



European
Commission

Horizon 2020
European Union funding
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ERC research showcased at

ESOF 2016

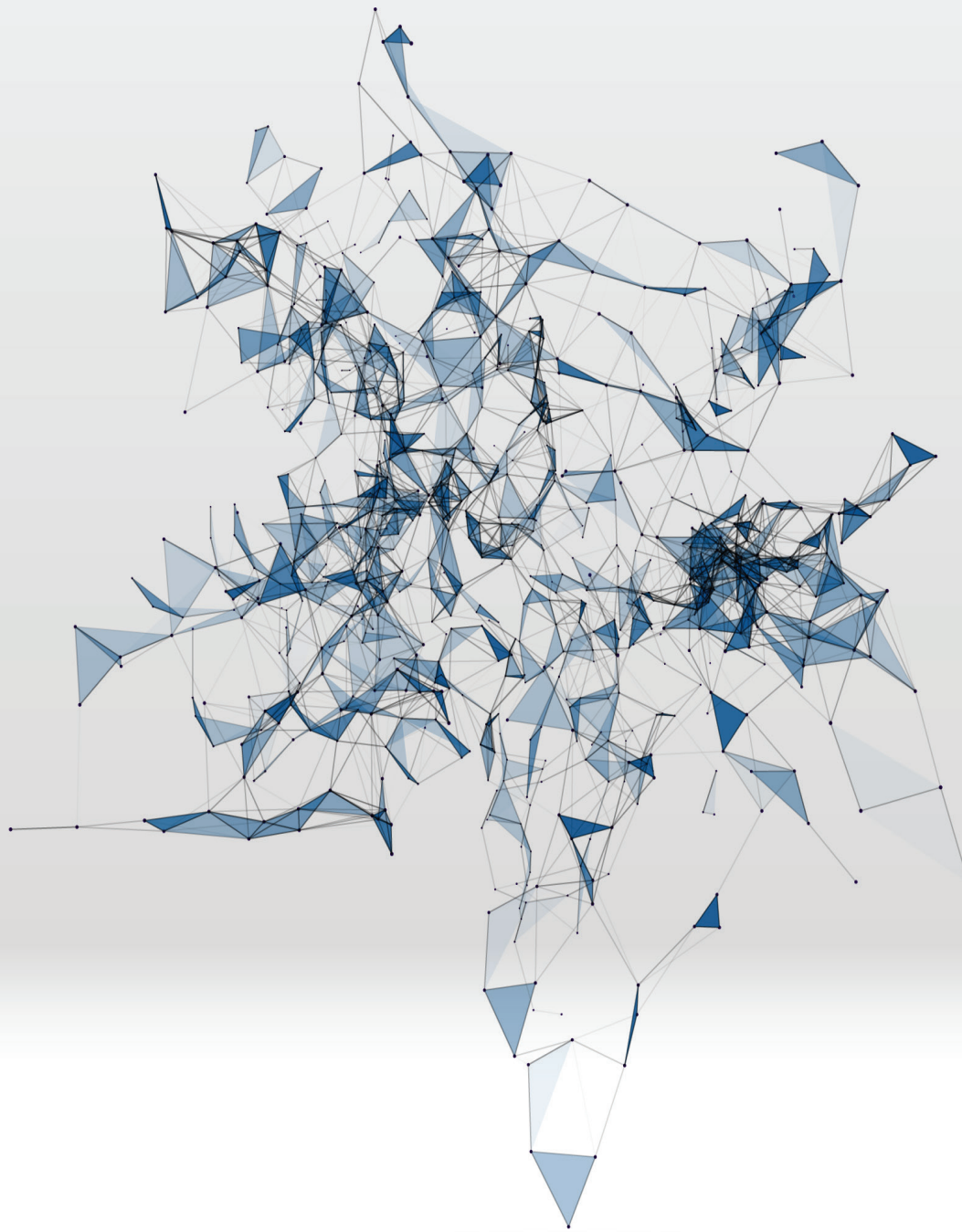
EuroScience Open Forum

Manchester
23-27 July 2016



European Research Council

Established by the European Commission



The European Research Council (ERC)

Set up in 2007 by the European Union, the European Research Council (ERC) is the first pan-European funding body designed to support investigator-driven frontier research and to stimulate scientific excellence across Europe. It aims to support the best and most creative scientists to identify and explore new directions in any field of research (Physical Sciences and Engineering, Life Sciences, Social Sciences and Humanities) with no thematic priorities and the only evaluation criterion being excellence. In the last nine years, the ERC has awarded more than 6 500 long-term grants to individual researchers of any nationality and age who wish to carry out their research projects in Europe.

The ERC has a budget of €13 billion for 2014-2020 under the EU Research and Innovation framework programme Horizon 2020. Since 2014, the ERC is led by Prof. Jean-Pierre Bourguignon.

The ERC at ESOF 2016 - Manchester

The ERC will again take part in the EuroScience Open Forum (ESOF), this time with President Jean-Pierre Bourguignon, Vice President Klaus Bock, Scientific Council members Dame Athene Donald and Thomas Jungwirth, as well as over 40 ERC grantees, of which more than 20 take part in nine ERC sessions. Discover them below.

ESOF, held once every two years, is a showcase for excellent European science. The forum brings together over 4 500 leading thinkers, innovators, policy makers, journalists and educators from more than 90 countries, to discuss current and future breakthroughs in contemporary science.

Sessions

Sunday 24 July

- 9:00 – 15:00 | **Science Communication event for Horizon 2020 grant holders**
Manchester Town Hall
organised by the European Commission's DG Research and Innovation with the participation of ERC grantee Virginie Orgogozo
- 9:15 – 10:30 | **Europe: Opportunities for the world's best researchers - careers workshop**
Manchester Central Convention Complex - Charter 3
with the participation of Martin Penny from ERC Executive Agency
Other speakers: Paul Harris (DG Education and Culture), Claire McNulty (British Council)

Monday 25 July

Manchester Central Convention Complex

- 12:50 – 15:20 | **Women in science: how to reboot the system?**
Exchange Hall
ERC grantees: Conny Aerts, Virginie Orgogozo
Other speakers: ERC President Jean-Pierre Bourguignon, ERC Scientific Council member Dame Athene Donald, ERC Panel Chair Daniel Conley, Angela Strank (BP)
- 14:15 – 15:30 | **Personalised medicine: hope or hype?**
Exchange 6-7
ERC grantees: Gael Yvert, Daniela Thorwarth
Other speaker: Mark Kroese (Public Health Genetics Foundation)
- 15:45 – 17:00 | **Deep Earth dynamics: what is happening underneath our feet?**
Charter 2
ERC grantees: Patrick Cordier, Eleonora Rivalta, Yan Lavallée, Fabrizio Nestola
Other speaker: former ERC Vice-President Sierd Cloetingh

Tuesday 26 July

Manchester Central Convention Complex

- 08:30 – 09:45 **Me and my microbes: health, disease and the human microbiome**
Exchange hall
ERC grantees: Peer Bork, Eran Elinav, Sabina Illi (senior scientist in an ERC-funded project)
- 10:00 – 11:15 **Regression to the pre-antibiotic era: time to panic?**
Charter 2
ERC grantees: Susanne Haussler, Roy Kishony, Johanna Coast, William Mack Durham (senior scientist in an ERC-funded project)
- 10:00 – 11:15 **Can we simulate the human brain?**
Exchange 10
ERC grantees: Gustavo Deco, Marco Zorzi, Simon Thorpe, Axel Cleeremans
- 12:50 – 14:05 **What drives interdisciplinary excellence?**
Charter 1
With the participation of ERC President Jean-Pierre Bourguignon
Other speakers: David Budtz Pedersen (Aalborg University Copenhagen), Thomas Bjørnholm (University of Copenhagen), Luke Georghiou (University of Manchester), Wilhelm Krull (Volkswagen Foundation), Suzanne Fortier (McGill University)
- 14:15 – 15:30 **Will 2D materials save the world?**
Exchange 11
ERC grantees: Kirill Bolotin, Michael De Volder, Xiangqian Jane Jiang
Other speakers: ERC Scientific Council member Tomas Jungwirth, Wolfgang Templ (Nokia Technologies)

Wednesday 27 July

Manchester Central Convention Complex

- 12:00 – 13:00 **Pi with the Prof**
Exhibition hall
With the participation of ERC President Jean-Pierre Bourguignon
Other speakers: James Wilsdon (University of Sheffield), Colette Zytnicki (University of Toulouse-Jean Jaurès)
- 15:45 – 17:00 **Prevention is cheaper than cure**
Exchange 11
ERC grantees: Harry J. de Koning, Olle Melander, Estefania Toledo (senior scientist in an ERC-funded project)

ERC Press conference

Tuesday 26 July 14.15-14.45

Nine years of ERC: New report reveals research impact

Since the ERC's creation in 2007, over 6500 blue sky projects have been supported, but how many led to breakthroughs? Does the ERC bet on risky research in the end? And does investment into curiosity-driven research really pay off for society and the economy? What's the impact on research careers? This and more is addressed in an independent qualitative pilot study that analysed finished ERC-funded projects. ERC President Jean-Pierre Bourguignon and ERC Scientific Council member Dame Athene Donald will discuss the promising findings and the method used. They will also speak about the ERC record annual budget (for 2017).

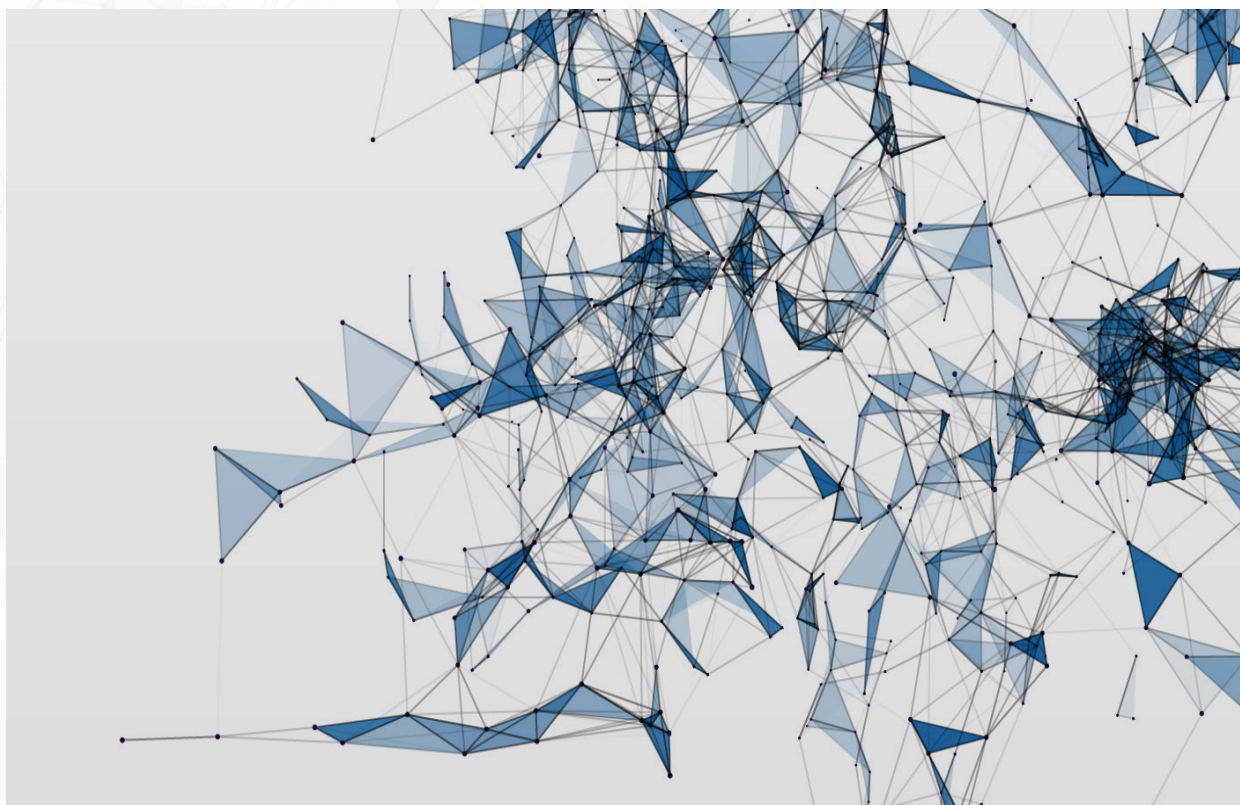
EMBARGOED press materials for the session, including the report, will be available on the ESOF 2016 AlphaGalileo online press room and within the onsite ESOF Press Centre. The embargo will lift at 14:45 BST on 26 July, following the press conference.

ERC Press contact

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erc-press@ec.europa.eu
Mobile +32 (0)498 984397

Exhibition area

More information about the ERC funding opportunities will be available at the European Commission's DG Research and Innovation booth in the exhibition area.



Women in science: how to reboot the system?

Monday 25 July | 12:50 - 15:20 | Exchange Hall

Women have historically been under-represented in the different fields of science. Despite progress in many countries in attracting women to research careers over recent years, the most influential and high-profile positions are still predominantly occupied by men and much still needs to be done to get female scientists into these posts. Why do women continue to be under-represented in high level positions in science, be that management, leadership and/or highly competitive awards? The ERC wants to provide equal opportunities to all scientists in Europe and works actively to reach a gender neutral funding model. The session will focus on obstacles that contribute to women's under-representation in high-level positions and low submissions to competitive calls, before examining concrete actions to tackle them, looking at questions such as: are women simply shying away from competition? Do they reject speaking invitations? Are men keeping committee roles for themselves and their friends? Is maternity leave a blessing or a career curse?

Speakers



Conny Aerts
ERC grantee
University of Leuven, Belgium

Conny Aerts is the Director of the Institute of Astronomy of the University of Leuven and Vice-Dean for Communication and Outreach of the Faculty of Science. She also leads the Chair in Asteroseismology at Radboud University Nijmegen (Netherlands). Prof. Aerts is the only woman to have received the Belgian Francqui prize in Exact Sciences since its creation. She is active in several mentor-mentee programmes worldwide.



Jean-Pierre Bourguignon
ERC President

Jean-Pierre Bourguignon is the President of the ERC since 2014. Until 2013 he was the director of the Institut des Hautes Études Scientifiques (IHES) in Paris. A mathematician by training, he spent his whole career as a fellow of the Centre National de la Recherche Scientifiques. From 1990 to 1992, he was President of the Société Mathématique de France and President of the European Mathematical Society from 1995 to 1998.



Daniel Conley
Lund University, Sweden

Daniel Conley is a Professor in Biogeochemistry. He obtained his PhD at the University of Michigan in 1987. He held a Marie Curie Chair in Lund (2007-2009). His research focuses on the perturbation of nutrient cycles by human activities and the responses of marine ecosystems to changes in human impact and climate. He is active in gender issues and is involved in programs and practices to close the gender gap.



Dame Athene Donald
University of Cambridge, UK

Dame Athene Donald is Professor of Experimental Physics. She is a member of the ERC Scientific Council and also of its Gender Balance Working Group. In Cambridge she was the first Gender Equality Champion of the University (2010- 2014) and was chair of the national Athena Forum (2009-13). In 2009 she became the L'Oreal/UNESCO Laureate for Europe and was appointed Dame Commander of the Order of the British Empire (DBE) in 2010 for services to Physics.



Angela Strank
BP, UK

Angela Strank became the Head of Technology, Downstream in 2015 and member of the Downstream Segment Executive Team. She is responsible for the delivery of the Downstream strategic agenda through the development of sustainable technology advantage, whilst retaining her current responsibilities as BP's Chief Scientist. She has a PhD in Geology from the University of Manchester. In 2010, she was the recipient of the UK's 'First Women Award' for Science & Technology.

Evolution of species: different, but not so different

*Through her work with the fruit fly *Drosophila santomea*, Dr Virginie Orgogozo aims to answer one of the most challenging questions of modern evolutionary biology: how do observable characteristics change between species and yet remain stable in a given species?*

Phenotypes are observable characteristics that represent the result of complicated biological mechanisms translating our genes into something we can actually see. Genes can determine our differences - whether we have brown or blue eyes, whether we are tall or short - and our similarities. Traits that define human beings, or any other species, are pretty stable within the population yet such traits have changed between species during evolution. For example, humans have long hairs on head, pubis and armpits whereas primates have them all over the body. How do we go from one stable phenotype to another new stable phenotype during evolution?

Dr Orgogozo supervises the ROBUST project, which aims to explain the mechanisms and genes that act together to produce a robust phenotype. The stability of biological systems is a central question for evolutionary scientists, and, with an ERC Starting Grant, Dr Orgogozo employs a cutting-edge multi-tool genetic approach to identify exactly what processes underline this phenomenon.

By studying the genes that determine the number of sensory hairs of the male reproductive organ in fruit flies, a number that remains the same within a species but changes between species, Dr Orgogozo and her team aim to reconstruct the evolutionary history of such trait, understanding what led to the stabilisation of this characteristic. This will offer almost a moment-by-moment picture of the trait's evolution, which should answer the question of whether mutations cause new phenotypes that are unstable and then get stabilised because of further mutations or whether specific mutations directly create a new stable phenotype.



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Virginie Orgogozo

ERC grantee

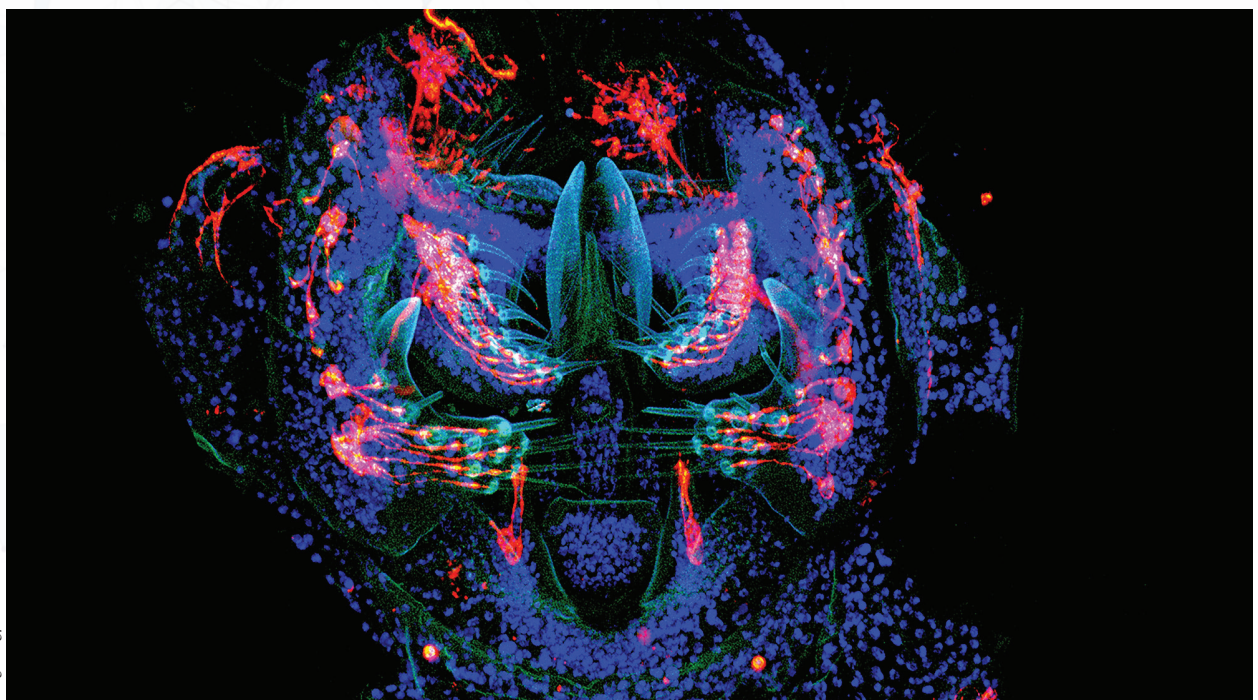
Centre National de la Recherche Scientifique, France

Since 2010, Virginie Orgogozo leads the team "Drosophila Evolution" at the Institut Jacques Monod in Paris. She was awarded the CNRS Bronze Medal in 2014 and was elected "Young Woman Scientist" in France the same year. She studies the mechanisms responsible for the evolution of stable morphological traits in *Drosophila* fruit flies.

Researcher: Virginie Orgogozo, Centre National de la Recherche Scientifique, Paris (France)

ERC Project: Evolution of a new stable phenotype: a genetic, developmental and behavioural analysis (ROBUST)

ERC funding: Starting Grant 2013, €1.4 million for five years



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Dissected genital organs of *Drosophila santomea* imaged with a confocal microscope

Personalised medicine: hope or hype?

Monday 25 July | 14:15 - 15:20 | Exchange 6-7

Personalised medicine has the potential to revolutionise healthcare through more effective prevention, diagnosis and treatment. In an era of an ageing population and escalating healthcare costs, the research community is making great efforts to better characterise genomic complexity and to develop better tools. The session will shed light on how recent scientific advances in genomics, epidemiology and experimental biology can be combined with new technology to lead to more targeted therapies.

We will explore questions such as Can the genomic dissection of traits lead to better treatments?, How can modelling help in the prediction of outcomes?, What lessons can we draw from targeted radiotherapy in cancer?, What are the challenges in the context of public health?, How can patient-centred practise benefit from the advancement of genomics?

Speakers



Mark Kroese
Public Health Genetics Foundation, UK

Mark Kroese is responsible for the leadership, development and delivery of the Foundation's core work programme. He graduated in Medicine from the University of Edinburgh in 1992. As a consultant in Public Health Medicine, he has considerable experience in the NHS. His interests include the evaluation of genetic tests and the commissioning of clinical genetics services.



Gael Yvert
ERC grantee
École normale supérieure de Lyon, France

Gael Yvert is a research director at CNRS. After undergraduate studies in mathematics and physics at Ecole Polytechnique, he obtained his PhD in experimental biology at University Louis Pasteur of Strasbourg with Prof. JL Mandel. He then worked at the Fred Hutchinson Cancer Research Center in Seattle (US) with Leonid Kruglyak and Rachel Brem to establish genetic mapping of gene expression traits. His research group at ENS Lyon discovered fundamental properties of non-DNA chromatin variation, and probabilistic effects of mutations on molecular and cellular regulations.



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Daniela Thorwarth
ERC grantee
University of Tübingen, Germany

Daniela Thorwarth is Professor of Biomedical Physics at the University of Tübingen. She studied in Germany and France and obtained her PhD in biomedical physics from the University of Tübingen. She currently heads a research group in biomedical physics, focusing on different aspects of biologically individualized radiotherapy.

A personalised cure for head-and-neck cancer patients

Thousands of new cases of head-and-neck cancer - which includes cancer of the larynx, throat, mouth, nose and salivary glands - are diagnosed every year in Europe. Despite improvements in diagnostic and therapeutic tools, these malignant tumours still show high resistance to current treatments. Dr Daniela Thorwarth is working on tailored therapies for individual patients.

Nowadays, radiotherapy alone or in combination with surgery and chemotherapy is the main treatment for head-and-neck cancer. This approach has proven to be successful only in half of the cases. Radiation resistance and other clinical factors, such as the stage and size of the tumour, account for this high rate of failure. In order to increase the chances of cure for this specific type of tumours, scientists are investigating alternative methods.

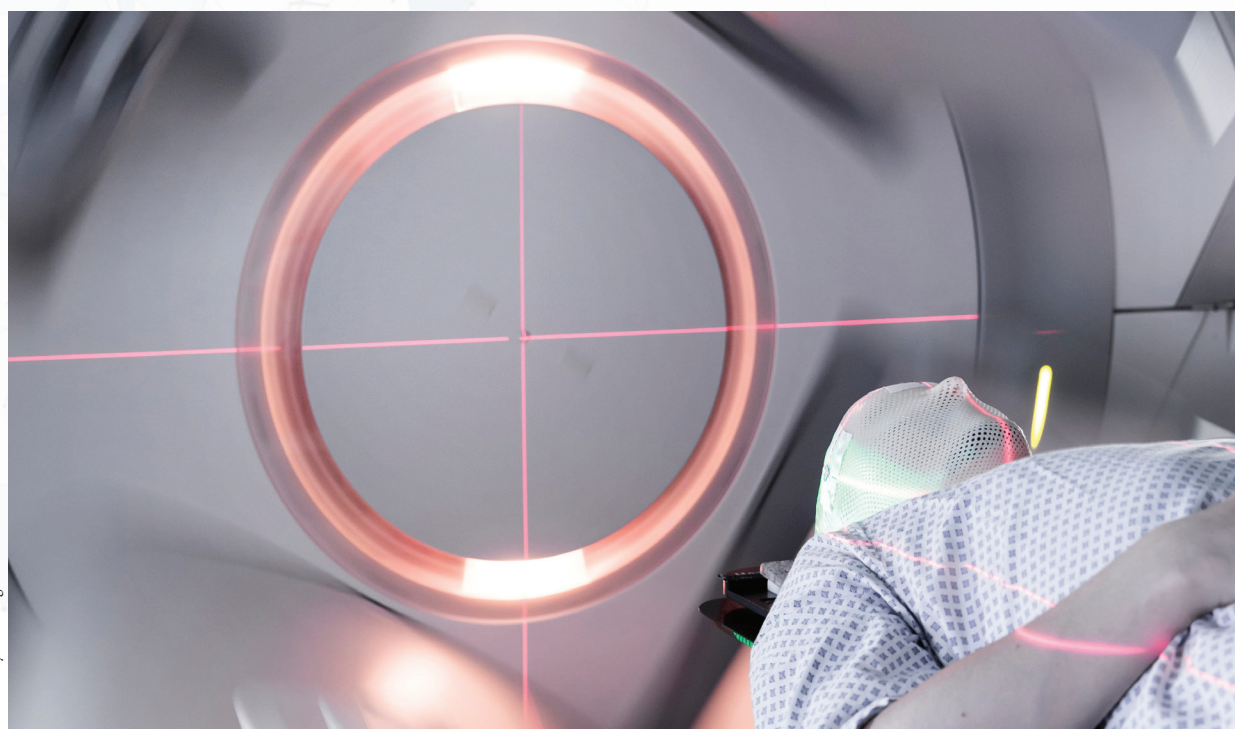
In this ERC-funded project, Dr Thorwarth proposes to integrate, for the first time, different biological markers with functional imaging parameters to design a model for individualised high precision radiotherapy. Tumour biology and radiation resistance are extremely complex factors varying from one patient to another, and, according to Dr Thorwarth, a multi-dimensional model is needed to map the composite nature of the underlying pathophysiology of the tumour as accurately as possible. A clinician could subsequently define an individualised radiotherapy dose prescription. The idea is that each patient should receive a different dose of radiation, on the basis of the available biological and imaging data.

To successfully address all different aspects of this issue, Dr Thorwarth is supported by an interdisciplinary team of researchers from the fields of radiobiology, medical physics, molecular imaging and biostatistics. During the last two years of the project, the team will carry out a clinical study to validate the preclinical model in patients. If successful, this ambitious research could introduce a novel treatment concept and eventually provide a unique base for personalized cancer treatment.



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- Researcher:** Daniela Thorwarth, University of Tübingen (Germany)
- ERC Project:** Biologically individualized, model-based radiotherapy on the basis of multi-parametric molecular tumour profiling (bio-iRT)
- ERC funding:** Starting Grant 2013, € 1.4 million for five years



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Modern clinical linear accelerator allowing for high precision radiotherapy treatments

Deep Earth dynamics: what is happening underneath our feet?

Monday 25 July | 15:45 - 17:00 | Charter 2

The study of the Earth's deep interior is one of the most active frontiers of Earth sciences. Using a multiscale approach, the session will highlight how the Earth is constantly shifting under our feet, controlled by the slow plastic deformation of the mantle. It will look into the spectacular world of volcanoes and the remarkable, unpredictable and alarming occurrence of eruptions. Diamonds and their inclusions are the deepest materials originating from the Earth's interior and reaching its surface. They can shed light on questions such as the role of carbon recycled from the surface and whether the Earth's mantle holds a secret water store.

Speakers



Sierd Cloetingh
Utrecht University, The Netherlands

Prof. Cloetingh is Head of the Tectonics Group at Utrecht University and President of the Academia Europaea. A former Vice-President of the ERC, he was distinguished in 2004 as Chevalier de la Légion d'Honneur for his contributions to science and European scientific cooperation in research and education.



Patrick Cordier
ERC grantee
Lille University of Science and Technology, France

Patrick Cordier is a professor in the Physics Department at the University of Lille in France. His research focuses on plastic deformation of minerals. In recent years he devoted special attention to high-pressure mantle phases. He is Chief Editor of the European Journal of Mineralogy and Associate Editor of the American Mineralogist. Prof. Cordier is a fellow the Mineralogical Society of America (MSA). In 2016, he was awarded the Dana Medal of the MSA.



Yan Lavallée
ERC grantee
University of Liverpool, UK

A Canadian national, Yan Lavallée studied in Canada and the USA before obtaining his PhD in Mineralogy in Germany. He is currently Chair of Volcanology and Magmatic Processes at the University of Liverpool that he joined in 2012. Dr Lavallée's research aims to describe the mechanics of magma and rocks and their impact on volcanic processes, earthquakes and geothermal exploration. His results could help refine models simulating and monitoring volcanic eruption and contribute to developing the new models of the Earth.



Fabrizio Nestola
ERC grantee
University of Padua, Italy

Fabrizio Nestola is Full Professor of Mineralogy. He graduated in Geology at the University of Turin and obtained his PhD in Mineralogy from the University of Modena. He was awarded the Medal for Research Excellence by the European Mineralogical Union in 2010. He studies natural diamonds and their mineral inclusions to shed more light on the composition of the Earth.



Eleonora Rivalta
ERC grantee
GFZ Potsdam, Germany

Eleonora Rivalta leads a research group at the Helmholtz Centre Potsdam of the GFZ German Research Centre for Geosciences. She specialises in physics of earthquakes and volcanoes. Before joining the Helmholtz Centre she was a researcher at the Universities of Hamburg and Bologna and lectured at the University of Leeds.

Minerals reveal the flow patterns inside the Earth

The Earth is made of layers, just like a big onion, composed of different materials. However, the compounds forming these layers are not static, flowing from one stratum to another, following patterns still not entirely understood. Prof. Patrick Cordier tries to model the real conditions minerals are subjected to beneath the Earth's crust. His aim is to understand the forces driving tectonic plates so we can better comprehend phenomena like earthquakes and volcanic eruptions.

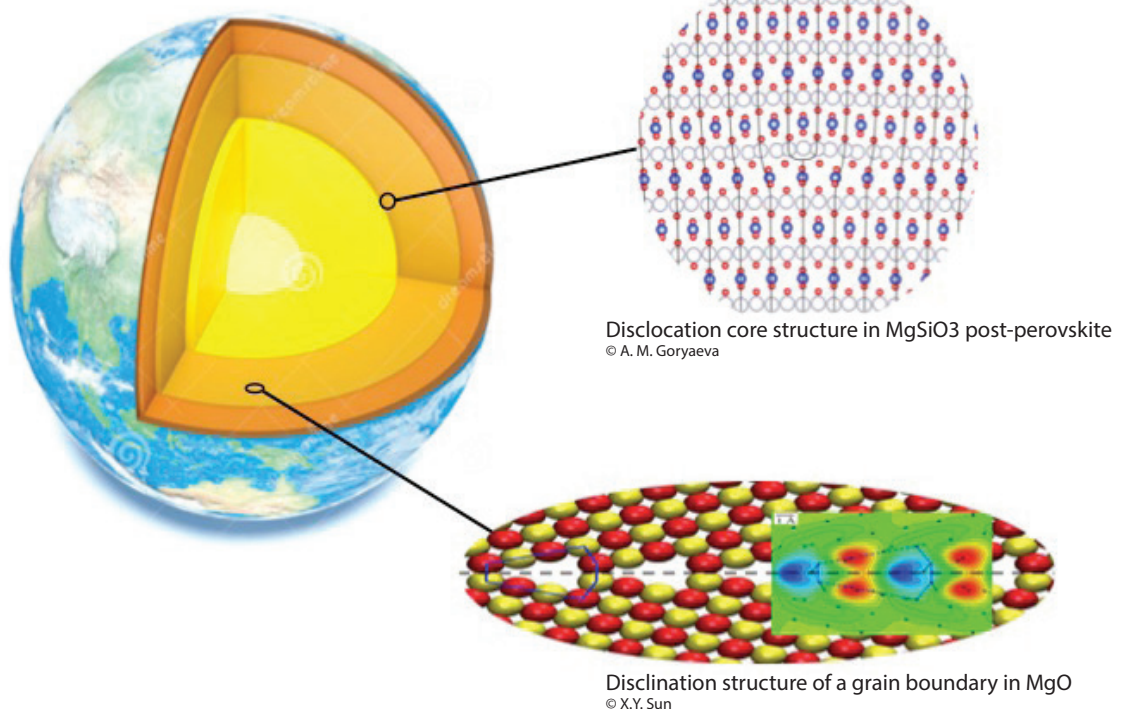
Understanding the inside of our planet is not an easy task: a whole discipline, rheology, is dedicated to the study of the flows inside the Earth, which stir the solid rocks of the mantle to dissipate the Earth's internal heat. Funded by the ERC, Prof. Cordier and his team apply a novel approach to materials science, called multiscale modelling, to shed new light on these mechanisms. This technique consists in accurately describing the forces which operate at the atomic scale under the high pressures of the deep Earth. Prof. Cordier's team wants to understand how small defects in the rocks have an impact on the flow of materials.

Prof. Cordier is modelling minerals like wadsleyite, ringwoodite, silicate perovskite and post-perovskite, which are found in their stable state at great depths only, to find the viscosity profile of the lower mantle (around 670 to 2 900 km below the Earth's surface) and its differences with the transition zone to the upper mantle (410-670 km deep). Additionally, he aims to understand how rocks flow at the core-mantle boundary – the very last layer before the Earth's inner metallic core, 2 900 km under our feet.

Started in 2012, the RHEOMAN project has generated promising advances: it has proposed a new mechanism to explain how deformations occur on olivine-based rocks, the most abundant materials in the Earth's upper mantle. Prof. Cordier's team is looking into how these defects, named disclinations, affect the mobility of materials in all the phases of the mantle. Their observations could lead to a whole new understanding of the rheology of planetary interiors.



Researcher: Patrick Cordier, Lille University of Science and Technology (France)
ERC Project: Multiscale modelling of the rheology of mantle minerals (RheoMan)
ERC funding: Advanced Grant 2011, € 2.17 million for six years



Me and my microbes: health, disease and the human microbiome

Tuesday 26 July | 08:30 - 09:45 | Exchange Hall

The human body is host to around 1.5 kg of microbes, with the number of bacterial cells outnumbering human cells. Only recently has the significance of this human microbiome in health and disease been realised. Traditionally, research on interactions between humans and microbes has focused on infectious pathogens as opposed to our 'normal' microbial flora. Mounting evidence shows that the composition of the human microbiome affects physiological processes and is associated with medical problems, such as obesity, allergies, autoimmune disorders and cancer. It is also known that it can be perturbed by the use of antimicrobial drugs or diet. Understanding the human microbiome and how it functions from the molecular to the physiological level is already enabling personalised, microbiome-based therapies to be designed against certain illnesses.

Speakers



Peer Bork
ERC grantee

European Molecular Biology Laboratory, Germany

Peer Bork is senior group leader and joint head of the Structural and Computational Biology unit at EMBL in Heidelberg. In addition, he holds an appointment at the Max-Delbrück-Center for Molecular Medicine in Berlin. Prof. Bork works in various areas of computational and systems biology, with over 500 publications in international journals including more than 60 articles in Nature, Science or Cell.



Eran Elinav
ERC grantee

Weizmann Institute of Science, Israel

Eran Elinav heads a research group at the Department of Immunology, Weizmann Institute of Science. He holds an MD from the Hebrew University of Jerusalem Hadassah Medical Center, a PhD from the Weizmann Institute of Science and a Post-Doc from Yale University. A highly recognised scientist, his work focuses on understanding host-microbe interactions for personalised therapies.



Sabina Illi
Senior scientist in an ERC project
University of Munich, Germany

Sabina Illi is a Statistician and Epidemiologist. With a PhD in asthma and allergies in childhood, she is involved in design, implementation and especially data analysis of pan-European, interdisciplinary projects. She studies the microbial factors for the development of asthma and allergic diseases. She is a team member of ERC grantee Prof. Erika von Mutius, whom she is replacing in this session.

Playing dirty against allergies and asthma

Parents may be afraid of their children playing in fields and sheds, but research shows that those who grew up in farms, where this is a common occurrence, are less likely to suffer from allergies and asthma. Prof. Erika von Mutius leads a team of researchers, including Sabina Illi, that uses this knowledge to investigate how we could treat such conditions more effectively.

City dwellers will be interested to know that their children are five times more likely to develop asthma or allergies, respiratory conditions that will affect around half of the European population before 2025 and remain, so far, without a cure. The ERC-funded project HERA focuses on what determines this type of protection.

By using the latest innovative high throughput DNA sequencing techniques, Prof. von Mutius and her team have highlighted the role of microbes in reducing the occurrence of these conditions. With the ERC grant, the researchers collected samples from children with different backgrounds and disease profiles to understand the composition of fungi and bacteria they were exposed to and analyse the substances these microorganisms produce. In addition, Prof. von Mutius was able to study the genetic susceptibility of specific individuals. This allowed her team to investigate the link between environmental factors, such as microbial exposure from a farm, and genetic factors in determining the occurrence of these conditions.

By describing, for the first time, the world of microbes that inhabit our body, in higher numbers than even our human cells, Prof. von Mutius discovered the importance of coming in contact with a diverse range of the right microorganisms. She even highlighted the protective role of certain bacterial and fungal chemicals, such as endotoxins and extracellular polysaccharides. The discoveries made during this study could help reduce the fear many allergic or asthmatic patients feel when spring approaches.



Researcher: Erika von Mutius, University of Munich (Germany)

ERC Project: Host-environment interactions in the protection from asthma and allergies (HERA)

ERC funding: Advanced Grant 2009, € 2.1 million for five years



Baby in a cow shed

Regression to the pre-antibiotic era: time to panic?

Tuesday 26 July | 10:00 - 11:15 | Charter 2

The resistance of micro-organisms to antibiotics is one of the most important threats facing public health. It may render many of the therapeutic drug breakthroughs of the last century powerless against infectious diseases, from common bacterial infections to more complex conditions associated with HIV and TB. Given the rapid development of resistant microbes and new strains of viruses it is crucial to find new interventions to manage these threats. The session will look into the underlying causes of resistance from an evolutionary and ecological perspective as well as at the genomic level, drawing lessons from population and social evolution studies of microbes.

Speakers



Joanna Coast
ERC grantee
University of Bristol, UK

Prof. Coast is a health economist who gained her PhD in 2000 on the topic of priority setting in health care. Her research interest is the use of economics in health care decision making and her particular focus is use of the capability approach in health economics. She has also worked for many years on the economics of antimicrobial resistance, applying environmental economic theory to resistance issues and incorporating resistance costs into analytical work.



William Mack Durham
Senior scientist in an ERC project
Oxford University, UK

William Mack Durham is Departmental Research Lecturer in Zoology at Oxford University. He received his PhD in Environmental Engineering from MIT in 2012. Using a combination of microfluidic experiments and mathematical modelling, his research aims to resolve how the microscale physical environment shapes the ecology and evolution of microbial life. He is a senior researcher in the ERC-funded project INTERACTINGMICROBES.



Susanne Häußler
ERC grantee
Helmholtz Centre for Infection Research, Germany

Susanne Häußler studied human medicine in Lübeck and Hannover, Germany, and specialised as a medical microbiologist. Since 2012 she has been heading the Molecular Bacteriology Department of the Helmholtz Centre for Infection Research (HZI) and the Institute of Molecular Bacteriology at Twincore Centre for Clinical and Experimental Infection Research.



Roy Kishony
ERC grantee
Technion – Israel Institute of Technology, Israel

Roy Kishony is the Marilyn and Henry Taub Professor of Life Sciences at the Departments of Biology and Computer Science at Technion-Israel Institute of Technology and a Visiting Faculty member at Harvard Medical School where he previously served as a Professor of Systems Biology. Prof. Kishony received his B.A. in Physics and Mathematics from the Hebrew University and his PhD in Physics from Tel-Aviv University in 1999.

New weapons in the fight against antibiotic resistance

Antibiotics are amongst the most crucial discoveries in modern medicine. However, the surge in microbial resistance to these, now common, drugs is a challenge that medical researchers work hard to tackle. Prof. Susanne Häußler believes early diagnostic tools could shift the paradigm of how we battle this problem.

Antimicrobial resistance is the phenomenon of the decade, increasing medical expenses, morbidity and costing the European Union alone 25 000 deaths per year. The rush to discover new antibiotics has slowed dramatically, with trials for new compounds becoming rarer and less effective. This is an arms race between microbes and human being, and Prof. Häußler believes that the solution may come from shifting the war from new drugs to better diagnostics.

In her project RESISTOME, Prof. Häußler uses a multi-disciplinary approach that combines work on clinical bacterial isolates with state-of-the-art biomolecular research, next generation-sequencing and array technology, to uncover all genetic determinants of antibiotic resistance. Her work aims at characterising the differences between resistant and non-resistant bacteria, to improve diagnostic instruments.

By working specifically on the common bacterium *Pseudomonas aeruginosa*, associated with many antibiotic resistant infections, for example in hospital patients and in cystic fibrosis sufferers, Prof. Häußler was able to observe very distinct gene expression profiles in resistant bacterial strains. This work will be the basis for the development of techniques for the early detection of resistance. This should allow treatments to become more personalised, avoiding the indiscriminate use of ineffective antibiotics.

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Researcher: Susanne Häußler, Helmholtz Centre for Infection Research (Germany)

ERC Project: Towards an individualised therapy and prevention of multi-drug resistant disease (RESISTOME)

ERC funding: Starting Grant 2010, € 1.5 million € for five years



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Can we simulate the human brain?

Tuesday 26 July | 10:00 - 11:15 | Exchange 10

In his 1950 seminal paper “Computing Machinery and Intelligence”, Alan Turing considered the question “Can machines think?” which he later rephrased to “What happens when a machine takes the part of a person?” and “Can the machine imitate or mimic the behaviour of a person?”. Current progress in deep networks offers the possibility to produce systems capable of achieving human levels of performance in tasks previously thought to be beyond the capabilities of machines – such as object and scene vision or deep learning. Companies in sectors such as the World Wide Web are massively investing in these and many jobs currently done by humans could be replaced by machines.

Where do we now stand, 65 years later: are machines able to mimic human cognitive capacities, such as processing information and decision-making, can they perform unsupervised learning and the retrieval of old memories? The session will examine these questions and provide insights to other objections expressed by Turing, like artificial consciousness.

Speakers



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Axel Cleeremans
ERC grantee

Université Libre de Bruxelles, Belgium

Axel Cleeremans is Professor of cognitive psychology at the Université Libre de Bruxelles, where he directs the Centre for Research in Cognition and Neurosciences. He is a research director at the Fonds de la Recherche Scientifique. His research centres on the differences between information processing with and without consciousness, particularly in the domain of learning and memory. In 2015, he received the Ernest-John Solvay Prize for Human Sciences.



Gustavo Deco
ERC grantee

Pompeu Fabra University, Spain

Gustavo Deco is Research Professor at the Catalan Institution for Research and Advanced Studies, and a Full Professor at the Universitat Pompeu Fabra. He heads the Computational Neuroscience Group and directs the Centre for Brain and Cognition at UPF. Recognised as a world leader in computational neuroscience, he has led pioneering work in dynamical modelling of human brain activity.



Simon Thorpe
ERC grantee

Brain and Cognition Research Centre, France

Simon Thorpe is the director of the Brain and Cognition Research Centre of CNRS and Paul Sabatier University in Toulouse. His current interests are centred on understanding the processing speed achieved by the visual system. He teaches neurosciences, cognition and neuropsychology. In 1999, he setup a company, SpikeNet Technology, that developed image processing software based on the principles of visual processing in humans.



Marco Zorzi
ERC grantee

University of Padua, Italy

Marco Zorzi is a Full Professor of Cognitive Psychology and Artificial Intelligence at the University of Padua. He leads an interdisciplinary research group, the Computational Cognitive Neuroscience Lab, that explores the computational bases of cognitive functions such as numeracy, spatial recognition, visuospatial processing, reading and writing.

Consciousness: is this what separates us from machines?

While computers can calculate or recognise faces, they are not aware of themselves (yet?). Consciousness is in the essence of human beings; its nature, however, appears to lack a reliable explanation. Prof. Axel Cleeremans is developing a new theory, the Radical Plasticity Thesis, maintaining that consciousness is a long-lasting property of our brain rather than just a static feature. In order to test it, he is taking a multidisciplinary approach including psychological studies and advanced brain imaging.

Our consciousness, or the movie of our own lives, is probably the main feature that makes us different from machines. The Radical Plasticity Thesis, a new theory for understanding our mind, states that consciousness is something that the brain learns to do rather than being a static property of our brain.

We are continuously trying to predict the consequences of our actions in order to minimize surprise. For this purpose, our brain is always reinventing its theory about itself, thus developing internal models shaped by its experience interacting with the world, with other agents, and, crucially, with itself, Prof. Cleeremans affirms. According to him, we are constantly learning, consciously and unconsciously, to improve that story. If the Radical Plasticity Thesis is demonstrated, our own ability, as well as our brain's ability to learn to better re-define our knowledge would be what make us conscious.

For Prof. Cleeremans, consciousness depends first on the quality of the representations we continuously create as we interact with the world and with other people: through learning and attention, strong, stable and distinctive representations emerge and can then become redescribed in such a way as to become conscious representations. Being conscious, in this sense, always involves knowing that we know: the brain is looking at itself, in the service of better control of action.

To prove his theory, Prof. Cleeremans' team is conducting a multidisciplinary study which mainly consists of behavioural experimentation, examining how people react to different types of events and experiences. These experiments will be complemented by computer simulations and brain imaging, using innovative techniques such as virtual reality, to map human consciousness.



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Researcher: Axel Cleeremans, Université Libre de Bruxelles (Belgium)

ERC Project: The Radical Plasticity Thesis: How we learn to be conscious (RADICAL)

ERC funding: Advanced Grant 2013, € 2.3 million for five years



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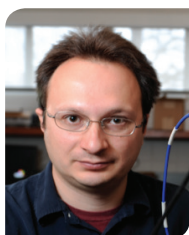
EEG cap

Will 2D materials save the world?

Tuesday 26 July | 14:15 - 15:30 | Exchange 11

Graphene and other two-dimensional materials have been hailed as potentially transformative in a wealth of applications, due to their unusual electronic and mechanical properties. Experience shows that some of the initial promises after such a discovery may be exaggerated, or have applications in entirely different areas than initially foreseen. The session will explore where we currently stand in frontier research into 2D materials and their applications. Are we able to make long-term predictions for fundamental discoveries? How can we manage expectations in a productive way to avoid a 'boom and bust' cycle? How can we narrow the gap between 'science push' and 'technology pull'?

Speakers



Kirill Bolotin

ERC grantee

Freie Universitat Berlin, Germany

Kirill Bolotin studied at the Moscow Institute of Physics and Technology and Cornell University. During his postdoc at Columbia University, he discovered the approaches to fabricate ultrahigh mobility graphene and found the Fractional Quantum Hall effect in graphene. As a faculty member at Vanderbilt University, he explored excitons in two-dimensional semiconductors, strain engineering of flexural phonons in graphene, and interfaces between two-dimensional materials and liquids.



©Michael De Volder

Michael De Volder

ERC grantee

University of Cambridge, UK

Michael De Volder is the principal investigator of the NanoManufacturing Group at the Department of Engineering of the University of Cambridge. He carried out his PhD research in Belgium and Japan. He then joined the Massachusetts Institute of Technology, the University of Michigan, and Harvard University as a postdoc researcher. He is a Laureate of the Belgian Royal Academy, and vice president of a nanotech start-up company.



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Xiangqian Jane Jiang

ERC grantee

University of Huddersfield, UK

Xiangqian Jane Jiang is the Director of the UK EPSRC National Centre for Innovative Manufacturing in Advanced Metrology. Her research mainly involves the development of mathematical models and algorithms for precision metrology and the development of new optical interferometry techniques for future embedded measurement sensors and instrumentation.



Thomas Jungwirth

Academy of Sciences of Czech Republic, Czech Republic

Prof. Jungwirth is Head of the Department of Spintronics and Nanoelectronics, Institute of Physics, Academy of Sciences of the Czech Republic (ASCR) and Professor at the School of Physics and Astronomy University of Nottingham (UK). His main research fields are condensed matter physics, materials science, and electronic properties of nanostructures. He is a member of the ERC Scientific Council.



Wolfgang Tempel

Bell Labs, Nokia, Germany

Wolfgang Tempel received his PhD in Physics from the University of Stuttgart in 1990 and joined Alcatel-SEL in 1992. There he led the microelectronic technology group of the Alcatel Research Centre which became Bell Labs Germany after a merger between Alcatel and Lucent and then worked in the optical networking department. Since 2013 he is leading a department directed to research on wireless transceivers for 4G and 5G radio infrastructure which became part of Nokia under the merger of Alcatel-Lucent with Nokia in early 2016.

Carbon nanotubes: from manufacturing to commercialisation

Stronger than steel, conducting electricity better than copper and heat better than diamonds: these are some of the promises held by carbon nanomaterials. Although not as well-known as graphene, carbon nanotubes (CNTs) show these properties, offering also a great advantage: they can be produced in larger quantities. Prof. Michael De Volder now explores new ways to manufacture CNTs-based devices with optimal features, potentially opening the way to their broader commercial use.

While wonder material graphene was first isolated in Manchester in 2004, carbon nanotubes (CNTs) have been actively researched since the 1990s. These cylinders of one or more layers of graphene are already used in nanotechnology, electronics, optics and material science. But many engineering applications are still not possible. The difficulty comes when building larger structures such as wires, as CNTs lose their assets to a great extent.

Prof. De Volder aims to develop new technologies to assemble CNTs into organised, hierarchical superstructures that would retain their exceptional properties. His team brings together engineers, chemists, physicists and material scientists to look at the process at different scales: from material synthesis and surface chemistry at the nanoscale, to the form and structure of the material at the microscale, up to the larger scale: how to integrate CNTs 'building blocks' into 3D all-carbon devices.

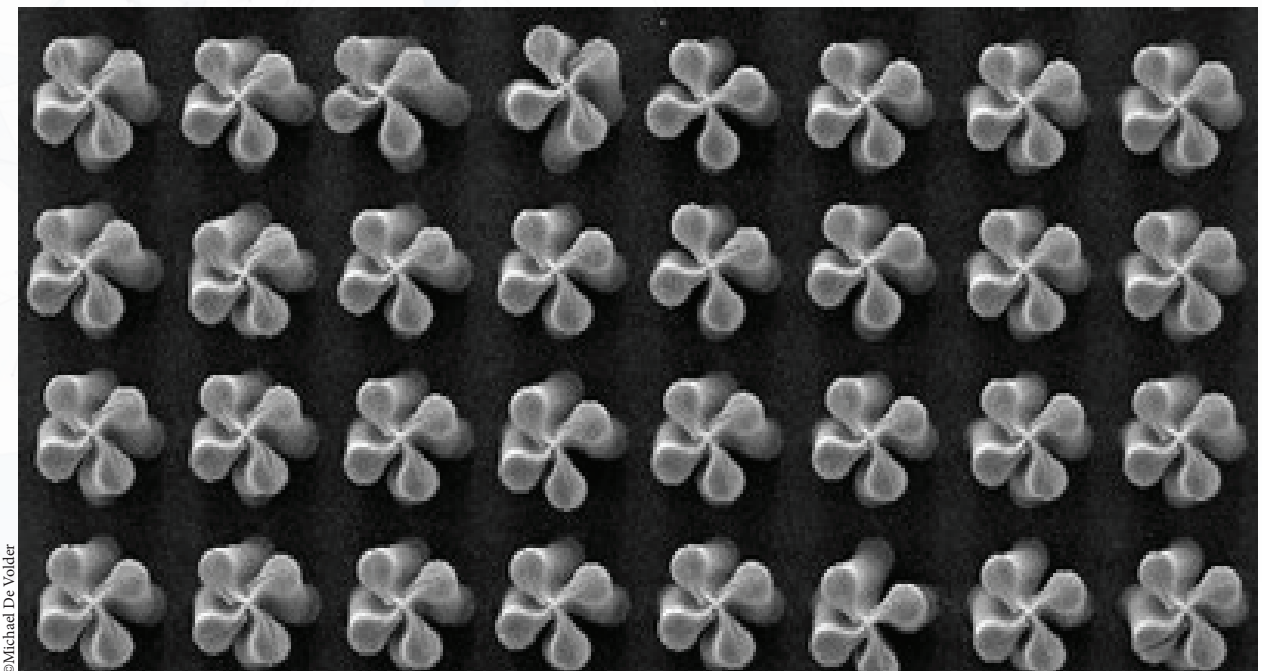
The team has already managed to produce microstructured surfaces* with tuneable characteristics such as stiffness or strength. To do so, they provoke the CNTs bending as they grow, managing to form controllable complex shapes in 3D. These compound surfaces could also replicate the water-repellent or adhesive features found in the skins of certain plants or animals for example.

Developed in the HIENA project, the technique is already used to make biomimetic smart surfaces but also chemical microsensors and batteries. Prof. De Volder's team also works on CNTs application for extremely accurate water purifiers and more efficient energy storage systems for electric cars.



©Michael De Volder

Researcher: Michael De Volder, University of Cambridge (UK)
ERC Project: Hierarchical Carbon Nanomaterials (HIENA)
ERC funding: Starting Grant 2013, € 1.5 million for five years



©Michael De Volder

Strain engineered carbon nanotube clover field

* M De Volder, S Park, S Tawfick, AJ Hart, Strain-engineered manufacturing of freeform carbon nanotube microstructures, Nature Comm 5, 2014.

Prevention is cheaper than cure

Wednesday 27 July | 15:45 - 17:00 | Exchange 11

Rising healthcare costs mean there is a need to adopt more efficient and cost effective health care strategies across Europe. Prevention is one of the most efficient ways to reduce costs, yet despite the increasing attention given to this topic, further insight is needed in order to understand and successfully apply preventive measures. The session will explore the complex issue of preventive medicine and its potential for better understanding, predicting and preventing cardiovascular diseases, obesity and diabetes, as well as assess the predictive value of genomic profiling in the prevention of complex diseases. It will present the evidence behind innovative interventions, methods, and approaches to improving public health, including the effects of lifestyle and Mediterranean diet.

Speakers



Harry de Koning
ERC grantee

Erasmus University Medical Center, The Netherlands

Henricus (Harry) J. de Koning is Professor of Public Health and Screening Evaluation in the Department of Public Health of the Erasmus Medical Center in Rotterdam, where he has worked since 1987. Professor de Koning has been a Member of the Medical Advisory Board of the Royal Netherlands Academy of Arts and Sciences since 2011.



Olle Melander
ERC grantee

Lund University, Sweden

Olle Melander is Professor of Internal Medicine at Lund University and a consultant at the Department of Internal Medicine of Skåne University Hospital in Malmö, Sweden. His research focuses on improvement of cardiovascular risk stratification and identification of potentially lifestyle and drug-modifiable mechanisms behind diabetes and cardiovascular diseases.



Estefania Toledo
Senior scientist in an ERC project
University of Navarra, Spain

Estefania Toledo is an associate professor in the Department of Preventive Medicine and Public Health at the University of Navarra in Spain. She specialises in nutritional and cardiovascular epidemiology, and holds senior positions on several research projects, including PREDIMED-PLUS funded with an ERC Advanced Grant.

Can we prevent cardiovascular diseases in healthy individuals?

Cardiovascular diseases (CVD) are a major cause of morbidity and mortality in Europe. Prevention relies on measuring traditional risk factors such as age, gender, hypertension, diabetes, hypercholesterolemia and smoking. However, many individuals, apparently at low-risk, still develop CVD. Improving predictions beyond the traditional risk factors is the challenge undertaken by Prof. Olle Melander.

According to recent investigations, some genetic variations are strongly linked to CVD but the mechanisms leading to the development of such conditions are largely unknown. This ERC-funded project focuses on a cohort of 60 000 unique individuals to identify these mechanisms and has already shown some promising results.

Prof. Melander and his team, drawing on previous findings, have discovered 58 gene variants linked to coronary artery disease. Thanks to this genetic information they could identify "hidden high-risk individuals" who would remain undetected considering only the traditional risk factors known today. These individuals could preventatively be treated with statins, usually used to lower cholesterol. The team has also found that a high level of neurotensin in the plasma is a strong predictor of CVD and diabetes. Neurotensin can be reduced with certain diets and drugs, decreasing the risk. In addition, they have provided evidence that higher water consumption reduces the level of vasopressin, which is associated with cardiometabolic diseases. Finally, they found that high concentrations of the amino acids tyrosine, phenylalanine and isoleucine are also a risk factor for CVD. The levels of these amino acids are high in individuals who consume large quantities of red meat and low in those with a high milk protein intake.

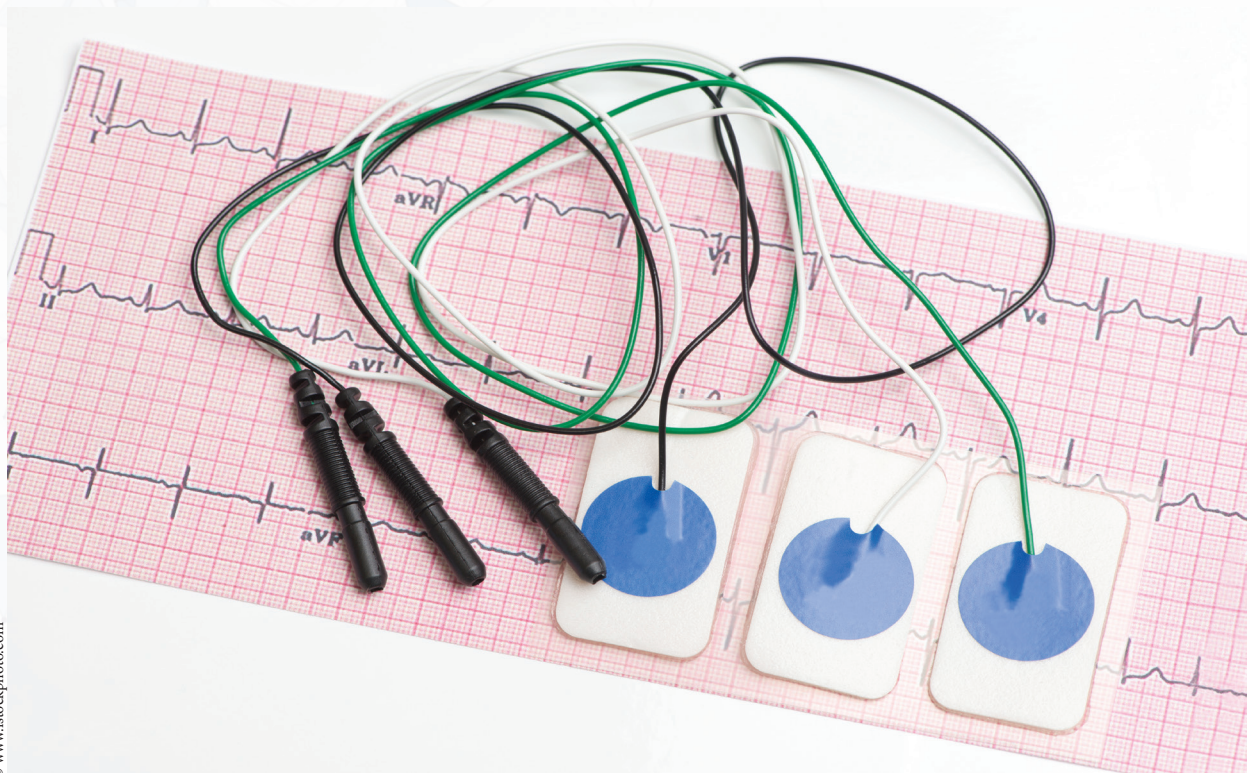
Prof. Melander's ultimate goal is to provide novel targets for pharmacological prevention and suggest focused lifestyle interventions. His work could have a clear impact on clinical medicine and prevention of CVD.



Researcher: Olle Melander, Lund University (Sweden)

ERC Project: Integration of genomics and cardiometabolic plasma biomarkers for improved prediction and primary prevention of cardiovascular disease (CARDIOPREVENT)

ERC funding: Starting Grant 2011, € 1.5 million for five years





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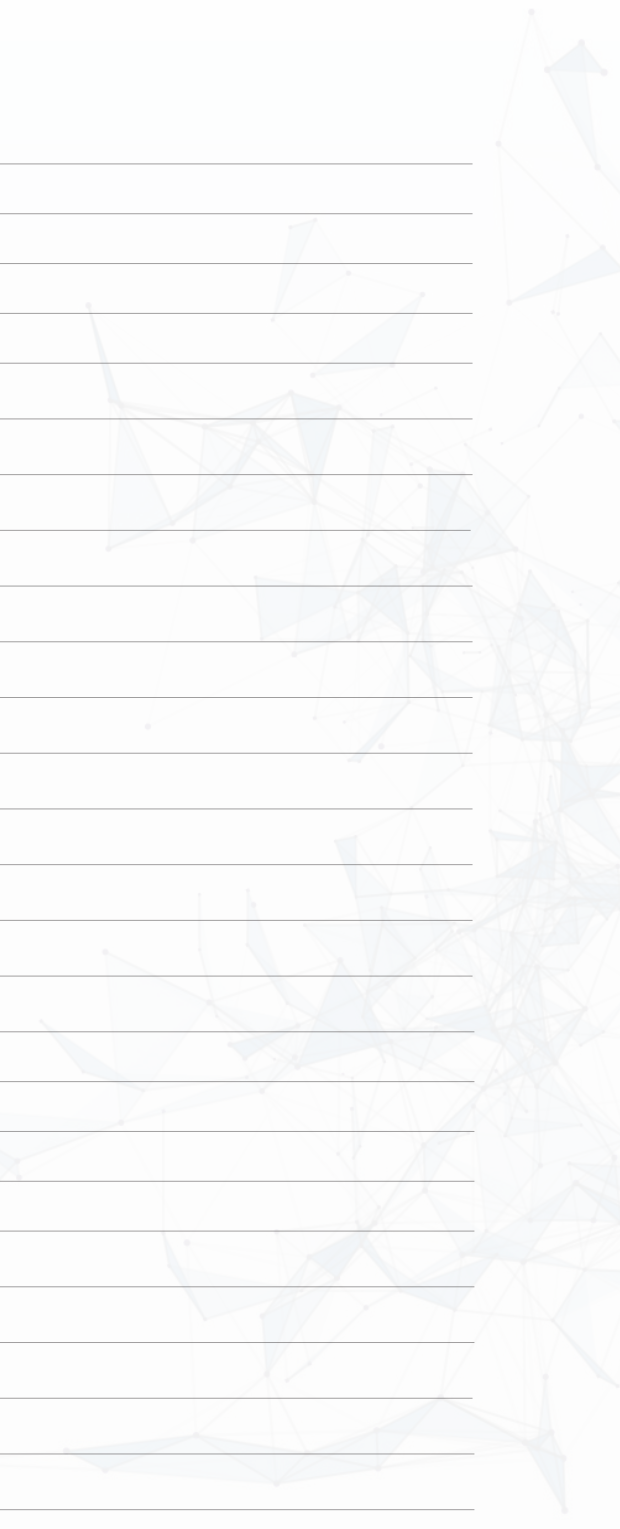
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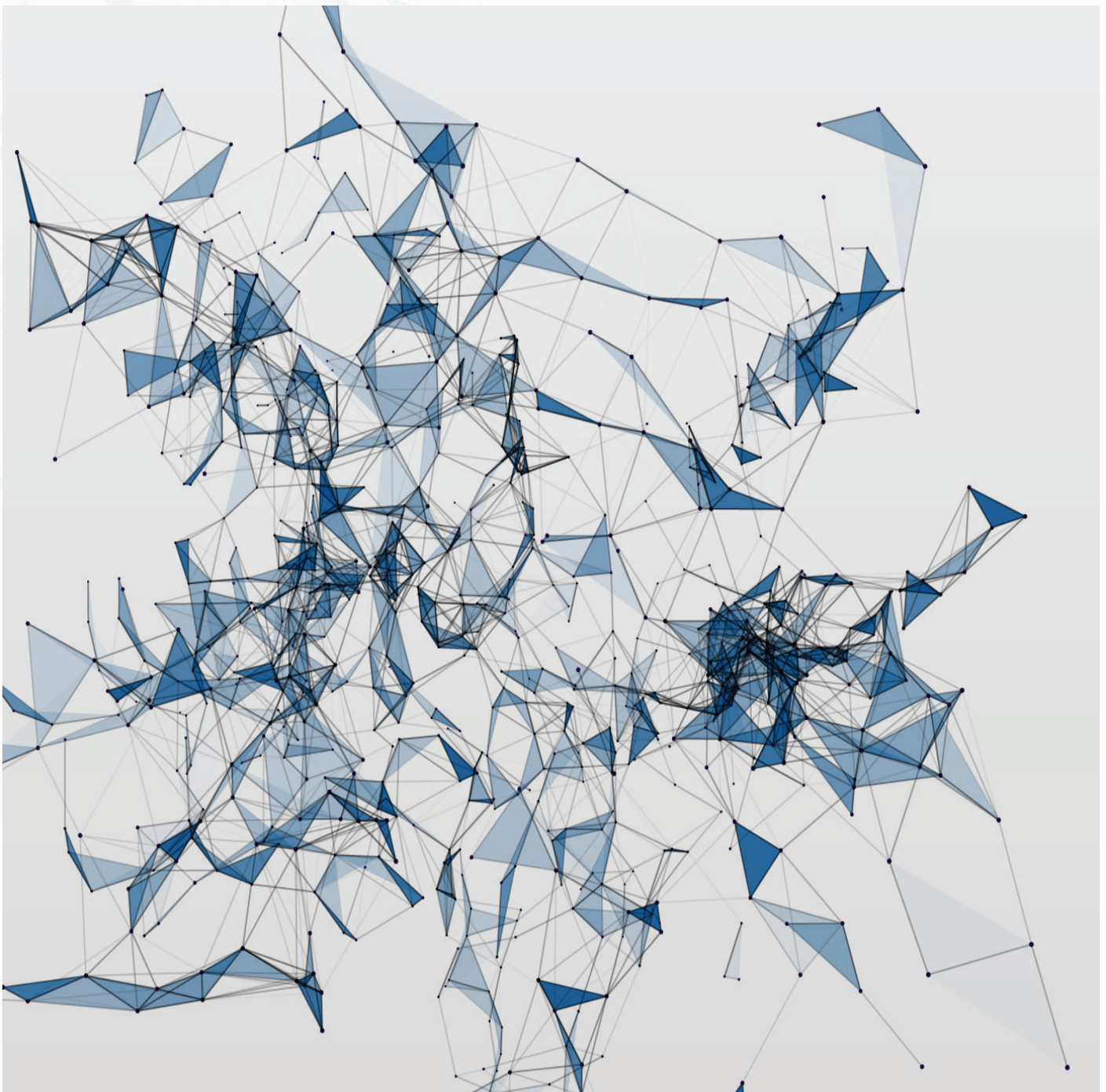


Visit ERC=Science² at ESOF 2016!

25 - 27 July 2016

Visit the ERC=Science² pop-up science tent from Monday 25 to Wednesday 27 July at ESOF 2016, where ERC research projects related to the improvement of urban spaces and food will be presented!

Launched in February 2016, ERC=Science² is a communication campaign using popular themes such as 'Cities', 'Longevity' or 'Robotics' to highlight the scientific research funded by the European Research Council and the potential impact it can have on citizens. The campaign is led by an international consortium of 8 partners and has received funding under the European Union's Horizon 2020 Research and Innovation programme following a call for proposals.



“The European Research Council has, in a short time, achieved world-class status as a funding body for excellent curiosity-driven frontier research. With its special emphasis on allowing top young talent to thrive, the ERC Scientific Council is committed to keeping to this course. The ERC will continue to help make Europe a power house for science and a place where innovation is fuelled by a new generation.”

Jean-Pierre Bourguignon
ERC President and Chair of its Scientific Council



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