

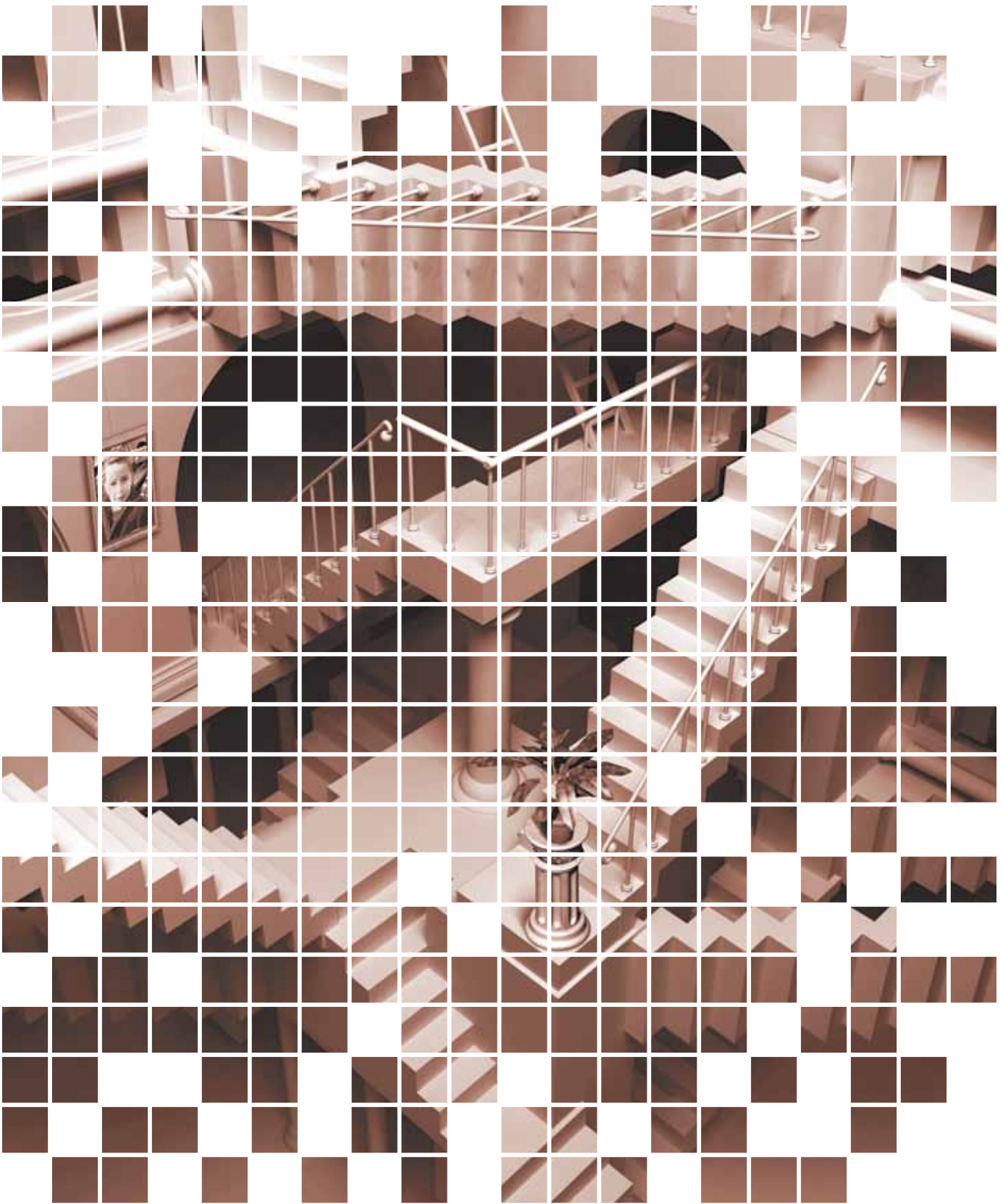
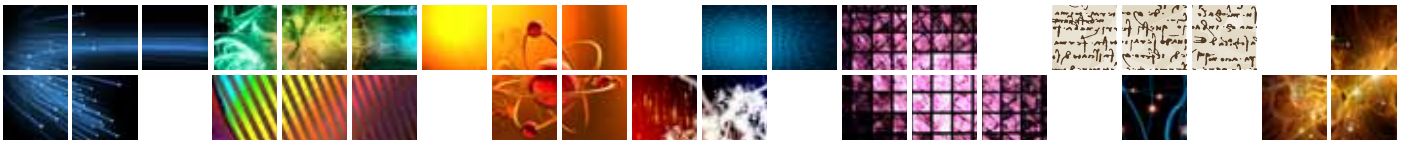
Supporting  
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at the frontiers of  
knowledge

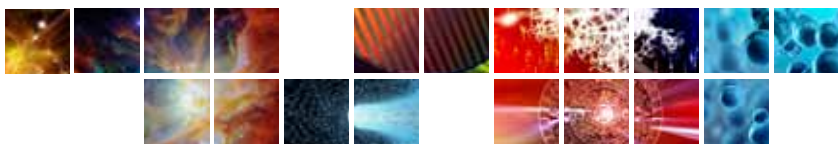
ERC Grantees  
at ESOF 2012

BRINGING GREAT IDEAS TO LIFE  
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**European Research Council**  
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## Antonio ACÍN

Host institution: **Institute of Photonic Sciences, Barcelona, Spain**



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### The future of quantum information processing

This project aims to understand how the resources which govern quantum information theory can be used for information processing, focusing on a network in which the participants are using different quantum systems. The research team have a particular interest in entanglement distribution and its impact on quantum networks. Prof Acín is working on the operation of complex networks, as their applications are wide – from fields as diverse as information technology and epidemiology. This line of enquiry has been extended to the possibilities of quantum computation, and its impact upon information processing capacities, using a network in which quantum memories interact with quantum states of light. The concept of a random network at a quantum scale has been central to the development of the research, as it exhibits markedly different behaviour from conventional networks. The PERCENT project is in the process of developing quantum information processing devices. In cryptographic terms the randomly generated key is much more secure because it is private, certifiable and acts independently of the device that produces it. Prof Acín received a Proof of Concept grant from the ERC in 2011 to explore the commercial possibilities of a compact quantum device capable of generated random numbers at high speed. The ultimate aim of the project is to design new applications which can solve problems classic information theory cannot tackle.

**ERC project:** Percolating Entanglement and Quantum Information Resources through Quantum Networks (PERCENT)

**ERC call:** Starting Grant 2007 & PoC 2011

**ERC funding:** € 699,600 for five years + up to € 150,000 for PoC 2011

*At ESOF 2012, Antonio Acín is participating in the Scientific Session on 'Quantum computing: the final frontier?' on Saturday 14 July from 1.15pm to 2.45pm (Wicklow Hall 2).*

*Antonio Acín is available for media interviews during ESOF on 14 July.*

#### Links:

[http://www.icfo.es/index.php?section=people0&lang=english&op=show\\_card&people\\_id=26&nick=Antonio%20Ac%EDn](http://www.icfo.es/index.php?section=people0&lang=english&op=show_card&people_id=26&nick=Antonio%20Ac%EDn)

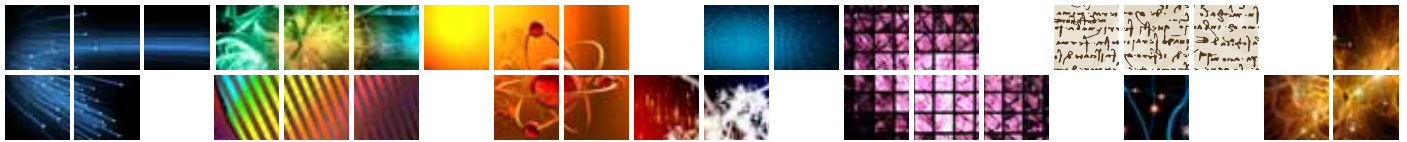
[http://www.icfo.es/index.php?section=news1&lang=english&op=show\\_announcement&announcement\\_id=1603](http://www.icfo.es/index.php?section=news1&lang=english&op=show_announcement&announcement_id=1603)

MAMBO-PERCENT



<http://erc.europa.eu>





## Valentina BOSETTI

Host institution: **Fondazione Eni Enrico Mattei (FEEM, Milan), Italy**

# ICARUS

## Bridging energy technology and economics to combat climate change

With a rapidly growing world population, humankind's energy demands are ever increasing. Innovation and breakthroughs in the energy sector are of utmost importance to reduce greenhouse emissions to a stable and safe concentration in the earth's atmosphere as emphasized by Europe's climate change targets for 2020 and beyond. However, there is a lack of empirical evidence on how Research and Development (R&D) investments can bring about those technologies that, while meeting energy demand, can mitigate the pressure on the environment and reinforce Europe's competitiveness.

Dr. Valentina Bosetti and her team members aim to fill this gap by producing an assessment of investment choices in existing energy technologies and research and development of innovative technologies, while taking into account the spill over effects and the uncertainties that inevitably affect the successfulness of R&D programmes.

The team provides new insights on how Europe can stimulate the necessary innovations to radically transform the way citizens produce and consume energy. To do so, they also extensively interviewed talented European experts in energy technologies, both individually and through focus groups, to elicit their visions on technological breakthrough potentials, uncertainties in RD&D investment programmes, successes in innovation, and absorption of new technologies by the markets. Based on this collected data, the team is building an unprecedented database of indicators on R&D investments. This new database should help to identify the major innovative firms and public institutions in the different energy-efficient technologies.

Results will be used to improve Integrated Assessment models that are at the basis of the forthcoming IPCC Assessment Report (Working Group 3) and are used to simulate optimal climate policy responses.

**ERC project:** Innovation for Climate Change Mitigation: a Study of Energy R&D, its Uncertain Effectiveness and Spillovers (ICARUS)

**ERC call:** Starting Grant 2009

**ERC funding:** € 920.000 for three years

*At ESOF 2012, Valentina Bosetti is participating in the Scientific Session on 'Adaptation or extinction? Responses to radical climate changes' on Sunday 15 July 2012 from 10.45am to 12.15pm (Wicklow Hall 2)  
Valentina Bosetti is available for media interviews during ESOF.*

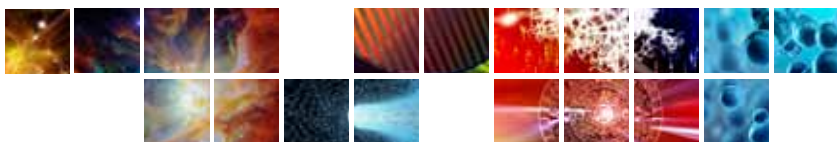
### Links:

<http://www.icarus-project.org/>

<http://www.feem.it/getpage.aspx?id=252&sez=People>

TED talk (in Italian): [http://www.youtube.com/watch?v=ALyeJY\\_ZQS0](http://www.youtube.com/watch?v=ALyeJY_ZQS0)





© Siwan Davies

## Siwan DAVIES

Host institution: **Swansea University, United Kingdom**

### Tephra constraints on rapid climatic events

Sudden climate shifts in the past are thought to have involved a strong interplay between ocean circulation and atmospheric dynamics, yet the mechanisms that drove these processes are poorly understood. This project investigates how tephra isochrones are vital to our understanding of rapid changes in climate conditions. Microscopic traces of tephra or volcanic ash, preserved in marine and ice, allow scientists to establish a much more precise timescale of past volcanic events. As each tephra has a distinct geochemical fingerprint, this allows us to use these as tie-lines or isochrones between the ice and marine records. These isochrones will boost our understanding of the cause-and-effect relationship between large-scale changes in both atmospheric and sea temperatures. Recent work has uncovered the fact that these invisible layers of volcanic ash have a wide geographical reach, just as we saw with the 2010 Icelandic ash cloud distribution. Examination of these records has also revealed several previously undocumented eruptions. The TRACE team, led by Prof Davies, works on marine samples from the North Atlantic and ice-cores from Greenland. This project ultimately aims to synchronize the North Atlantic tephra record with the Greenland ice-core records. This will result in a more complete, systematically documented picture of the dynamics of the interplay between the atmosphere and the ocean during the course of the last glacial period.

TRACE

**ERC project:** Tephra constraints on Rapid Climate Events (TRACE)

**ERC call:** Starting Grant 2010

**ERC funding:** € 1.47 million for five years

*At ESOF 2012, Siwan Davies is participating in the Scientific Session on 'Adaptation or extinction? Responses to radical climate changes' on Sunday 15 July from 10.45am to 12.15pm (Liffey Hall 2). Siwan Davies is available for media interviews on 15 July.*

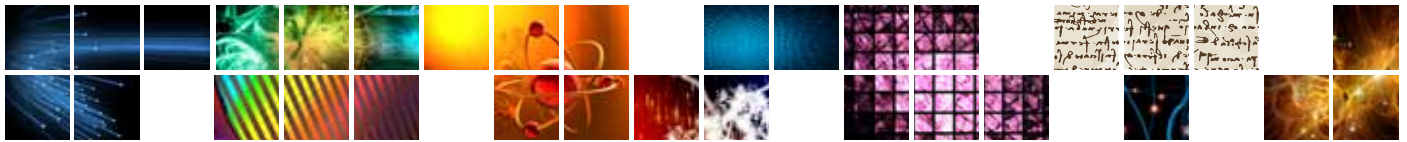
#### Links:

<http://www.swan.ac.uk/staff/academic/enviromentsociety/geography/daviessiwan/>

<http://www.swansea.ac.uk/science/news/147milliongrantforpioneeringclimatechangeresearch.php>



<http://erc.europa.eu>



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## Virpi LUMMAA

Host institution: **University of Sheffield, United Kingdom**

# HUMANLIFESPAN

## Maximising evolutionary success

Ageing, senescence and death are universal processes and fundamental concepts which preoccupy the mind of every human at some stage. This project aims to assess the ecological and demographic factors affecting human lifespan by using unique demographic data on three generations of individuals who pre-date healthcare and modern contraceptives in Finland. All animals have finite resources which must be split between reproduction and self-maintenance. Humans are exceptional: women are virtually unique amongst animals in experiencing both the menopause and a prolonged post-reproductive lifespan. How humans achieve this has not been considered, but is essential to our understanding of the basis of reproductive effort, senescence and lifespan in humans and animals more widely. Maternal care is not solely responsible for the fact that women live longer. Instead, a balance between the costs of reproducing and the gains of becoming a grandmother may help to explain women's longevity.

Preliminary results suggest that in a pre-demographic transition society long lifespan after menopause in women was associated with more grandchildren born and raised to adulthood, whereas natural selection only favoured intermediate lifespan lengths in men, leading to a potential sexual conflict over "optimum" longevity. Dr. Lummaa's research has not only investigated how much overall opportunity there is for selection to operate on different key traits, such as reproductive timing and longevity, in such societies but also what the genetic basis for selection is, and thus how these traits are likely to evolve in the future. Many environmental factors have dramatic consequences for reproductive patterns and survival. Dr Lummaa investigates at which ages we are most sensitive to such effects, and how deprivation in early life affects our ability to cope in a range of later conditions. Overall, this research will have important and far-reaching ramifications for predicting demographic structures in human populations and understanding the ecological and genetic foundations of reproductive patterns and senescence.

**ERC project:** Mothers, grandmothers and the evolution of prolonged lifespan in humans (HUMANLIFESPAN)

**ERC call:** Starting Grant 2007

**ERC funding:** € 1.1 million for five years

*At ESOF 2012, Virpi Lummaa is participating in the Scientific Session on 'Ageing: from genome to sex' on Sunday 15 July from 8.00am to 9.30am (Liffey Hall 2).*

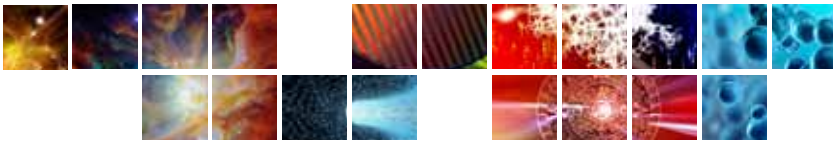
*Virpi Lummaa is available for media interviews during ESOF.*

### Links:

<http://www.huli.group.shef.ac.uk/virpi-personal.html>

<http://www.shef.ac.uk/news/nr/darwin-evolution-natural-selection-lummaa-courtio1-1.174534>





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## Alexei MAKLAKOV

Host institution: **University of Uppsala, Sweden**

### The evolutionary “battle of the sexes”

There is continuing debate about the causes and consequences of the difference in life expectancy between males and females. For example, in human societies, females usually outlive males and the gap is widening. Moreover, in most species sexes differ not only in how long they live, but also in how they react when their life span is artificially prolonged. This research project, led by Dr Alexei Maklakov is about the evolution of lifespan and ageing, which has been a fundamental yet unresolved issue in biology since the beginning of the 20th century, with a special emphasis on sexual dimorphism in ageing. To understand the sex differences in reproductive, demographic and physiological senescence, Dr Alexei Maklakov is developing a series of experimental evolution studies in invertebrate model organisms. In his talk he will address a major puzzle in biology, which has direct implications for biomedical sciences: the intricate relationship between sex, death and the genome. Shared genetic machinery can severely constrain the sexes from reaching their optimal life-history leading to intragenomic sexual conflict, which can inhibit successful therapies aimed at prolonging healthy lifespan. Using experimental evolution in a popular insect model, he will show that genetic conflict does indeed prevent the sexes from attaining lifespans that maximize their fitness. By combining techniques from different disciplines his research team aims to improve our understanding of the biological basis of sex differences.

**ERC project:** Ageing Differently: Understanding Sex Differences in Reproductive, Demographic and Functional Senescence (AGINGSEXDIFF)

**ERC call:** Starting Grant 2010

**ERC funding:** € 1.4 million for five years

*At ESOF 2012, Alexei Maklakov is participating in the Scientific Session on ‘Ageing: from genome to sex’ on Sunday 15 July 2012 from 8.00am to 9.30am (Liffey Hall 2).*

*Alexei Maklakov is available for media interviews during ESOF.*

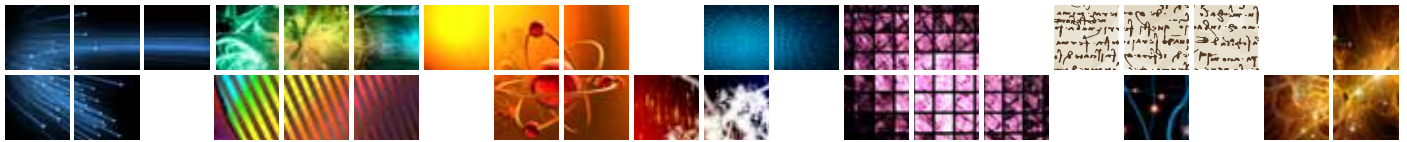
#### Links:

[http://www.ebc.uu.se/Research/IEG/zooeko/People/Alexei\\_Maklakov/?languageId=1](http://www.ebc.uu.se/Research/IEG/zooeko/People/Alexei_Maklakov/?languageId=1)

AGINGSEXDIFF



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## Jeremy O'BRIEN

Host institution: **University of Bristol, United Kingdom**

# IQP-QNET

## Boosting the security of mobile communications

This ERC project is about quantum information science, a discipline which has emerged in the last 20 years as a pioneering field of interest, with substantial investments being made in North America, Asia and Europe. Dr Jeremy O'Brien's idea is to explore the innate properties of quantum mechanics to enhance the way technologies work in information, processing and communication. The research is about generating, manipulating and measuring single photons (i.e. single particles of light) as well as the quantum systems that emit these photons. Low noise, high-speed transmission and ease of manipulation make single photons model systems for exploring fundamental scientific questions and developing future technologies.

However, further progress is limited by the inefficient, large-scale and low performance of photon sources, detectors and circuits. The researcher thus believes that the implementation of quantum technologies outside laboratories requires miniaturisation. One promising approach is therefore to miniaturise the circuits and embed various photon sources on-chip; this is referred as integrated quantum photonics (IQP). Technologies such as silicon and lithium niobate are being tested for the purposes of miniaturisation and polarisation with photon sources. His hope is that the "quantum revolution" provides communication networks with the ultimate security, high precision measurements and lithography (which enables the fabrication of devices with features much smaller than the wavelength of light), and processors with unprecedented power.

With his additional Proof of Concept (PoC) grant, Jeremy O'Brien will try to market his innovations in mobile communications security. He aims to bring to ordinary consumers, at low cost, the same high levels of security that big corporations and governments have in place to prevent cyber-attacks.

**ERC project:** Integrated quantum photonics (IQP) and Quantum secure communication for mobile networks (QNET)

**ERC call:** Starting Grant 2009 & PoC 2011

**ERC funding:** € 1.5 million for five years + up to € 150.000 for PoC 2011

*At ESOF 2012, Jeremy O'Brien is participating in the Scientific Session on 'Quantum computing: the final frontier?' on Saturday 14 July 2012 from 1.15pm to 2.45pm (Wicklow meeting room 2).*

*Jeremy O'Brien is available for media interviews during ESOF.*

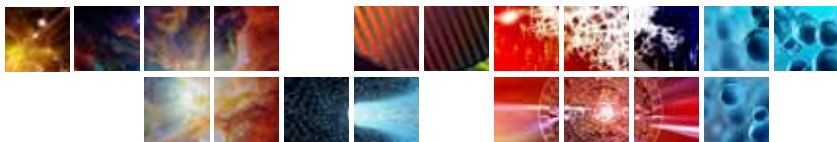
### Links:

<http://www.bristol.ac.uk/physics/people/jeremy-l-obrien/overview.html>

Video from Bristol University: <http://www.bristol.ac.uk/physics/research/research-video.html>







## Björn SCHUMACHER

Host institution: **University of Köln, Germany**



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### DNA damage and ageing

The research team is investigating the molecular mechanism of ageing. Ageing is strongly correlated with several human pathologies - cancer and neurodegenerative diseases such as Parkinson's and Alzheimer's as well as general functional decline. The team led by Dr Björn Schumacher aims at understanding the mechanisms underlying ageing. DNA damage has been showed to play a central role in both cancer and premature ageing (with syndromes called "progeroid" syndromes). Progeroid disorders appear early in childhood and severely impact children's health with for instance, growth retardation and neurodegenerative problems such as deafness, vision deficits and motor difficulties. The consequences of DNA damage have also been recognised in patients with inborn deficiencies in nucleotide excision repair (NER) which is a DNA-repair mechanism activated when people are exposed to ultra violet radiations from the sun, or to chemicals and other mutagens. Failure to repair can contribute to ageing, incorrect repair can lead to mutations and consequently to cancer. Dr Schumacher proposes to use the powerful genetic systems of roundworms (*C. elegans*) and mammals to identify the mechanisms underlying ageing and the genetic pathways of longevity regulation. The objective of the research team is to find novel preventive therapeutic strategies for age-related pathologies as well as for the treatment of those rare genetic progeroid diseases.

**ERC project:** Genome Stability Mechanisms in Ageing (GENSTAGE)

**ERC call:** Starting Grant 2010

**ERC funding:** € 1.4 million for five years

*At ESOF 2012, Björn Schumacher is participating in the Scientific Session on 'Ageing: from Genome to Sex' on Sunday 15 July 2012 from 8.00am to 9.30am (Liffey Hall 2).*

*Björn Schumacher is available for media interviews during ESOF.*

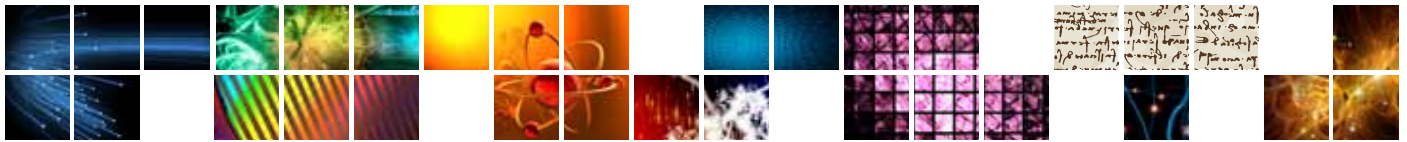
#### Links:

<http://www.uni-koeln.de/inter-fak/cecad/schumacher/index.html>

**GENSTAGE**



<http://erc.europa.eu>



© Paul Stewart



## Paul STEWART

Host institution: **University of Birmingham, United Kingdom**

# PRECORT

## The role of hormones in ageing and disease

Prof Stewart's project analyses steroid hormone action and its role in human diseases. Europe's population is ageing: at the beginning of 2010 there were 87 million people in Europe aged 65 or above: more than 17% of the total population. The burden this will place on health services, and the economy more widely, has to be seriously considered. People may be living longer, but they are frequently in very poor health as they age.

The hypothesis driving the project is that the bodily changes which occur with age – weight gain, thinning skin, a reduction in skeletal and muscular mass – and the resulting diseases, such as diabetes mellitus, hypertension, obesity and osteoporosis, can be attributed to excessive glucocorticoids. Glucocorticoids are hormones secreted by the adrenal glands, with circulating levels under the control of hypothalamo-pituitary-adrenal axis. Although circulating levels are unchanged across ageing, at a local level in tissues such as fat, bone, muscle and skin the enzyme  $11\beta$ -hydroxysteroid dehydrogenase type 1 ( $11\beta$ -HSD1) can generate cortisol from inactive cortisone.  $11\beta$ -HSD1 expression is increased with age, which has led the research team to explore the relationship between the degenerative symptoms of ageing and tissue specific cortisol excess: notably how this impacts upon skin thinning, a reduction in bone mass and muscle wastage.

This project hopes to contribute to our understanding of the ageing process by analysing the questions surrounding the ageing phenotype from a multi-disciplinary perspective. Selective  $11\beta$ -HSD1 inhibitors have been developed by many pharmaceutical companies and the ambition is to use these interventions to allow us to stay healthier as we get older.

**ERC project:** Pre-receptor cortisol metabolism and human Ageing (PRECORT)

**ERC call:** Advanced Grant 2009

**ERC funding:** € 2.49 million for five years

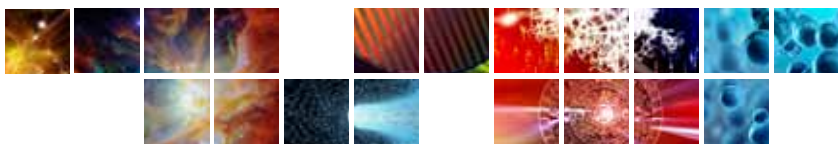
*At ESOF 2012, Paul Stewart is participating in the Scientific Session on 'Ageing: from genome to sex' on Sunday 15 July from 8.00am to 9.30am (Liffey Hall 2).*

*Paul Stewart is available for media interviews during ESOF.*

### Links:

<http://www.birmingham.ac.uk/staff/profiles/cem/EDM/Stewart-Paul.aspx>

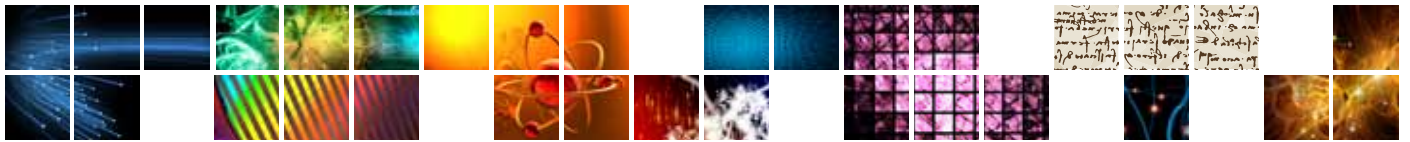




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European Research Council President, Prof Helga Nowotny on the ERC's mission and excellence:

*“Excellence in science is the ultimate goal that every researcher aspires to obtain. Excellence is multidimensional. It fosters innovative new thinking, experimentation and the discovery of new solutions. It encourages variety and often flourishes at the interface of established disciplines and practices.”*

*“The ERC’s mission is to find and fund the best researchers, through competition at the global level, who will conduct their frontier research projects in Europe.”*



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