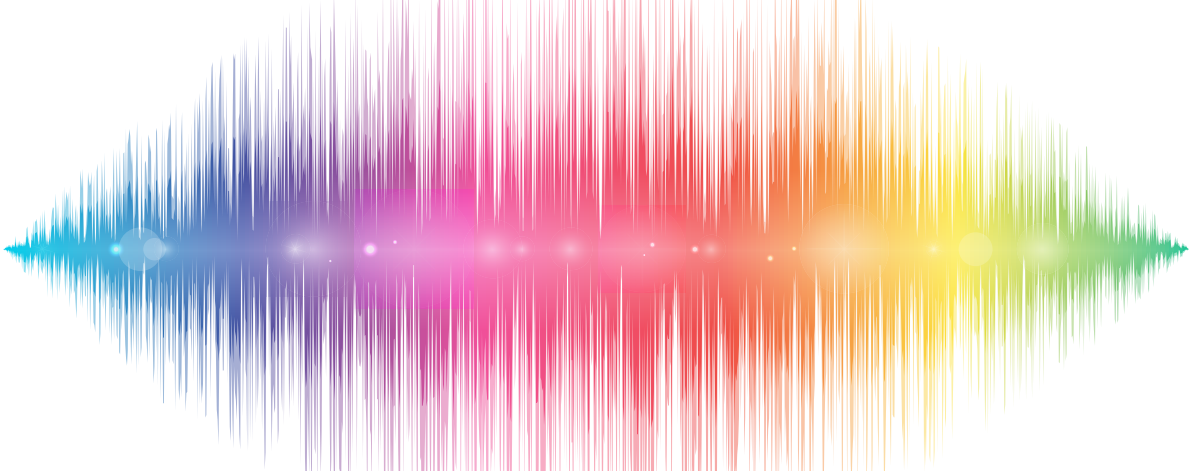
Principal investigator: Mark Pagel

Host institution: University of Reading (UK)

ERC project: The Evolution of Human Languages (MOTHERTONGUE)

ERC call: Advanced grant 2010

ERC funding: €2 million for five years



Silencing your inner voices

Silencing your inner voices

Auditory hallucinations, the inner voices patients with schizophrenia hear in the absence of any external input, can be very disruptive for health and for social life. Prof. Kenneth Hugdahl has developed an iPhone/iPod touch app to help patients re-focus their attention.

Hearing voices is more common than we think: 'healthy' people often experience them too, but cope and interpret them in a different way than schizophrenic patients.

With his ERC project, Prof. Hugdahl aims at localizing brain areas that are involved in auditory hallucinations. He uses imaging techniques such as functional Magnetic Resonance Imaging (fMRI) to track neuronal activation in the brain.

He has showed for instance that "inner voices" generate activity in the speech regions of the left hemisphere in a very similar way to real auditory input. Surprisingly, patients with auditory hallucinations shut down the outer world and switch their attention fully to the inner voices.

To help them inhibit their inner voices, Prof. Hugdahl has developed cognitive training sessions, where patients are presented with two different sounds in each ear and are asked to focus their attention on the outer sounds in particular.

The team have recently adapted this training into an iPhone/iPod touch app, which allows patients to train autonomously without having to come to the laboratory.

Project details

Principal investigator: Kenneth Hugdahl

Host institution: University of Bergen (Norway)

ERC project: "Hearing voices" - From cognition to brain systems (VOICE)

ERC call: Advanced grant 2009

ERC funding: €2.28 million for five years

Improving models for weather forecasts and climate evolution

Improving models for weather forecasts and climate evolution

Weather and climate models are continuously improved. Yet Prof. Nedjeljka Žagar believes meteorologists still lack efficient tools for their diagnosis and verification. She studies atmospheric circulation to clarify some of the reasons behind the uncertainty of weather forecasts and climate model deficiencies.

Much of the time, the atmosphere is in a nearly balanced state: the mass fields and wind fields work against solar and other forces to adjust to equilibrium. In mid-latitudes such as Europe, the atmospheric circulation on average tends to be nearly horizontal and almost balanced: its main properties are understood by a theory which builds on "Rossby-type" motions. In the tropics, however, a balance can hardly be maintained due to continuous convection movements, represented by "inertio-gravity" motions.

Prof. Žagar analyses atmospheric temperature and wind data in terms of inertio-gravity (unbalanced) motions and Rossby-type (balanced) motions to advance our understanding of atmospheric predictability and verify the circulation properties of current climate models.

She applies the same methodology to study atmospheric predictability, in particular the impact of the tropics on the loss of predictability in mid-latitudes. Her results could support the planning of economic activities and infrastructures across the globe such as agriculture, insurance, water supplies and wind-energy power.

Project details

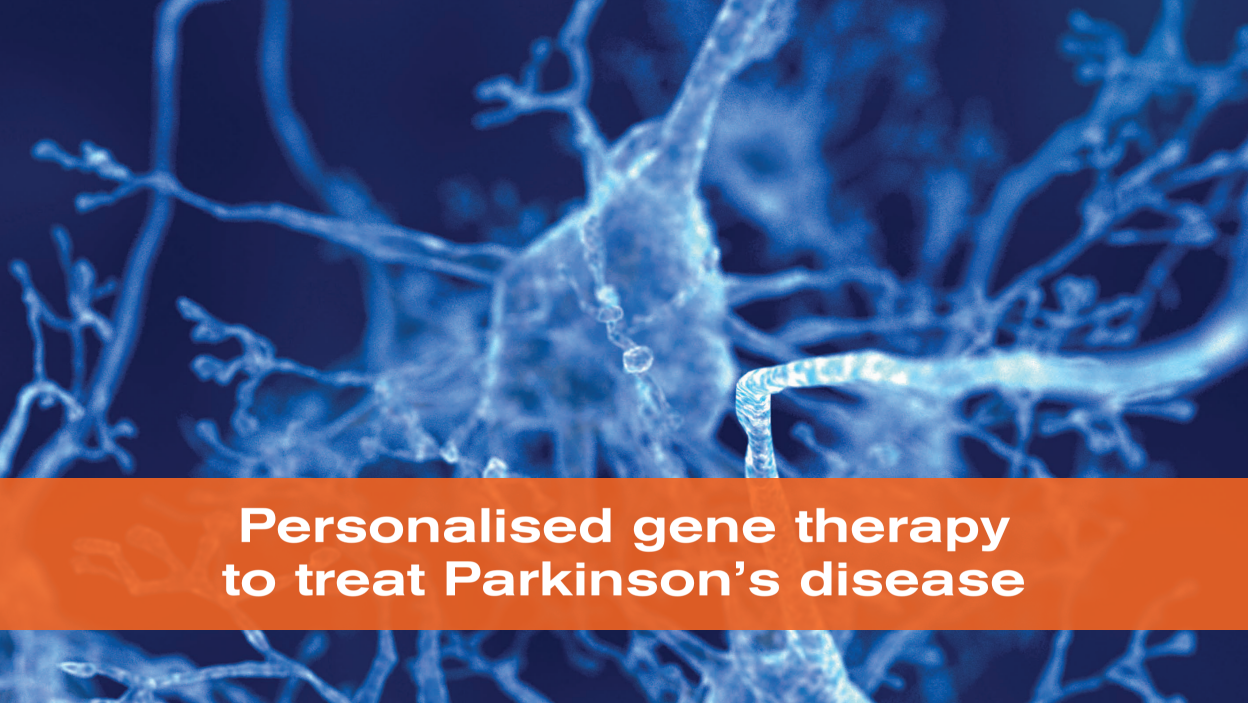
Principal investigator: Nedjeljka Žagar

Host institution: University of Ljubljana (Slovenia)

ERC project: Modal analysis of atmospheric balance, predictability and climate (MODES)

ERC call: Starting grant 2011

ERC funding: €500 000 for four years



Personalised gene therapy to treat Parkinson's disease

Personalised gene therapy to treat Parkinson's disease

Parkinson's disease is the second most common neurodegenerative disease of the brain. With his ERC grants, neuroscientist Prof. Deniz Kirik aims to understand the mechanisms of the disease and develop new treatments based on advanced cell and gene therapy techniques.

Using small laboratory animals (rats and mice) and large animals (non-human primates and pigs), Prof. Kirik's research team are studying neuropathology and progressive cell death in neuronal systems, similar to those observed in patients suffering from neurodegenerative diseases.

The idea is to reverse the disease's symptoms or to replace the lost functions by introducing small and harmless recombinant viruses into brain cells, so that the affected region is again capable of producing dopamine, an essential neurotransmitter. Prof. Kirik's research is also about following the progression of the disease in the brain with new in vivo imaging technologies.

In 2012 he received an ERC Proof-of-Concept grant that will support the team to find solutions to regulate therapeutic intervention and tune the delivery of the drug to meet patients' individual needs. In particular, Prof. Kirik aims to develop a regulatable gene delivery system for clinical use for patients with Parkinson's disease, and investigate its further commercialisation.

Project details

Principal investigator: Deniz Kirik

Host institution: Lund University (Sweden)

ERC projects: Cell and gene therapy based approaches for treatment of Parkinson's disease: from models to clinics (TREATPD), A novel mechanism to regulate gene expression in the brain (DD-PD)

ERC calls: Starting grant 2009, Proof-of-Concept 2012

ERC funding: €1.5 million for five years + €150 000


Understanding the roots of conflicts

Understanding the roots of conflicts

During the last two decades, many developing countries have experienced violent conflicts with enormous economic and human costs. In the mid-1990s, one in three African countries was involved in a civil war. ERC grantee Prof. Eliana La Ferrara is studying the economics of conflict in these countries.

Using tools from economics, political science and sociology, Prof. La Ferrara aims to identify the causes of conflicts and to assess their consequences. This domain of research includes analysing not only violent conflicts, but also social clashes, cultural divisions or conflicts over the control of natural resources.

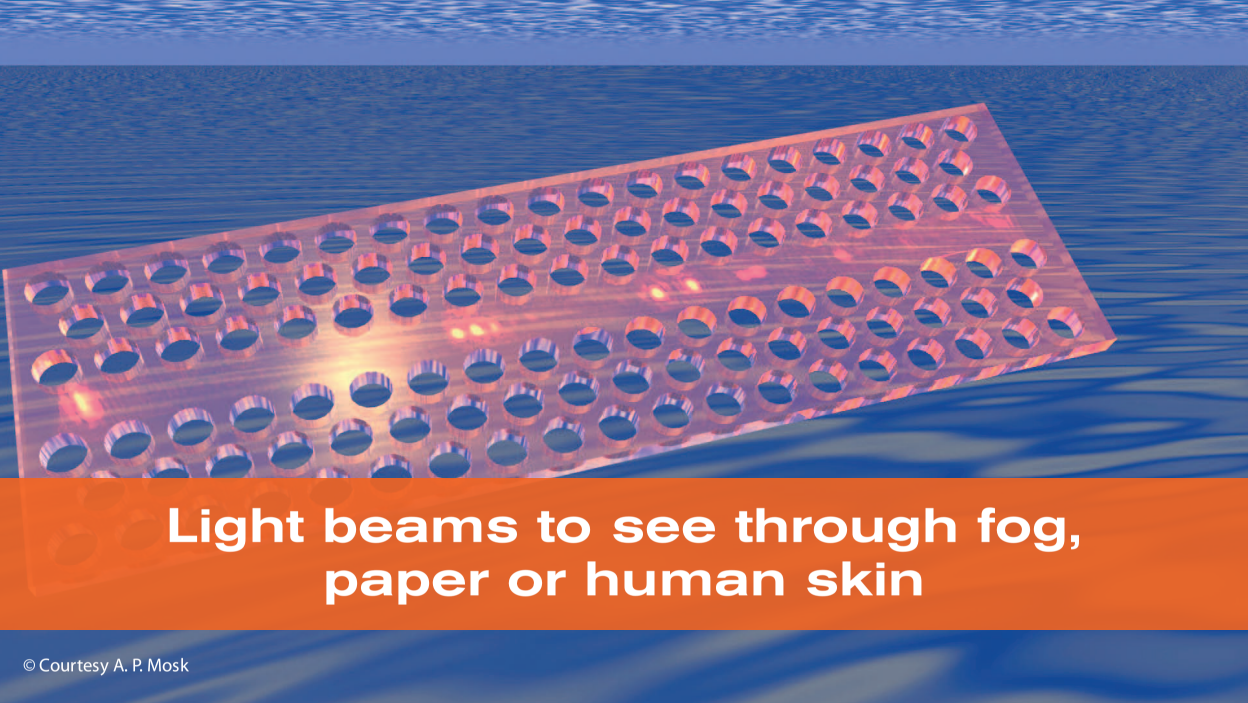
One aspect of her research focuses on the behaviour of multinationals and foreign investors. Although political instability is harmful for private investment, she believes that some businesses, not only the defence industry, may benefit from war. In her project, she has tried to establish the link between conflicts and companies' stock market valuation and to detect the occurrence of arms embargo violations.

At a smaller scale, her team showed that the incidence of conflicts in Sub-Saharan Africa increases in areas particularly affected by climate changes such as severe drought. The team also revealed significant persistence of conflicts over time and large conflict spill-overs across neighbouring areas.

Her research results are promising. One example is the new index she could develop to measure the role of diversity as a potential source of conflict. This index which takes into account the ethno-linguistic origin, educational background, employment status and several other characteristics of individuals belonging to a specific population, could also be used in industrialised countries.

Project details

Principal investigator: Eliana La Ferrara
Host institution: Bocconi University, Milan (Italy)
ERC project: Conflict, Identity and Markets (CIDAM)
ERC call: Starting grant 2007
ERC funding: €430 000 for five years



Light beams to see through fog, paper or human skin

Light beams to see through fog, paper or human skin

Dr Allard Mosk studies the propagation of light through nanophotonic circuits to unlock their potential for future applications: from radars and communication systems to medical imaging. In 2012, his research led to a breakthrough in imaging through opaque material.

A nanophotonic circuit is a miniaturized device for transmitting, receiving and processing complex lightwave signals. Such circuits, which would fit easily within a human hair, are expected to find applications in communication technology, medical imaging equipment and compact radar antennas to guide airplanes through fog. However, unavoidable imperfections make it difficult to control the flow of light through the circuits – which currently hampers the development of their use.

Dr Mosk and his team have set out to build a new generation of nanophotonic circuits where the effects of these imperfections are countered. They use a light beam that modifies the local properties of the circuit where needed, so signals are not affected by the imperfections. Such programmable circuits can even be adapted to compensate when a circuit element breaks down.

The team has already shown that their powerful adaptive methods can guide light through opaque materials such as paper and ground glass. This enabled them to image fluorescent objects through such materials, an achievement that may one day help doctors to "see through" human skin using visible light instead of X-rays.

Project details

Principal investigator: Dr A. P. Mosk

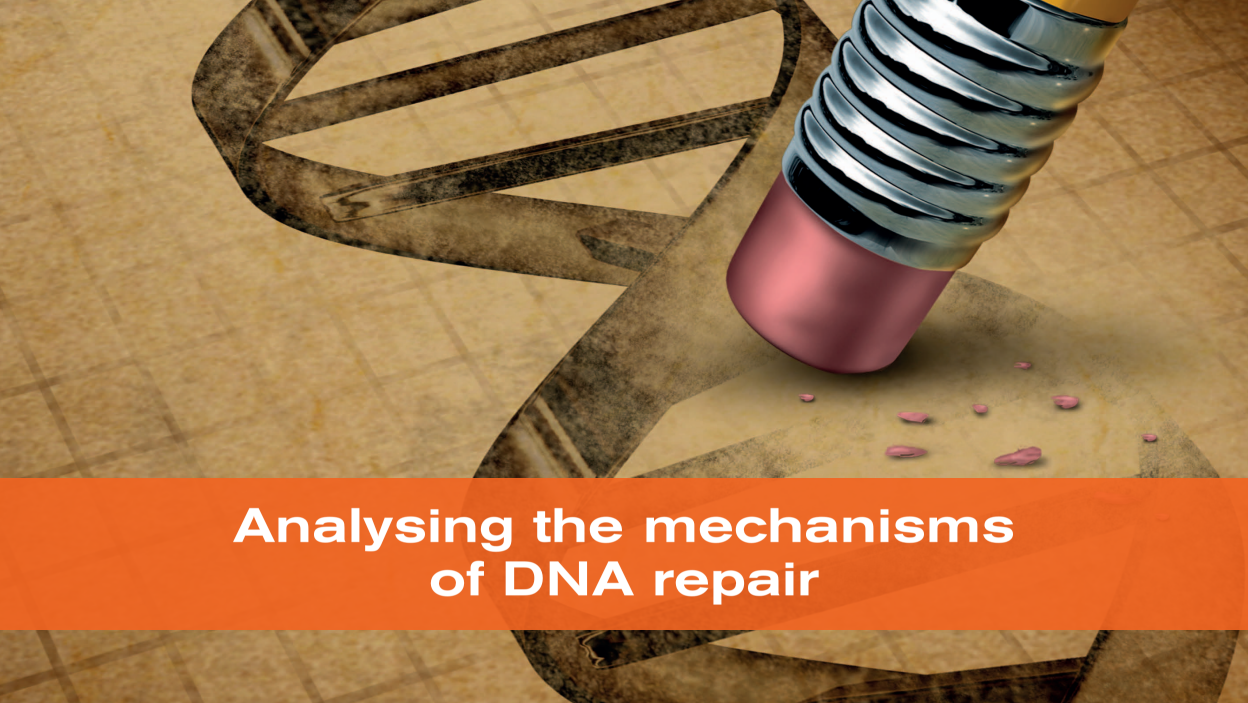
Host institution: University of Twente (The Netherlands)

Partner group: Dr A. de Rossi and Dr S. Combrié, Thales SA (France)

ERC project: Guiding Light through Disorder in Adaptive Photonic Resonator Arrays (PHAROS)

ERC call: Starting grant 2011

ERC funding: €1.5 million for five years



Analysing the mechanisms of DNA repair

Analysing the mechanisms of DNA repair

The recipe for every living organism is stored in its DNA. This chemical compound can suffer damages spontaneously or because of external factors such as ultraviolet light, radiation or heat. ERC grantee Prof. Marcin Nowotny studies the molecular mechanisms that allow its restoration.

When the genetic material of a cell is disturbed, mutations can lead to the formation of tumours. To ensure genetic stability, the chemical damage of the DNA must be corrected and one of the main pathways to achieve this repair is the 'nucleotide excision repair' (NER) process.

When the NER is activated, the cells first locate the damage and verify its presence, then two cuts occur on the sides of the lesion. The resulting DNA fragment is removed, the gap is filled by a DNA specific enzyme and sealed by a ligase (an enzyme that joins DNA fragments).

The unique feature of NER is its ability to correct a wide spectrum of DNA modifications of different sizes and chemical structures. The aim of Prof. Marcin Nowotny's project is to better understand the mechanisms involved in NER.

His research has great relevance for genomics, and indirectly, for human diseases like cancer. Cancer cells are very often unable to repair their DNA. Exploring these processes is very important for developing new drugs or therapies to treat such diseases.

Project details

Principal investigator: Marcin Nowotny

Host institution: International Institute of Molecular and Cell Biology, Warsaw (Poland)

ERC project: Structural studies of Nucleotide Excision Repair complexes (NERCOMP)

ERC call: Starting grant 2011

ERC funding: €1.5 million for five years

Predicting people's response to water disasters

Predicting people's response to water disasters

Human societies are haunted by a sense of vulnerability in the face of major environmental disasters and global climate change. These natural hazards are usually associated with a loss of natural resources, a fear of nature that is increasingly unpredictable and social disruptions as natural habitats are destroyed.

While water is the most vital natural resource, unexpected changes in water levels and water supplies can also be devastating. ERC grantee Prof. Kirsten Hastrup endeavours to examine people's apprehension of disastrous environmental changes. She aims to offer a new approach of the notions of risk and disaster and explore their close relation.

She studies three kinds of water-provoked crises: the melting ice in the Arctic and other glacier areas such as the Peruvian Highlands, the rising seas in the Pacific and along the Indian coast, as well as the drying lands and desertification mainly in West Africa.

Prof. Hastrup's research promises to reveal a new understanding of the ability of societies to deal with water borne environmental crises. In other words, she wishes to provide clues on how people respond to related uncertainties and ensure the survival of their communities. She believes that technologies are useful in that field but the human and social potential is vital for humans to adapt to new environmental realities.

At the crossroads between environmental sciences, geography and anthropology, this interdisciplinary project will show how nature and society are deeply interconnected. There are also hopes that the results might bring some useful insights to the pressing challenge of global warming.

Project details

Principal investigator: Kirsten Hastrup

Host institution: University of Copenhagen (Denmark)

ERC project: Natural environmental disasters and social resilience in anthropological perspective (Waterworlds)

ERC call: Advanced grant 2008

ERC funding: €2.98 million for five years

Erratum

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