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RESULTS MAGAZINE

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'Spotlight on international cooperation under FP7'.

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'Predicting climate-change-related disease in Africa', 

Kay Matzner of Fraunhofer on 'Towards EU-China cooperation in ICT', 

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Save energy: commercial cooler chills beverage

in just 50 seconds!, page 36 

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Pushing global science

When it comes to climate change, space exploration or even consumer protection, in an increasingly interdependent world with limited resources, pooling expertise from different countries has become a must — and science is no exception.

The EU's Research Framework Programmes, such as the soon-to-end FP7 or the upcoming Horizon 2020, are often thought of as being limited to EU Member States and, perhaps, Associated Countries. But many projects involve participants from outside these regions where it makes sense from a scientific or economic perspective.

The objective is threefold: supporting European competitiveness through strategic partnerships; enhancing knowledge and scientific excellence of European firms and institutions via access to external research environments; and addressing specific problems either faced by third countries or global in character, on the basis of mutual interest and mutual benefit.

This issue of the *research*eu results magazine* gives the floor to projects building on these mutual benefits. We reveal how such projects cover the whole spectrum of science topics — from biology and medicine to social sciences, energy, transport, space, ICT and industrial technologies — even in fields where most people might think competition is more important than cooperation.

This issue notably includes three exclusive interviews. The first is with Professor Andy Morse, from the QWECI project, who focused on methods and tools to predict health issues arising from climate change in Africa. Kay Matzner, coordinator of OPENCHINAICT, then points out how science is also about forging new international bonds with competing regions of the world, even in unexpected areas such as ICT. Dr Luigi Carotenuto concludes with the CIRCE project, a European initiative that aims for better exploitation and conservation of the data produced by the International Space Station.

As usual, many other topics are also covered in the magazine. The 'social sciences and humanities' section begins with 'Fixing the economy by rewarding long-term investment in innovation' on page 13, followed by the 'energy and transport' section which starts with 'A brighter future? Anti-ageing treatment for solar panels' on page 17.

The 'environment' section begins with 'Unravelling the secrets to achieving high-yield plants' on page 22, while the 'industrial technologies' section provides tips on how to 'Save energy: commercial cooler chills beverage in just 50 seconds!' on page 36.

The issue ends, as usual, with a list of events and upcoming conferences.

We look forward to receiving your feedback on this issue and on the *research*eu* publications in general. Send questions or suggestions to: cordis-helpdesk@publications.europa.eu

The editorial team



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- European Research Council: <http://erc.europa.eu>



Special topic

Each issue of the *research*eu results magazine* sheds light on a specific science topic. To find out more about the latest results and findings, look out for this icon next to article headlines.



Videos

Want to see EU research projects in motion? Some of the projects presented in this issue have a dedicated video available on the internet. To view a video, just open the digital version of the magazine (available at <http://cordis.europa.eu/research-eu>) and click on this icon.

See you next month!

Coming up in issue 28 of *research*eu results magazine* — a special dossier called 'Robots taking over'.

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BIOLOGY AND MEDICINE



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Predicting climate-change-related disease in Africa

It is common knowledge that climate change particularly affects developing countries, but its effects on health are still very hard to predict. In a joint effort to bridge this gap, the QWECI project set out to assist medical practitioners and public health decision-makers in allocating resources and implementing preventative measures ahead of disease epidemics.

Whilst climate-change predictions depend on many variables, making forecasting a real conundrum for scientists across the world, the impact of a changing weather on human health is even more uncertain. It is now largely accepted that global warming increases the concentrations of air and water pollutants, and affects the seasonality of certain epidemic diseases. But how can such changes be predicted, especially in Africa where local knowledge is hardly used in forecasting methods?

The QWECI¹ project brought together researchers from 13 European and African research institutes to integrate data from climate-modelling and disease-forecasting systems. The project focused on climate and disease in Senegal, Ghana and Malawi and aimed to give decision-makers the necessary time to deploy intervention methods and help prevent large-scale spread of diseases such as malaria and Rift Valley fever. It is expected

to help predict the likelihood of a malaria epidemic four to six months in advance.

Andy Morse, principal project investigator and climatologist at the UK's University of Liverpool, told *research eu* results magazine* about the project's outcomes and their expected impact on Africa's capacity to predict and counter health-related issues caused by climate change.

What were the main objectives of the project?

The overall objective of QWECI was to combine state-of-the-art climate models, weather-dependent infection-control data for key African diseases, and local knowledge about population behaviour, disease, vectors and transmission patterns. The outputs could thus generate maps of infection risk appropriate to the decision-making of health professionals on the ground and the policy-making of governments in susceptible countries.

What was new or innovative about how you addressed climate change impact in developing countries?

QWECI's value-added resides in the integration of the most reliable climate-based prediction models with models of climate controls on disease risk variables for 'vector-borne diseases' (VBDs) on medium and long timescales. This results in unique and meaningful information which can be rapidly conveyed to end-users and allows for the quantification and prediction of the impact of climate and weather on health in Africa.

What first drew you to research in this area?

Back in the late 1990s, the need for better prediction and containment of climate-change-related diseases became obvious in the developing world, especially in Africa. There was a clear lack of use of climate-model data sets for impact studies, and I wanted to contribute to their more widespread use.

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What difficulties did you encounter and how did you solve them?

It is difficult running a project across such a large area, which is so far from Europe, while maintaining the uptake of the model outputs by local users. We overcame this by getting key regional partners and users on-board, through the organisation of national and local level workshops.

What are the concrete results from the project?

We have taken malaria modelling driven by seasonal-scale ensemble prediction systems to the operational cusp. The region's capacity to use and interact with malaria-modelling technologies was also developed: we used local parameter settings from field studies in the region, and methods including long-range WiFi to communicate the results to local users.

Through international workshops and visits, QWECI helped to share the knowledge of local health practitioners in isolated communities and state-of-the-art modelling expertise.

It also enabled long-standing collaboration between different institutes, countries, scientific communities and health agents across Africa and Europe, which should all facilitate future joint efforts.

How do you expect QWECI to improve people's lives in developing countries?

If we can get the QWECI malaria models fully operational within a seasonal ensemble prediction system, we will have reached an effective stage in what could develop into a pan-African early-warning system.

What are the next topics for your research?

In the future, we would like to develop similar systems for other climate-driven vector-borne diseases, including Rift Valley fever which primarily affects animals but can cause severe disease in humans as well.

The project was coordinated by the University of Liverpool in the United Kingdom.



© Andy Morse

Andy Morse

- 1 Quantifying weather and climate impacts on health in developing countries.

Funded under the FP7-specific programme 'Cooperation' under the research theme 'Environment'.
Project website: <http://www.liv.ac.uk/qweci/>



Better understanding of diseases devastating African communities

While high-profile diseases such as malaria and tuberculosis tend to take the lion's share of both publicity and funding, a number of neglected diseases, transmissible between animals and humans (zoonoses), continue to devastate communities in Africa, Asia and Latin America. A team of international scientists is tackling this problem from all angles: prevention, diagnosis, understanding and awareness.



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The EU-funded project ICONZ¹ is looking at the impact of eight diseases: anthrax, rabies, brucellosis, bovine tuberculosis (TB), zoonotic trypanosomiasis, echinococcosis, cysticercosis and leishmaniasis. These diseases pose a direct risk to human health, and can also have a serious impact on livestock productivity — and hence the livelihoods of the poor.

The project is expected to have a major impact by helping developing countries implement effective zoonosis controls and for increasing awareness of the problems they cause. The team is developing new practical, cost-effective and sustainable strategies for keeping the diseases in check.

After mapping and reviewing previous research into the

eight diseases, the team built a unique database able to provide detailed information on location, scope and type of research currently being carried out on these eight key neglected zoonoses. They also created an inventory of all diagnostic tools for each of the diseases being studied.

Key work was done on assessing neglected zoonoses in communities in Mali, Morocco, Mozambique, Nigeria, Tanzania, Uganda and Zambia. This involved livestock keepers, householders, patients, medical and veterinary service personnel and other key individuals.

Four types of strategies are under development, addressing different types of neglected zoonoses: bacterial diseases; those affecting



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dogs and small ruminants; those affecting pigs; and vector-borne zoonoses.

The team is also looking at cultural attitudes and practices, gender issues and traditional knowledge. In the same way as a doctor would make a medical diagnosis before recommending treatment, the ICONZ team intends to make an educational diagnosis before proposing an intervention plan.

ICONZ has identified an overwhelming need for capacity building in the seven African countries. While all institutions surveyed had carried out training in one or more of the neglected zoonoses in

the past five years, and have the facilities to host and train students, more support is needed. Most institutions had also focused more on veterinary medicine than human health. This project, along with another EU-funded project, OH-NEXTGEN², will help by transferring knowledge to African researchers.

The project team has also identified a need for more women researchers and policy-makers in the African partner countries. In several of the areas where pilot projects or case studies are being carried out, local women's groups have been invited to help design and run them, and to determine the

most appropriate methods for communication and publicity.

ICONZ's results and those of another related project on advocacy for neglected zoonoses, ADVANZ³, will be made available to national governments so that they may develop policies and secure commitment at national level. Participation by all stakeholders, including government, district officials, traditional and religious authorities, should ensure a major impact is achieved, and each community's unique requirements are supported.

- 1 'Integrated control of neglected zoonoses: improving human health and animal production through scientific innovation and public engagement', coordinated by the University of Edinburgh in the United Kingdom.
- 2 'Training of the "One Health" next scientific generation in the Sahel and Maghreb', coordinated by the Institute of Tropical Medicine Antwerp in Belgium.
- 3 'Advocacy for the fight against neglected zoonotic diseases', coordinated by the University of Copenhagen in Denmark.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology' (KBBE).
<http://cordis.europa.eu/news/search/36044>
 Project website: <http://www.iconzafrica.org>



Antibacterial textiles for hospitals — preventing nosocomial infections

Infections that occur in the hospital are a major health concern in Europe, as well as a significant economic burden. In response, researchers are now developing a novel process to create antibacterial textiles for use in hospitals.

One in 10 hospital patients are affected by these so-called 'nosocomial' infections. The result is an extension of hospital stays by more than 10 million patient-days per year in Europe alone. Thus, impregnating hospital textiles, such as bedding and bandages, with

antibacterial nanoparticles would significantly decrease nosocomial infections, improve patient outcomes and save millions of euros.

This is the premise of the EU-funded project SONO¹. This research effort expands on a

recently proven and patented single-step laboratory process to impregnate textiles with copper-oxide and zinc-oxide nanoparticles.

Project partners have created two pilot plants and are using them to optimise the coating process. This includes computational modelling of pressure, fluid dynamics and heat transport inside the sonochemical reactors. The team's findings will be used in scaling up to industrial level.

Software and control equipment for the reactors have also been developed, tested and installed at the pilot plants. This allowed for process optimisation with regard to nanoparticle production and impregnation. Nanoparticle-coated fabrics were tested and displayed effective antibacterial properties and good longevity, lasting for more than 65 washes in hospital washing machines (75 °C) with insignificant loss of nanoparticles.

The pilot plants within the SONO project have shown that this is an effective method of producing textiles with strong antibacterial qualities. This project will now be upgraded to an industrial-scale plant for testing, and commercial applications should follow.

The project was coordinated by Bar-Ilan University in Israel.

- 1 'A pilot line of antibacterial and antifungal medical textiles based on a sonochemical process'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP).
http://cordis.europa.eu/result/brief/rcn/11169_en.html
 Project website: <http://www.fp7-sono.eu/>





Landmark EU-Russia study to shed new light on heart disease

Heart disease is one of the world's biggest health-care, social and economic challenges. It is often associated with other conditions, such as diabetes and obesity. Researchers are now trying to determine how these conditions interact in an effort to better identify people at high risk and to improve treatment.

Landmark research into these interactions, including extensive clinical trials, is being conducted by the EU-funded project SICA-HF¹. The project is also being supported by the Russian Federation and brings together 12 Russian and European organisations.

The researchers aim to provide important insights into the complex interaction between heart failure, diabetes, obesity and muscle wasting. The work will contribute to improved disease management and outcomes for patients.

They will also examine some of the many still unknown factors on the causes and treatment of chronic heart failure (CHF). For example, there are currently no precise statistics to back up some research estimates that 15 to 25% of diabetic patients over the age of 55 are unaware they may have some form of heart problem.

There are also no clear warning signs that someone is at risk — a major threat to their health given that if a patient has CHF their chance of dying jumps from 5% a year to 35% a year once blood-sugar levels exceed a certain limit.

CHF, which occurs when the heart is unable to pump hard enough to maintain blood flow to meet the body's needs, is not a curable condition, although its progression can be slowed and symptoms improved through effective management, especially if diagnosed early.

Early diagnosis also greatly reduces the high costs of treatment. Treating people with CHF is estimated to account for around 2% of total health-care spending in some EU countries.

The SICA-HF team is conducting 13 clinical and preclinical trials in Europe and Russia to study the associations of CHF and the three conditions at the clinical, vascular, cellular and molecular levels. The trials involve more than 1600 patients with CHF, and over 300 patients with type-2 diabetes without CHF; more than 150 healthy subjects will serve as control groups.

The team is using standardised protocols that focus on body composition, insulin resistance, exercise capacity, cardiopulmonary reflex patterns and peripheral blood flow, with subjects assessed at baseline,

after four to six months, and again after 16 to 18 months. From then on, assessments would be done each year.

Significantly, blood and tissue samples from patients being clinically evaluated will be sent to partner research laboratories, enabling them to study the same patients. Such interaction is very rare in large-scale studies and allows researchers to better integrate the data as it is collected.

The information will provide doctors with a more complete background on CHF — gathered from the lives of trial participants — and its interplay with three important and commonly associated conditions: type-2 diabetes mellitus, obesity, and cachexia, a form of muscle wasting.

The researchers expect their research on CHF will lead to faster diagnosis and better treatment for those at risk of heart disease. They will also have key data on incidence and prevalence of the three associated conditions among CHF patients, which will confirm established indicators of CHF and allow researchers to investigate new ones.



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Partner institutions from five EU countries and Russia teamed up for SICA-HF. It is supported by funding of more than EUR 6.3 million, of which around EUR 3 million came from the EU.

The project is coordinated by Charité – Universitätsmedizin Berlin in Germany.

- 1 'Studies Investigating co-morbidities aggravating heart failure'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
<http://cordis.europa.eu/news/search/35980>
 Project website:
<http://www.sica-hf.com/index.php>



Harmonising EU research on traditional Chinese medicines

Traditional Chinese medicine is based on an individual and holistic approach to describe health and disease — it emphasises a harmony of bodily functions.

EU-funded project GP-TCM¹ was set up to assess current EU research practice on the use, safety and efficacy of traditional Chinese medicine. In particular, the project focused on herbal medicines and acupuncture.

The project's researchers say that their application of

emerging technologies, such as functional genomics and systems biology, to analyse traditional Chinese medicine might help EU pharmaceutical companies innovate and discover new types of drugs.

The team studied best practices and issues in research being

done in 27 EU Member States (before Croatia's accession) on traditional Chinese medicine. They fostered an exchange of opinions, experience and expertise among scientists in EU countries and China.

Based on this information, GP-TCM's researchers reviewed current issues and solutions concerning quality control, extraction and analysis of existing data on Chinese traditional medicine. They also contributed to research

into traditional Chinese medicine by:

- developing a European-Chinese network for collaborating on functional genomics research;
- reviewing current research practice, identifying problems and proposing ways forward;
- proposing standard methodological protocols;



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- identifying priority areas for future research;
- developing online resources to support best practices and to improve pan-European studies;
- helping to foster sustainable European collaboration by founding a European society dedicated to research in this field.

The project's guidelines for harmonising research across the EU were published in the *Journal of Ethnopharmacology*. The project also worked to strengthen EU collaboration with China in this field of research.

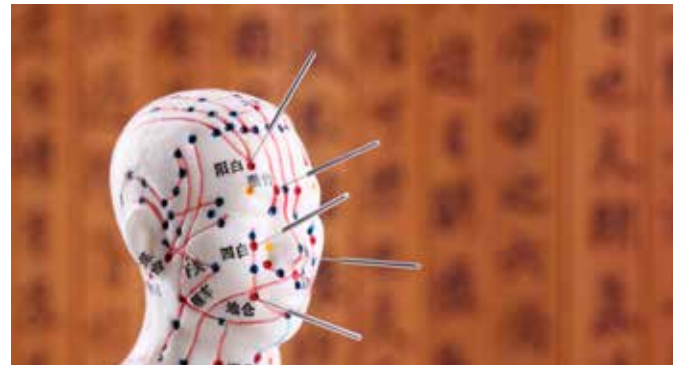
The Good Practice in Traditional Chinese Medicine Research Association, created during the project, will carry on the work. The Association is coordinated

by founding president Professor Rudolf Bauer from the University of Graz, Austria.

He says the Association believes that the challenges of researching traditional Chinese medicine can only be solved through an interdisciplinary network, using the most advanced methodologies of the post-genomic era.

According to Prof. Bauer, the expertise of the GP-TCM consortium and the ideas garnered from new members will enable researchers to develop and implement good practices in an integrated way.

Dr Qihe Xu from King's College London and the coordinator of the GP-TCM consortium says founding the research association for promoting high-quality evidence-based research is one of the project's most important milestones.



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'This will prove to be a critical step towards sustainable development of traditional Chinese medicine research worldwide,' he says.

The project involved 200 scientists, clinicians and practitioners of traditional Chinese medicine from 112 institutions in 24 countries. GP-TCM received EUR 1.1 million in funding from the EU. The project completed its work in October 2012.

The project was coordinated by King's College London in the United Kingdom.

- 1 'Good practice in traditional Chinese medicine research in the post-genomic era'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
<http://cordis.europa.eu/news/search/36108>
 Project website: <http://www.gp-tcm.org/>



A functional atlas of the mouse genome

Elucidation of gene function is central to understanding mammalian biology. An international consortium is pursuing this grand plan by developing genetic tools and resources to functionally annotate the entire mouse genome.

The decoding of the human and mouse genomes has unveiled about 20 000 protein-coding genes amid a great abundance of non-coding regulatory regions. For functional annotation of the genome, scientists need to perform mutations in these genes and study their outcome in the mouse.

Recent technological developments enable the performance of gene mutagenesis in a systematic, high-throughput manner. To mutate all protein-coding mouse genes, cooperation of research teams on a global scale is necessary — and is now being facilitated by the International Knockout Mouse Consortium (IKMC), a common initiative of European, US and Canadian mutagenesis projects.

The EU-funded EUCOMM¹ is the founder member and European cornerstone of the IKMC and,

together with its successor project EUCOMMTOOLS², contributes the largest proportion of conditionally mutated mouse genes to the IKMC. To date, around 12 300 genes have already been successfully mutated by the two EU consortia. Furthermore, EUCOMMTOOLS and its predecessor project EUCOMM are delivering vectors, gene-targeted and gene-trapped murine 'embryonic stem cells' (ES cells) and mutant mouse lines to scientists worldwide. Another objective of EUCOMMTOOLS is to generate up to 250 'Cre-driver mouse lines' (Cre recombinase is an enzyme used in the field of molecular biology) with specific tissue- and cell-type expression profiles to capitalise on the conditionally mutated part of the IKMC mouse ES cell resource.

In addition, the consortium is developing cassettes for integration into the conditionally mutated EUCOMM alleles,

which may, for example, carry any 'open reading frame' (ORF) of interest, reporter genes, suicide genes, various recombinases or 'small interfering ribonucleic acids' (siRNAs). To integrate these cassettes into the EUCOMM alleles, EUCOMMTOOLS is either employing 'recombinase-mediated cassette exchange' (RMCE) in ES cells, or is using 'Transcription activator-like effector nucleases' (TALENs) to facilitate homologous replacement of genes in mouse-fertilised oocytes.

EUCOMMTOOLS' work is advancing gene-function annotation and, in addition, mammalian genetic-engineering technology in general and conditional mutagenesis in particular. As a consequence, project outcomes are expected to enhance knowledge about disease mechanisms — a prerequisite for the design of therapeutic interventions.



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The EUCOMMTOOLS project is coordinated by the Helmholtz Zentrum München in Germany.

- 1 'The European conditional mouse mutagenesis program'.
- 2 'EUCOMM: Tools for functional annotation of the mouse genome'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
http://cordis.europa.eu/result/brief/rcn/11669_en.html
 Project website: <http://www.eucmmtools.org>



Linking arms against HIV

For decades, scientists in many different fields have been working to combat the pandemic spread of HIV/AIDS. The aim of the EU-funded EUROPRISE project was to bring together two particular areas of research which, for many years, had moved forward independently in this crucial fight.

The project, led by St George's Hospital Medical School in London, gathered together researchers in the fields of anti-HIV vaccines and anti-HIV microbicides. As such, it represents an unusual example of scientists breaking down long-established divisions between research disciplines, and by doing so, making possible new advances in HIV research.

EUROPRISE¹ partners carried out an integrated programme of research, coordinating a wide range of studies on vaccine and microbicide development, from early discovery through to the emergence of potential treatments.

One unexpected consequence of the collaboration was the initiation by partners of new clinical trials, some of which involved a number of African countries.

While initially EUROPRISE did not intend to undertake such trials, they were made possible thanks to the sharing of information and strategies between partners within the project. Scientists were able to fill some of the important gaps in European HIV research, which had been caused, in part, by the long-standing schism between work on vaccines and microbicides.

In addition, the network created a new PhD training programme in HIV-prevention technologies, building a new foundation for future generations of scientists working in the field.

The scheme has already trained over 60 students, including some participants from China, India and Tanzania.

EUROPRISE has also provided a recognised identity and a



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platform on the international stage for its research partners, a number of whom now sit on important global committees, including the Global HIV Vaccine Enterprise and the WHO-UNAIDS HIV Vaccine Advisory Committee.

EUROPRISE researchers received EU funding of EUR 15.5 million. They also had support from the Bill and Melinda Gates Foundation and the National Institutes of Health, an agency of the US Department of Health.

The project's consortium was made up of partners from nine EU countries and the Russian

Federation. The project ended in June 2012.

The project was coordinated by St George's Hospital Medical School in the United Kingdom.

1 'European vaccine and microbicides enterprise'.

Funded under the FP6 specific programme 'Life sciences, genomics and biotechnology for health'.
<http://cordis.europa.eu/news> > search > 36118
 Project website: <http://www.europrise.org/>

Silencing your inner voices

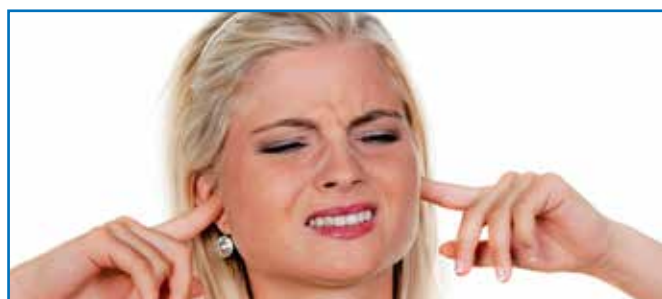
Hallucinations have been the seeds of inspiration for legendary film-makers such as Luis Buñuel, Terry Gilliam or David Lynch. Auditory hallucinations are a major symptom of schizophrenia. The inner voices people hear in the absence of any external acoustic input can be very disruptive for both their health and social life.

Based at the University of Bergen in Norway, Professor Kenneth Hugdahl, who holds an ERC Advanced Grant, has developed an iPhone app to help patients to re-focus their attention.

'Hearing voices may be more common than we actually think. Patients with schizophrenia as well as "healthy" people experience this phenomenon — the latter just seem to have another way to cope with and interpret

what they hear,' Prof. Hugdahl says.

His initial research aims at localising areas of the brain that are involved in auditory hallucinations. He is using imaging techniques such as 'functional Magnetic Resonance Imaging' (fMRI) that allow tracking neuronal activation in the left-temporal-lobe speech perception area. In his VOICE¹ project, he showed that auditory hallucinations (inner voices) generate activity



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in the speech regions in the left hemisphere in a very similar way to real auditory input.

Commenting on the progress of his research, he explains: 'We expected that patients with auditory hallucinations would also hear outer voices and that they would have a much higher activation in the upper-left temporal lobe. Very surprisingly, it is as if they shut down the outer world and switch their attention fully to the inner

voices. Science is paradoxical in that way.'

iPhone app

To help patients to inhibit the inner voices, Prof. Hugdahl turned to cognitive training. He subjected some of his patients to dichotic listening, a test in which they are presented with two different sounds in each ear and are asked to focus their attention. 'Since our patients hear strong inner voices and weak outer voices, we train them



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so that they will be able to focus on the outer sounds.'

With the ERC grant he obtained in 2009, Prof. Hugdahl and his research team had the idea to design an iPhone app to perform such training in a more autonomous way. The advantages of this technology are remarkable: instead of having to come to the laboratory to have headphones connected to a computer, patients can train themselves to ignore the inner voices while in the bus or when walking.

Prof. Hugdahl comments: 'A young PhD student of my team actually suggested the idea of an iPhone app. For patients, it can be

frustrating and time-consuming to get an appointment at the lab every time they need to practise. Now they can do the training at their best convenience, especially when they are experiencing strong auditory hallucinations. Our patients appreciated it a lot,' he adds. 'The training doesn't work on each and every person, but young people respond positively, perhaps because they are used to this interface. Many of them reported that it helped them a lot.'

Science is about ideas

Optimistic by nature, Prof. Hugdahl sees many good reasons for applying for an ERC grant. 'An ERC grant can change one's career

tremendously. The ERC requires new and unique ideas, the kind that no one has ever applied before,' he stresses. 'It forces scientists to be creative, and it actually made me think in a new direction. This prestigious grant is also recognised in Europe, and it helps to recruit the best young researchers in a team.'

On a more philosophical ground, Prof. Hugdahl shares with us the distinction between 'science' and 'research': 'People tend to use these words interchangeably. I believe that science is an idea while research is about all the things to test the idea. This goes for the ERC which is all about the core of science. That is precisely

what I like about the ERC. I hope its uniqueness, based on scientific excellence, will remain the same under the new research programme Horizon 2020.'

The project is coordinated by the University of Bergen in Norway.

1 'Hearing voices - from cognition to brain systems'.

Funded under the FP7 specific programme 'Ideas' (European Research Council).
<http://erc.europa.eu> > Projects and results
> ERC Stories



Anticipating climate change, tackling disease

Climate change will have a significant impact on the spread of infectious diseases, in particular vector-borne diseases (VBDs) such as malaria and dengue fever. This is partly due to anticipated biodiversity loss, and partly because some diseases thrive in warmer temperatures.

The effects of these changes will be felt most strongly among some of the world's poorest communities, either through an increase in the rate of direct infection or indirectly through the loss of domesticated animals and plants.

For this reason, the EU-funded HEALTHY FUTURES¹ project was launched in January 2011 to construct a disease risk-mapping system for three water-related, high-impact

VBDs (malaria, Rift Valley fever and schistosomiasis) in eastern Africa. The project, which is scheduled for completion in December 2014, will also develop decision-support tools (DSTs) to help health workers assess and compare strategies for managing human responses to these critical disease risks.

These tools will be presented at a stakeholder meeting on 24-25 February 2014 at the International Livestock Research

Institute's facilities in Nairobi, Kenya. The aim of the meeting is to refine the DSTs with the end-users in mind, prior to their final implementation.

The project kicked off in January 2011 by examining several key points. These included assessing the environmental factors that determine the distribution and activity of relevant vectors and pathogens in eastern Africa, and the extent to which outbreaks in the three target VBDs are a reflection of socio-economic conditions, such as migration and conflict.

HEALTHY FUTURES has also looked into how the transmission and outbreak of the three target diseases are likely to vary according to internationally accepted scenarios of environmental conditions. The project has examined the main barriers restricting the ability of health services to respond to disease-outbreak warnings, and how best to overcome them.

Another major project conference is scheduled for next year. It will be hosted by the National

University of Rwanda to coincide with the release of the next (fifth) Intergovernmental Panel for Climate Change (IPCC) Climate Change Assessment report. This conference will specifically target the wider implications of research findings, with a view to translating the results to other at-risk regions.

HEALTHY FUTURES is now past its halfway point, with less than 18 months remaining. The project has received EUR 3.38 million in EU funding through the Seventh Framework Programme (FP7).

The project is coordinated by Trinity College Dublin in Ireland.

1 'Health, environmental change and adaptive capacity: mapping, examining and anticipating future risks of water-related vector-borne diseases in eastern Africa'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
<http://cordis.europa.eu/news> > search > 36012
Project website:
<http://www.healthyfutures.eu/>





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Fixing the economy by rewarding long-term investment in innovation

The world's economy has yet to fully recover from the global financial crisis, although it is now half a decade since it began. Economists are still debating its causes and solutions, and are likely to continue doing so for years to come.

Challenging times call for challenging ideas and solutions. An EU-funded research project attributes part of the cause of the crisis to an economic value system that rewarded short-term gain over sustainable growth. This in turn deprived the economy of important investments in innovation, green technologies and other new-economy industries forecast to drive growth into the 21st century.

According to the researchers, it is most important to recognise that many of the proceeds from major public investments in these new industries have not been returned to government coffers. Rather, they have been lost to financial dealings and speculation. These are among the incisive conclusions of the FINNOV¹ initiative which brought together economics experts from seven high-profile European research institutions to examine the relationship between financial markets and investment in innovation.

The FINNOV team analysed the critical question of how well the financial system has stimulated growth in high-tech and science-based industries and companies. The conclusion: not as well as it could or should have.

'The economy is unbalanced. We need a new framework,' says FINNOV coordinator Mariana Mazzucato, a professor of science and technology policy at the UK's University of Sussex. 'There is an overemphasis on the financial industry. This has allowed economic resources to be extracted at the expense of industrial growth and actual value creation,' explains Mazzucato.

'Investment in productive activity has been undermined,' she continues, 'and the economy has been destabilised.'

Mazzucato, a visible and influential economic analyst, says the world's economy has

become overly 'financialised'. This means the balance of risks and rewards has been warped by dysfunctional incentives that have undermined productive investment. 'The financial sector tended to focus on value-extraction aimed at quick but unsustainable, short-term gains,' she says, 'rather than on value-creation that could contribute to long-term, sustainable and equitable economic growth.'

As a result, Mazzucato maintains that substantial financial gains have been privatised — held on to by the private sector — while the risks have been socialised — shouldered by governments and, by extension, the taxpayers. 'What we have now is an inequitable, unstable economic system that is obstructing innovation, and increasing the size and frequency of financial crises that are becoming more difficult for policy-makers to understand and control,' she notes. ➤

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The professor explains: 'What we need is finance for innovation, not innovation for finance.' Indeed, governments have both the role and the capacity to spark innovation, she says. But because of tightening budgets, governments' innovation funds should be regularly replenished with the profits from publicly funded successes.

'Governments should get a reward for investing in high-risk technologies and industries. They should retain a "golden share" of royalties,' according to Mazzucato. 'Had the US government thought ahead and kept even 0.05% of future proceeds from the internet, think about how much of that money could have been invested in green technology,' she concludes.

In addition, the FINNOV team has released many other recommendations for public- and private-sector leaders. For example, tax rules should be written to reward innovators who create lasting value, not those who extract short-term gains. Indicators used to measure financial performance should reflect companies' investments in innovation, research and development, and productivity. Financial support for small- and medium-sized companies should help job creation and high-quality products. Moreover, the practice of 'share buyback' — by which companies repurchase their own stock in order to boost share prices (and executives' bonuses) at the expense of research and development investment — should be strictly regulated. Last, but not least, the green economy should

be recognised as the 'next big thing' after the internet, which is likely to produce high returns.

The project was coordinated by the Open University in the United Kingdom.

- 1 'Finance, innovation and growth: changing patterns and policy implications'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Socio-economic sciences and humanities' (SSH).
<http://ec.europa.eu/research/infocentre> > search > 30953
 Project website: <http://www.finnov-fp7.eu/>



Establishing a base for ethnographic research

An EU-funded project has set up a research centre at Denmark's Aarhus University for PhD and postdoctoral researchers. The focus is on ethnographic studies of migration and mobility in Asia-Pacific, Europe and North America.

The GLOREA¹ project aimed at establishing the centre as a core component of an initial five-year research professorship. Pegged for enabling research into the ethnography of global and regional migration and mobility, the professorship covers two broad areas.

The first concerns new forms of migration and mobility in Europe, European borders and the management of migration through a

comparative regional perspective. The second focuses on transnational mobility and entrepreneurship in creative industries and creative cities, again in comparative regional contexts, albeit with a focus on East Asia.

PhD and postdoctoral research students, recruited internationally, receive support and training in quantitative and qualitative methods, as well as specialist training as ethnographers. An

additional aim is to create the conditions for bringing back an established European researcher from the United States.

Integration in Europe has been achieved with a high degree of success by securing a position as full professor at a prestigious social sciences institution in France. The Marie Curie International Reintegration Grant (IRG) has clearly contributed to the retention of a high-profile researcher in Europe and support for the integration phase for the two different hosts.

A wide range of international research and dissemination activities, as well as recruitment drives, have built up GLOREA as a small but dynamic research centre. Since the project commenced, the centre has secured funding through the EU's Seventh Framework Programme (FP7) EUCROSS² initiative. It also successfully supported a bid for two years of postdoctoral funding from the Danish humanities board (FKK).

Work in the centre's two areas of focus forms a fundamental base for exploring the human dimensions of globalisation and

regionalisation. Thus, ongoing achievements inspired by the establishment of GLOREA stand to contribute significantly to ethnographic research.

Knowledge transfer to both host organisations — Aarhus University in Denmark and the Paris Institute of Political Studies (Sciences Po) in France — has been very successful. It will continue in both organisations beyond the IRG funding period through networks and staffing arrangements, including collaborations and PhD supervision established by the GLOREA consortium.

- 1 'Centre for global and regional ethnographies at Aarhus University', coordinated by the National Foundation of Political Science in France, which manages the Paris Institute of Political Studies. The project was funded under the FP7 specific programme 'People' (Marie-Curie actions).
- 2 'Europeanisation of everyday life: cross-border practices and transnational identities among EU and third-country citizens', coordinated by the University of Chieti in Italy.

The project is funded under the FP7 specific programme 'Cooperation' under the research theme 'Socio-economic sciences and humanities' (SSH).
http://cordis.europa.eu/result/brief/rcn/6216_en.html
 EUCROSS Project website: <http://www.eucross.eu>



Can 'public' mean different things in different countries?

During the 20th century, the experiences of post-communist states in Central and Eastern Europe were very different from those of much of Western Europe. Have these different experiences fostered different attitudes when it comes to public space, and 'public goods' like health care, education or the environment?

Dr Natalia Letki of the University of Warsaw in Poland is using an ERC Starting Grant to carry out an ambitious multi-disciplinary study of attitudes and behaviour regarding 'public goods' across this region — drawing on political science, sociology, economics and even psychology.

'The full-scale public opinion survey we are conducting is probably the biggest such in-depth cross-national study based in and run from Central and Eastern Europe,' says Dr Letki of her PGPE¹ project. 'We are carrying out fieldwork in 14 post-communist countries: 11 EU Member States — Bulgaria, Czech Republic, Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania, Slovakia and Slovenia and three non-EU members — Moldova, Serbia and Ukraine.'

Dr Letki, an Assistant Professor at the Institute of Sociology at Warsaw University, hopes this project will help us arrive at a better understanding of how citizens and governments in these transition countries can work together towards greater social, political, economic and environmental sustainability.

The temptation to free ride

'When it comes to goods that cannot easily exclude people — such as defence or access to public education systems — there is an incentive to free ride,' she explains. 'The legacy of Communism, when people were intentionally set apart by the state, further contributed to their reluctance to cooperate with each other. The study will look at people's experiences and perceptions of public goods through their interactions with public institutions and agencies, and with other citizens. We will also consider people's attitudes to "green issues" or their "sustainable" behaviour towards what

we call "common pool resources" such as the environment.

'We expect to see different attitudes in Eastern Europe,' she continues. 'The retrenchment of the welfare state in Western Europe was gradual — but in Eastern Europe, the changes that occurred in the 1990s were radical and rapid: state services were withdrawn very rapidly.'

'Many people feel they are treated unfairly by the state, so they don't want to contribute to it anymore. Macroeconomic circumstances are not easy to change, but we know that people's feelings about the quality of institutions they deal with on a daily basis often matter more than what they actually receive in services,' she explains. 'Even when it comes to relations between citizens, the quality of exchange is also important — it's not just tit for tat but whether there is a sense of community and shared purpose.'

For example, she says, 'based on Western experience, we had devoted a lot of energy to finding sophisticated ways of asking about sensitive topics and behaviour, such as tax avoidance. But the early results show that in Eastern Europe you can be open, ask a straight question, and people will answer it — an indication that in post-Communist countries people don't see this behaviour as harming other citizens.'

The project will combine these subjective measures with structural indicators — including institutional design, social changes, political and economic reforms, and historical legacies — to try to understand attitudes to, for instance, paying taxes or law-abiding behaviour.

'We have a very multi-disciplinary international advisory board in this project. This helps



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us to bridge different (or similar) explanations from different disciplines running from sociology, economics, political sciences and psychology,' Dr Letki comments.

'The ERC grant is brilliant,' she says. 'We need the kind of generous funding that the ERC provides to conduct such a full-scale survey. In our case, we will be interviewing 1500 people in each of the 14 countries covered. This extraordinary data set will allow us to analyse the effects of varying qualities of social institutions.'

The grant has allowed Dr Letki to hire polling companies and put together a team of two postdoc researchers and two research assistants to work on the project. While still in its early days in the other countries, the fieldwork is already almost finished in Poland.

'This is the adventure of my life,' she admits. 'I am the first researcher in Poland to win an ERC Starting Grant in social sciences and the university has been very helpful in supporting me. For scientists in the early stages of their career this is a truly unique opportunity.'

The project is coordinated by the Institute of Sociology, University of Warsaw, in Poland.

1 'Public goods through private eyes. Exploring citizens' attitudes to public goods and the state in Central Eastern Europe'.

SOCIAL SCIENCES AND HUMANITIES



Keeping track of Africa-EU migration

A study is being carried out on sub-Saharan African (SSA) immigrants going to and returning from Europe. A better understanding of African migration should improve the quality of Europe's immigration policies.

International migration from SSA to Europe has recently generated both increased public attention and new policy measures. Yet understanding of the scope, nature and future development of SSA migration to Europe is still poor. In turn, this means that European immigration policies may prove ineffective.

In an attempt to overcome this lack of understanding, the MAFE¹ project, funded by the EU, was established. It set out to collect unique data on the characteristics and behaviour of migrants moving from sub-Saharan countries to Europe.

Comparable data on African migration have been collected in both origin and destination countries. Importantly, this data includes background information on individuals as well as data linking their histories to other details in both the origin and destination countries.

Based on the initial analyses of the MAFE project, very clear changes in migration trends and strong differences across countries are evident. In addition, a first comparison was conducted to investigate gender differences in international migration.



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The MAFE team also studied the family arrangements of migrants in three African migration flows by comparing three groups of families: current migrants, non-migrants and return-migrants. In each case, the preliminary results indicated significant differences between the three family groups.

Future research in the project will involve completing the full data analysis and drawing up comparative reports. Meanwhile, the MAFE project is informing the continuing debate on migration and development, and creating sustained and

mutual interest in EU-Africa cooperation on migration.

The project was coordinated by the National Institute for Demographic Studies in France.

1 'Migration between Africa and Europe'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Socio-economic sciences and humanities' (SSH).
http://cordis.europa.eu/result/brief/rcn/5843_en.html
 Project website:
<http://www.mafeproject.com/>



Leveraging social entrepreneurship for service innovation

An increasingly competitive economic and business environment makes companies hard pressed to follow the innovation wave. European researchers joined forces in the SELUSI project to explore how social entrepreneurs can help companies in high-tech or knowledge-based services innovate their service functions.

Set up with EU funding, the SELUSI¹ project aimed to gain a deeper understanding of the market- and organisation-level behaviours of social enterprises across Europe. And by extension, team members are keen to examine what kinds of specific knowledge social entrepreneurs can contribute to the service-innovation processes of mainstream businesses. An important project question, therefore, was 'How can their expertise be leveraged to help boost the competitiveness of Europe's services sector in general?'

Recent trends highlight a turn to traditional business being increasingly attuned to entrepreneurial opportunities that match profit-making with providing social good. As such, a new business model is fast emerging, calling for the reassessment of organisational practices and market interactions.

SELUSI researchers have built new evidence around the two themes of social enterprise in Europe, and social business innovation. They explored the possibility of linking up emerging social entrepreneurs as 'lead users' with traditional businesses in open innovation projects geared towards advancing novel service-design concepts.

Several findings have come from initial in-depth interviews with social enterprises: they all reportedly have a flat organisational structure, very few adopt performance pay, and almost all were open to the idea of collaborating with traditional businesses in the production of service innovations. This is of special interest for the project's action component. For example, project members collaborated with three major companies as part of a real-world 'experiment' to rigorously demonstrate exactly how the



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intelligence of social entrepreneurs can be integrated and combined to produce innovative service ideas.

The project worked to develop a large-scale panel database documenting the organisational and market behaviours of some 600 social enterprises in five European countries. The team also aimed to create and pilot-test new ways for the services sector to innovate and integrate the know-how of social entrepreneurs. This will help in the development of new service concepts that are profitable while addressing major societal needs.

The outcomes of the SELUSI project will be significant for EU- and state-level policy-making geared towards realising the Europe 2020 strategy. Research insights can be leveraged

to help inform policy initiatives that specifically target responding to the needs of social enterprises, scaling social enterprise initiatives and stimulating social service innovation.

The project was coordinated by the London School of Economics and Political Science (LSE) in the United Kingdom.

1 'Social entrepreneurs as "lead users" for service innovation'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Socio-economic sciences and humanities' (SSH).
http://cordis.europa.eu/result/brief/rcn/11663_en.html
 Project website: <http://www.selusi.eu/>



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A brighter future? Anti-ageing treatment for solar panels

Solar power is potentially an almost limitless resource. The sun provides enough energy in one minute to supply the world's energy needs for one year. But turning this resource into affordable electricity is difficult — silicon-based solar cells still suffer from a decline in their effectiveness over time. Through her ERC-funded SOLARX¹ project, Professor Hele Savin, of Aalto University in Finland, is investigating a possible route to solving this problem.

'This degradation is observed but not yet fully understood,' Prof. Savin says, explaining that the power output of solar cells is seen to decline as they age. 'Currently, up to 20% efficiency loss is due to this effect, although the reasons are still unknown. Industry is trying to tackle the problem by using better-quality, but more expensive materials, or by using different dopants in the silicon, but to date there is no cost-effective solution.'

This is where Prof. Savin's background in electronic engineering has come in useful: having studied microelectronics at Helsinki University of Technology (TKK), she is currently head of the Electron Physics Group in the Micro- and Nano-Sciences Department at the Aalto University School of Electrical Engineering in Finland.

Copper-bottomed reasoning

In recent years, the technologies and materials used in microelectronics and silicon-based photovoltaic (PV) solar cells have been converging. Prof. Savin is now trying to apply her previous research to solve a problem in this new field.

'My proposal is that copper impurities in the silicon, reacting with light, cause the decline in power output,' she says. 'There is always copper in the silicon used in large PV cells — either pre-existing impurities or resulting from the production process — and this copper can move around, diffusing through the silicon, even at room temperature.'

'In my PhD, I studied copper in microelectronics — in particular, copper contamination

in silicon,' she continues. 'I used light to make the copper electrically active. I wanted to produce this effect, but my hypothesis is that this also explains the degradation the PV industry would like to prevent. When you expose photovoltaic cells to sunlight, it makes the copper impurities electrically active. They move and accumulate so that existing clumps grow bigger, and this is what damages the PV cell and disrupts the flow of electric current.'

Therefore, Prof. Savin's research group is developing a solution using a negative charge at the surface of the silicon — exploiting the insulation properties of the protective oxidised coatings common to most PV cells. Thus, the surface attracts copper ions — instead of them



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accumulating in clusters — and the flow of electric power remains unaffected.

‘The degradation effect is slow, so the experiments have to last for days,’ she says. ‘The ERC’s support has meant we can focus on solving this issue for the next five years — with a postdoc and PhD student devoted to it — and use the specialised tools available at the Micronova facility to control copper-contaminant levels.’

Micronova is Finland’s national research infrastructure for micro- and nanotechnology, run by the VTT Technical Research Centre of Finland and Aalto University. Its dedicated equipment enables Prof. Savin to study the effects of copper in silicon alone, while avoiding cross-contamination from other impurities.

‘This project is basic science, but the production capacity and market for PV technology is already huge, so there will be a big technological impact if it works — and applications could potentially arrive quite quickly,’ she says. ‘On the other hand, even if it doesn’t work on an industrial scale, a better understanding of the science of this effect could also be a significant result, leading to other, better solutions in the future.’

After hydro and wind power, solar energy based on photovoltaics is already the third most important renewable energy source — with more than 100 GW of capacity installed globally. So, by continuing her work, Prof. Savin may help to bring an energy revolution — based on reliable, renewable power — one step closer.

‘My dream is that technology developed by me will be utilised by the global photovoltaic industry,’ she concludes.

The project is coordinated by the Aalto University in Finland.

1 ‘Riddle of light-induced degradation in silicon photovoltaics’.

Funded under FP7 specific programme ‘Ideas’ (European Research Council).
<http://erc.europa.eu> > Projects and results > ERC stories

Advanced solar cells cost less and live longer

Harnessing the Sun’s energy for electricity is perhaps the most sustainable alternative to fossil-fuel combustion conceivable. The development of innovative materials for advanced solar cells (SCs) should encourage their wider uptake.

There are now many different types of solar energy-conversion devices (SCs) at various stages of development and commercialisation. One way of classifying them is based on their photo-conversion mechanism that differs in inorganic (conventional) versus organic (excitonic) SCs. Excitonic SCs (XSCs) enable charge generation and separation simultaneously and include the most advanced dye-sensitised SCs (DSSCs).

The conversion efficiency of DSSCs is currently low

(around 11%), largely limited by the electrolyte and dye materials used. Overcoming these obstacles was the impetus for the EU-funded project INNOVASOL¹.

Scientists set out to replace the liquid electrolyte material with solid-state hole conductors (a different type of charge-carrying medium), and to substitute semiconductor quantum dots (QDs) — tiny nanocrystals that absorb light — for the organic dyes. In addition, researchers investigated two other types of

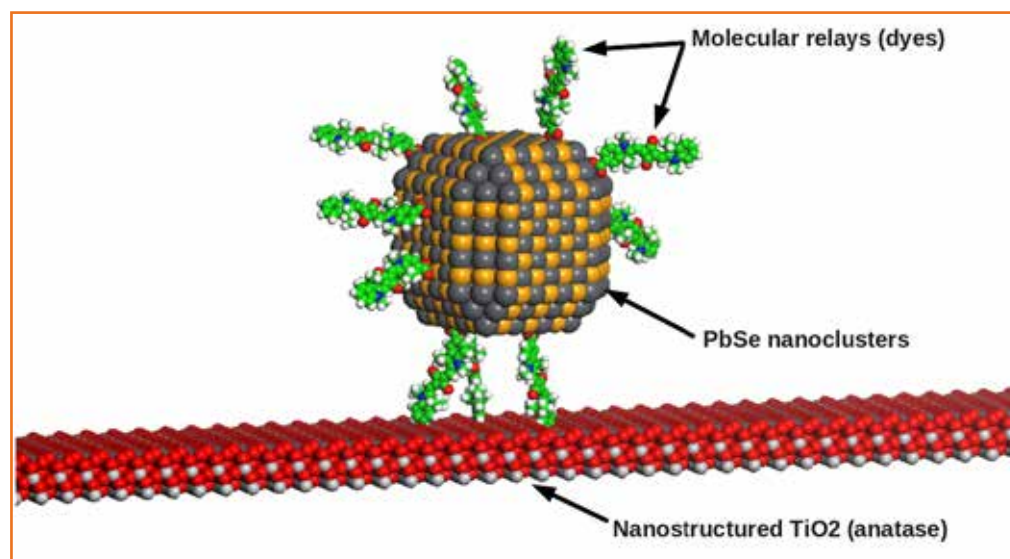
associated or support materials: molecules acting as molecular relays (MRs) connecting the QDs to electron conductor materials, and novel semiconductor materials to maximise charge transfer and electron transport.

With careful screening and selection of materials, as well as innovative design concepts, INNOVASOL successfully produced XSCs with the target efficiency of 15%, having simultaneously lowered production costs and significantly

enhanced device lifetime. The innovative solar-harvesting approach is particularly well suited to the automotive sector with improved power management for battery charging, enhanced battery lifetime and lower costs. It also supports the use of miniature solar modules to power cars’ interior lighting, for example.

INNOVASOL has provided a step change in the state of the art of XSCs, and the commercialisation of the technology stands to benefit small businesses, consumers and the environment.

The project was coordinated by the University of Eastern Piedmont in Italy.



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1 ‘Innovative materials for future generation excitonic solar cells’.

Funded under FP7 specific programme ‘Cooperation’ under the research theme ‘Nanosciences, nanotechnologies, materials and new production technologies’ (NMP).
http://cordis.europa.eu/result/brief/rcn/11674_en.html
Project website: <http://www.innovasol.eu/>

New algal species for biofuel production

Cultivating microalgae for use in the production of biofuels is an attractive alternative to traditional sources of biomass. The latest research in this area has identified important new species and processes that could become indispensable for microalgal production of biofuel.



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Development of clean energy sources is vital to slow the use of fossil fuels for energy production. Microalgae produce triglycerides that are important biofuel precursors — much faster than other plants, and not used as a food or feed crop. Furthermore, they grow very quickly and can thrive in a range of waste water and other non-freshwater sources.

The EU-funded project ALGFUEL¹ investigated new species and processes for the production of next-generation biofuels. The project

aimed to identify promising new candidates for biofuel production, and to improve the understanding of microalgal triglyceride production at pilot scale. Another aspect involved the development of mathematical and economic models to study the viability of microalgal-produced biodiesel.

ALGFUEL measured the growth and lipid composition of several species, and identified *Nitzschia lembiformis* as a promising new strain. Studies of common lab-grown microalgae also provided new data on the conditions that favour high growth rates and higher triglyceride production.

This project has thus contributed to the knowledge and skills sets in the field of microalgal biofuel

production. Having confirmed that microalgae are a potentially useful source of biofuel, researchers can now use this information to investigate production on both a pilot and industrial scale.

The project was coordinated by the Institute for Food Research and Technology (IRTA) in Spain.

1 'Biodiesel production from microalgae'.

Funded under FP7 specific programme 'People' (Marie-Curie actions).
http://cordis.europa.eu/result/brief/rcn/11678_en.html



Europe and Russia to join their electric grids

An ambitious plan to connect the European and Russian power grids could bring a variety of benefits, such as security and sustainability, to both regions.

Europe has an electricity grid which works well, although blackouts still occur for a variety of reasons, be they natural or man-made. The EU has considered linking its power grid to that of Russia in order to create a powerful interconnected entity that can overcome power shortages and surges. This, however, requires sophisticated approaches for the monitoring,

control and protection of such an impressive electricity system.

The EU-funded project ICOEUR¹ rose to this challenge, bringing together partners from both regions. They developed novel state estimators that European and Russian 'transmission system operators' (TSOs) could use to examine the state of the electricity grids.

Based on 'wide-area monitoring system' (WAMS) technology and a central data concentrator, these solutions were successfully tested on a large scale. The system demonstrated that it could successfully measure any instability within large-scale power systems due to voltage deviations or inter-area electric oscillations. This was achieved thanks to advanced new algorithms and more centralised data collection.

Overall, the project delivered tools to support the collaboration of TSOs in maintaining individual and general system stability, activating local protection systems when needed. In addition, the project team developed models of European and Russian transmission grids to evaluate the new tools and methods adopted to ensure optimal functioning.

Project results have been disseminated through journals,

conferences and publications, as well as through stakeholder workshops in Europe and Russia. The project team has also devised an exploitation plan to facilitate adoption of the ICOEUR tools. When this happens, both Europe and Russia will have more powerful and stable electric grids that will minimise downtime and optimise the use of resources. This will contribute to both regions' energy sustainability and security needs.

The project was coordinated by the Technical University of Dortmund in Germany.

1 'Intelligent coordination of operation and emergency control of EU and Russian power grids'.

Funded under FP7 specific programme 'Cooperation' under the research theme 'Energy'.
http://cordis.europa.eu/result/brief/rcn/11069_en.html
Project website: <http://icoeur.eu>



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ENERGY AND TRANSPORT

A new generation of magnets

Researchers have developed permanent magnets based on nanoparticles. The innovative materials promise to help drive more efficient engines for wind energy and other renewable energy applications.

Magnets are key to many applications in the generation and control of energy. However, a new generation of permanent magnets is needed to fuel developments in wind-turbine technologies, electric cars and space technologies.

The project NANOPERMAG¹, funded by the EU, used a 'bottom-up' approach to develop a new class of anisotropic nanocomposite magnets with previously unattainable high-energy products.

Project innovations hinged on making magnetically hard rare-earth intermetallic nanoparticles. Developments focused on samarium-cobalt (Sm-Co), neodymium-iron-boron (Nd-Fe-B) and

samarium-iron-nitride (Sm-Fe-N) nanoparticles measuring less than 150 nanometres (nm), and soft powders based on Fe(Co) nanoparticles in the range of 15–30 nm with high magnetisation. Fabrication techniques included sputtering, mechano-chemical synthesis and surfactant-assisted milling.

The project team modelled different architectures using micro-magnetic calculations. Researchers optimised performance based on particle size and shape, geometrical arrangement of the hard and soft nanoparticles, and hard/soft structures with core/shell morphology.

NANOPERMAG outcomes should lead to a radical advance in the



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state of the art in this field, spurring on the development of the next generation of permanent magnets. The project team estimates they will produce a two-fold increase in the BH_{max} — the measurement for magnetic field strength relative to magnet size — to up to 800 kilojoules per cubic metre.

This significant advancement has the potential to spur on developments in renewable energy and open up new areas in many other applications, creating widespread societal benefits.

The project was coordinated by the National Center for Scientific Research "Demokritos" in Greece.

1 'High-performance nanostructure permanent magnets'.

Funded under FP7 specific programme 'People' (Marie-Curie actions).
http://cordis.europa.eu/result/brief/rcn/11686_en.html

Lighter-weight energy storage for transport

How can hybrid cars improve their efficiency and become more viable alternatives to conventional road vehicles? European researchers are focusing on innovative composite materials that lower the weight of hybrid vehicles by integrating energy-storage systems.

The heavier a vehicle is, the more energy it requires to move. Currently, the weight of batteries is reducing the environmental benefits of hybrid technology by increasing vehicle weight. Incorporating the battery in parts of the structure could mitigate such shortcomings.

The EU-funded research project STORAGE¹ is developing new

concepts for lighter-weight energy storage which can radically improve the efficiency of vehicles, among other potential applications.

Focusing on carbon-fibre composites, the project considered integrating into structural components four different energy-storage devices: capacitors, batteries, supercapacitors and hybrid capacitors.

Initial work focused on two techniques for developing such materials: 'reinforcing and grafting' and 'multifunctional resin'. Cost-benefit analyses helped to identify the most promising constituents, which were then combined into composites. Next, samples of these innovative materials were manufactured and tested for their mechanical and electrical performance.

The project team, drawn from research institutes and industry across different European countries, set a target of 15% improvement in efficiency over conventional materials.

They identified several novel technologies which improved performance. These included carbon aerogel reinforcement, matrix development based on a mixture of existing epoxy resins and liquid electrolyte, and improved composition of multifunctional resins for supercapacitors.

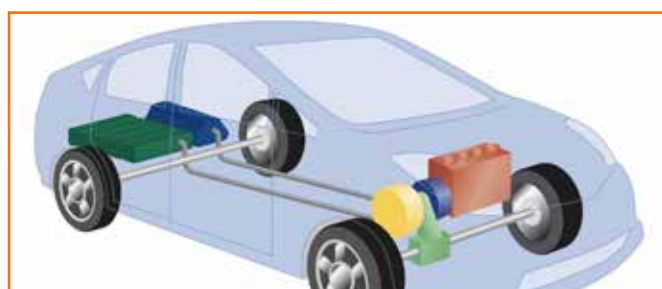
The STORAGE researchers also looked at system issues associated with structural power sources, such as power management, packaging and connectivity. Demonstrators using the new composites were built and tested on a small scale.

The project has laid the groundwork for revolutionary developments in efficient vehicles for the future. These technologies will help implement more sustainable transport solutions.

STORAGE was coordinated by the Imperial College of Science, Technology and Medicine in the United Kingdom.

1 'Composite structural power storage for hybrid vehicles'.

Funded under FP7 specific programme 'Cooperation' under the research theme 'Transport'.
http://cordis.europa.eu/result/brief/rcn/11648_en.html



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EU-African aerospace collaboration flying high

New agreements and joint projects between the EU and South Africa have brought a strong international perspective to Europe's aeronautics industry. Other African countries also stand to benefit from the initiative.

Globalisation is changing the face of industries around the world. In Europe, the aeronautics industry is looking to remain competitive by strengthening its strategic international partnerships. One such collaboration has been struck between the EU and South Africa, which is the largest economy in Africa and boasts formidable industrial capabilities. The partnership was achieved through the EU-funded project AEROAFRICA-EU¹.

The project established a platform to upgrade research and development (R&D) in the aeronautics and air transport field, while also promoting collaboration with other African countries. After mapping aeronautics R&D capabilities in the country, the project team organised events and conducted workshops to identify key areas of collaboration between Africa and Europe. These activities led to many

new EU-Africa projects under the Seventh Framework Programme (FP7), supported by brokerage events, forums and training for firms to join EU projects.

Demonstrating the global aspect of the project, AEROAFRICA-EU boasted research and academic partners from France, Germany, South Africa and Sweden. Four memorandums of understanding between the two regions were signed, including a specific agreement to promote transport research between the EU and South Africa. In parallel, the project team launched the AEROAFRICA website to disseminate information on project-related events and activities, enabling stakeholders to access important documents and resources, too.

An overall strategic framework for promoting collaboration in



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aeronautics and air transport R&D emerged from the project, as well as key recommendations on achieving this vision. These efforts have facilitated access to knowledge and expertise for all stakeholders, increased participation in European projects and opened a host of new opportunities in the aeronautics field.

The project has not only contributed to strengthening the aerospace sector in Europe, but also in South Africa and other African nations. The end result should be a strong industry and the emergence of high-tech advances that promise to upgrade the sector. With such dynamic partnerships involving two

major regions of the world, the sky is the limit.

The project was coordinated by the University of the Witwatersrand, Johannesburg in South Africa.

- 1 'Promoting European – South African research cooperation in aeronautics and air transport'.

Funded under FP7 specific programme 'Cooperation' under the research theme 'Transport'.
http://cordis.europa.eu/result/brief/rcn6077_en.html
 Project website:
<http://www.aeroafrica-eu.org/>

New model of atomic interactions in solar cells

Researchers have developed a sophisticated modelling system that will help improve the performance of solar cells.

A large amount of energy loss in solar cells occurs at the two interfaces within the silicon semiconductor: the passivation layer, which prevents electronic loss from silicon; and the metal contact layer, which transfers charge away from the solar cell. Current models do not adequately describe the interactions at the atomic scale, and this limited understanding is preventing improvements in efficiency.

The EU-funded project HIPERSOL¹ was set up to develop and implement a modelling system to address this problem. This system enables

modelling at scales from the atomic level up to the full size of a solar cell, and could therefore bring about substantial technological advancements.

The project team incorporated quantum mechanics models of metal-silicon interfaces and pioneered a new way to scale low-atom-number models up to 100 000 atoms. This is the first time that a stand-alone model has been used to fully predict the lifetime of silicon and other semiconductors in a solar cell.

Another important advancement was the measurement of

recombination processes at the interfaces, a major cause of reduced lifespan in solar cells. These measurements were achieved both theoretically by computation, and experimentally using fluorescence, both yielding very similar results and thus validating the model.

The modelling system developed by HIPERSOL has aided our understanding of recombination events and improved the prediction of interactions on the atomic scale. It already offers several ways of potentially improving solar cell systems, and may also be generally applicable to complex interface modelling in other areas.

The project was coordinated by Stiftelsen Sintef in Norway.



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- 1 'Modelling of interfaces for high-performance solar-cell materials'.

Funded under FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP).
http://cordis.europa.eu/result/brief/rcn11303_en.html
 Project website:
<http://www.sintef.no/Projectweb/HiperSol/>

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Unravelling the secrets to achieving high-yield plants

Understanding the basic mechanics of plant growth could help Europe increase crop yield while reducing the need for pesticides — a vitally important consideration given our growing demand for sustainable food. An EU-funded project has made significant advances in this respect, by shedding new light on the behaviour of certain plant hormones and their role in achieving successful crops.

The European BRAVISSIMO¹ project focused on 'brassinosteroids' (BRs), specific plant hormones that control aspects of plant growth and development. Scientists were already aware that these hormones have a positive effect on the quality and productivity of crops, and that they can increase crop resistance to stress and disease.

The BRAVISSIMO project's major contribution in this field has been to successfully unravel the mechanism of brassinosteroid hormones that regulates 'stomata' development. Stomata are microscopic pores through which plants breathe and release water.

'When rain is scarce, for example, the pores will close to prevent the plant from wasting water while an automatic drought-protection

mechanism is triggered into action,' explains Dr Jenny Russinova, project coordinator of the EU-funded BRAVISSIMO project. Brassinosteroids play an important role in determining the number of leaf stomata, but the underlying mechanism has not been well understood, until now.'

This breakthrough has important implications for environmental research and for the protection of plants. The results have since been published in the prestigious science journal *Nature Cell Biology*. In a wider sense, better understanding of BRs could lead to innovative new agricultural practices.

'Like human steroid hormones, brassinosteroids are crucially important, since a lack of this hormone can lead to the development

of extremely small plants,' explains Dr Russinova. 'Brassinosteroids offer the unique possibility of increasing crop yields by changing plant metabolism and protecting plants.'

Adapting to change

Dr Russinova and her colleagues believe that a better understanding of BR function could provide the basis for developing plant varieties better adapted to anticipated environmental change, and more resistant to disease. This could have significant economic implications.

'Plants are the basis of European industries with an annual turnover of more than EUR 1 trillion, and they will continue to play an even more important role in our

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economies in the future,' says Dr Russinova. 'Over the next 20 years, the challenge for European agriculture will be to satisfy the growing demands for producing food in a sustainable manner.'

At the beginning of the project, the tomato was selected as an ideal species for analysis, and also as a model system for fruit production. Together with scientists from Crop Design, a BASF Science Company, a review was carried out of known genes involved in the BR pathway, and several candidates have since been selected for functional tests on rice.

Dr Russinova credits her involvement in the project as a crucial step in her research career. 'Being a coordinator of BRAVISSIMO was an extremely useful experience for me

because I learned how to communicate and collaborate with different research teams,' she acknowledges. 'I interacted with many young researchers who introduced me to new ways of approaching certain scientific challenges. I also learned what interests them, and how they see their career development.'

By creating new opportunities and developing potential new technologies for agriculture, the ground-breaking BRAVISSIMO project supports the EU's stated Horizon 2020 goals of creating growth and jobs through research.

As group leader at the VIB Department of Plant Systems Biology at Ghent University, Dr Russinova is currently working on the interaction between plant cells and

brassinosteroids. Unravelling this, she says, will be another important step towards the development of effective strategies for producing high-yielding plants.

The project was coordinated by the VIB life-sciences institute in Belgium.

- 1 'Brassinosteroid venture increasing students' international mobility'.

Funded under the FP7 specific programme 'People' (Marie-Curie actions).
<http://ec.europa.eu/research > headlines > search > 31033>
 Project website: <http://www.bravissimo-fp7.eu/>



Engaging China and India in climate-change abatement

Major reductions are needed in the emissions of greenhouse gases (GHGs) in order to combat global warming and the effects of climate change. Although much of the carbon dioxide (CO₂) accumulated from human activities originates in industrialised countries, a growing share will come from the developing world, particularly China and India.

The participation of China and India in climate-change abatement is essential. However, both nations are reluctant to enter into any binding agreement as they do not wish to impede their development goals. The POEM¹ project is examining different ways in which the two countries can achieve both their development and climate-change abatement objectives.

POEM is developing a range of macro-socio-economic, energy

and environment policies for the two nations, thereby facilitating engagement in climate-change protection measures. A range of options, including both international and national climate policies, have been examined, as have institutional frameworks for international cooperation.

By applying an integrated modelling framework the project aims to explore a range of approaches and different impacts and scenarios. The

resulting policy options will enable China and India to contribute to international climate change initiatives without compromising national development priorities.

Project partners have identified and developed international climate policies and developed a country-specific modelling framework for studying possible impacts and scenarios. Due to the different gross domestic product (GDP) levels and energy structures, results

differ considerably between China and India. The policy options under examination will also address the impact of development pathways on so-called burden-sharing regimes.

The POEM project will support decision-making on energy, environmental and economic matters by indicating how climate and socio-economic policies can be successfully aligned, rather than working against one another.

The project was coordinated by Chalmers University of Technology in Sweden.



- 1 'Policy options to engage emerging Asian economies in a post-Kyoto regime'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
http://cordis.europa.eu/result/brief/rcn/11517_en.html

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How climate change will impact 'Asia's Water Tower'

Northern India's hydrological system is based on two main phenomena: the monsoon precipitation in summer, and the growth and melt of snow and ice cover in the Himalayas. An international group of researchers have examined how climate change stands to impact these phenomena, and by extension, the region's water resources.

Funded under the EU's Seventh Framework Programme, the HIGHNOON¹ project was a collaboration between European, Indian and Japanese research organisations and universities. The team's primary focus was to assess the impact of glacier retreat and possible changes of the Indian summer monsoon on the spatial and temporal distribution of water resources in northern India.

HIGHNOON applied a trans-disciplinary research approach to climate-change adaptation. The team integrated stakeholder knowledge on climate change and climate variability with scientific knowledge produced from improved regional climate modelling and socio-economic scenario development.

Stakeholders' (from individual farm-level to that of national government) project activities led to recommendations for strategies supporting the cause for adaptation to hydrological extreme events, on the basis of a participatory process.

Findings indicate a gradual widespread warming over northern India, with temperature increases for the Ganges basin projected



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at, on average, 2°C by 2050, and 4°C by 2100. Supported by the use of regional climate models (RCMs), temperature increases will likely be more pronounced over mountainous areas. Other research findings point to a non-significant increase in annual total precipitation by 2050.

Innovative modelling of glaciers at a large scale within RCMs confirmed the expected continuation of glacier shrinkage in most parts of the Himalayan mountain ranges, the so-called 'Water Tower of Asia'. Another finding was that higher temperatures and fewer days of rain will likely exacerbate drought conditions by 2050.

In upstream regions where climate change is expected to increase flood risk, adaptation measures to prevent flood damage are high priority. Below that, in the Ganges basin's midstream and downstream regions, stakeholders anticipate droughts and a lowering of the water table. This has prompted them to prioritise measures to maintain groundwater levels, and to develop water harvesting and water-use efficiency.

HIGHNOON has communicated its results to both EU and Indian policy-makers, and published a comprehensive project policy brief. Results, available on the project website, are also being

communicated to the scientific community in peer-reviewed papers and at conferences.

The project was coordinated by Stichting Dienst Landbouwkundig Onderzoek in the Netherlands.

1 'HIGHNOON: adaptation to changing water resources availability in northern India with Himalayan glacier retreat and changing monsoon pattern'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
http://cordis.europa.eu/result/brief/rcn/11664_en.html
 Project website:
<http://www.eu-highnoon.org/>



Boosting sustainability policy in Russia

Russia is the largest country in the world, covering more than one-eighth of the Earth's inhabited land area. So it is in everyone's interest to see that its lawmakers deliver sound policies when it comes to environmental sustainability.

However, times have been tough recently, and interest in economic growth has taken centre stage, with concerns about the environment being pushed into the background.

Under the EU-funded SUST-RUS¹ project, researchers set out to develop an integrated, state-of-the-art modelling approach that could assist Russian policy-makers in their

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choice of short-, medium- and long-term sustainability policies.

To achieve this, project researchers, led by Russia's Centre for Economic and Financial Research, first developed the new modelling approach itself.

They then produced a set of sustainability indicators associated with the model, enabling the quantification of the social, economic and environmental effects of sustainability policies.

Finally, the team used the model to assess the potential effects of a set of important sustainability policy measures,

thus demonstrating the capabilities and reliability of the approach.

Crucially, SUST-RUS project partners say they wanted to create an open source model that could be used by both Russian and European researchers. The resulting model considers sustainability in terms of social, economic and environmental outlook, over the short term — one to two years — or over the long term — five to six years.

When the SUST-RUS team ran the model to assess the energy efficiency of natural gas, they concluded that pricing policy should be favourable to both

producers and consumers in order to have a real impact on efficiency and greenhouse gas emissions.

The project subsequently recommended the removal of state subsidies for gas consumers and a decrease in subsidies for industrial producers. These recommendations are now being put into practice by the Russian government.

The SUST-RUS modelling approach provides Russia and the international community with sound scientific support for formulating sustainability policies, balancing social, economic and environmental objectives. It received EUR 1.3

million in EU funding, and ran for three years between 2009 and 2011.

The project was coordinated by the Centre for Economic and Financial Research (CEFIR) in Russia.

1 'Spatial-economic-ecological model for the assessment of sustainability policies of Russia'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
[http://cordis.europa.eu/news > search > 36011](http://cordis.europa.eu/news/search/36011)
Project website: <http://sust-rus.org>



Ensuring safe water and sanitation for sub-Saharan Africa

WASHTECH is an EU co-funded project geared towards the provision of sustainable water and sanitation services, with research undertaken in Burkina Faso, Ghana and Uganda. The consortium comprises national and international non-governmental organisations (NGOs), academic institutes and training centres in Africa and Europe.

Advancements in technology have led to the development of innovative 'water, sanitation and hygiene' (WASH) technologies. WASHTECH¹ members are developing tools that will help to provide safe water for drinking and hygienic sanitation facilities and services that are affordable and adaptable,

especially in poorer countries. Yet implementation of many WASH technologies has been unsuccessful due to factors such as cost, sustainability and suitability. WASHTECH partners aim to identify the stumbling blocks and help to resolve these issues in order to improve the quality of life for everyone.

Project members intend to use a 'technology assessment framework' (TAF) for assessing the effectiveness, performance, suitability and sustainability of new technologies prior to implementation. Supply chain regulation, logistics, maintenance, training and financial support were also factored in by WASHTECH for screening technologies through the TAF. Pilot studies in Burkina Faso, Ghana and Uganda will help provide country-specific recommendations. The WASHTECH website, meetings, training courses and more will help support TAF application and adaptation at district and national levels.

hinder the adaptation of WASH technologies.

A review of WASH technologies and the development of status reports were completed in the three African countries. Pilot study results were included in the TAF research report, and a TAF manual, training materials for country TAF teams and detailed TAF field materials were also prepared.

WASHTECH activities will thus promote the adaptation of cost-effective technologies that provide WASH services that are sustainable for safe water and hygienic conditions.

The project is coordinated by Stichting IRC International Water and Sanitation Centre in the Netherlands.

1 'Water, sanitation and hygiene technologies'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
http://cordis.europa.eu/result/brief/rcn/11635_en.html
Project website: <http://washtechfrica.wordpress.com/>



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Saving the world's wetlands

Wetlands provide valuable ecosystem functions and services ranging from food provision to tourism. The EU-funded WETWIN project has outlined the factors endangering wetlands, now and in the future, and has identified strategies for their restoration and sustainable management.

The WETWIN¹ approach for stopping and reversing the ongoing degradation of wetlands was based on the four basic premises of wetland management: wise use, adaptive management, integrated water-resource management, and participation of local communities and stakeholders. Seven wetlands were investigated from Africa, Europe and South America.

WETWIN researchers identified a range of problems at the case-study sites. These included desiccation and terrestrialisation due to reduced inflows,

encroachment and disturbance, pollution and diseases like malaria from mosquito vectors in the tropical wetland habitat. Moreover, the high nutrient content of these waste waters, plus the nutrient-rich run-off waters coming from the agricultural lands result in eutrophication problems.

Involvement of stakeholders from the case-study sites played a crucial role in the project throughout. The WETWIN project applied an ecosystem services approach for characterisation of the natural and

socio-economic statuses of wetlands. Characterisation was followed by the identification of major environmental and livelihood issues in the wetlands. Cause-effect mechanisms behind the problems were explored with the help of the 'driving-forces, state, impact and responses' (DSIR) methodology.

WETWIN researchers were particularly concerned about reducing vulnerability in the wetlands in terms of external impact (EI) and adaptive capacity (AC). Their aim was to apply appropriate management interventions on a local to large scale. These actions could turn the state of the wetlands, and also that of the basin, from vulnerable to resilient.

Wetlands International is a non-profit organisation for conservation of wetlands. They aim to organise several dissemination activities that may include WETWIN fact sheets in French, training materials and guidelines, and a brochure on health impact.

Further development of a sophisticated model system for the Inner Niger Delta (IND) leading to a high-resolution digital terrain model is also planned.

The outcomes of WETWIN are expected to enhance the recognition of the functions and services that wetland ecosystems provide on both local and river-basin scales. The alarming messages from the project about the degradation and vulnerability of wetlands will help to raise awareness among politicians, managers and stakeholders. These interventions will bring conservation, restoration and sustainable management of wetlands more into the limelight.

The project was coordinated by Antea Group in Belgium.



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1 'Enhancing the role of wetlands in integrated water-resources management for twinned river basins in EU, Africa and South America in support of EU water initiatives'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
http://cordis.europa.eu/result/brief/rcn/6296_en.html
 Project website:
<http://www.wetwin.eu>



Arctic exploration provides window on future climate change

Climate-model projections show that the Arctic Ocean will be completely ice-free in the summer months by 2060. However, the record lows in sea-ice extent of 2007 and 2012 demonstrated that these projections were too optimistic and some scientists think that we might see an ice-free Arctic within this or the next decade. This momentous transformation will undoubtedly have important consequences for our climate, although opinions on the severity of this change vary.

However, in order to put in place timely and effective remedial action it is clear that we need to have the tools at hand to accurately monitor and assess exactly what is happening.

For this reason, the EU-funded DAMOCLES¹ project was established to improve Europe's Arctic modelling and observation capabilities. The ultimate objective is to identify and understand

the changes that are currently happening in the sea-ice, atmosphere and ocean of the Arctic and subarctic region. Indeed, a key concern has been that while the rest of the world is monitored by meteorological and oceanic instruments, the Arctic has never been subject to a comparable level of monitoring.

In order to address this, DAMOCLES brought together 48 research

institutions — including 10 SMEs distributed among 11 European countries, Russia and Belarus — along with experts from the US, Russia, Canada and Japan. The project is part of an international effort, truly global in both its ambition and nature, to jointly tackle the Arctic research challenges.

The tasks were highly complex, involving ships, aircraft, ice-breakers, satellite recordings

and the use of equipment underneath the ice. The team attached unmanned buoys to drifting sea-ice to measure the heat and salinity of the ocean. These buoys communicate with satellites and data streams in real time to scientists in Europe.

Furthermore, sound waves were used to measure ocean temperature. An underwater loud-speaker was lowered below the

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Torpedo-shaped robots were also used to measure temperature, salinity, pressure and speed as they travelled through the ocean at different depths.

Instruments were anchored to the seabed along the edge of the Arctic Ocean, where strong currents carry warm Atlantic waters from the North Atlantic into the central Arctic. This enables scientists to monitor the state of the ocean in a specific place over a long period of time. Instruments installed on drifting ice also provide a clearer picture of how fast Arctic ice is disappearing.

When data from early 2007 was entered into the DAMOCLES model, it correctly predicted the presence of large ice-free areas in the middle of the Arctic Ocean later on in the year. The project managed to improve Arctic monitoring, giving authorities a

longer lead time to prepare for the onset of extreme climate events.

The project was coordinated by the University Pierre et Marie Curie – Paris VI in France.

- 1 'Developing Arctic modelling and observing capabilities for long-term environmental studies'.

Funded under the FP6 specific programme 'Sustainable development, global change and ecosystems'.
[http://cordis.europa.eu/news > search > 35884](http://cordis.europa.eu/news/search/35884)
 Project website:
<http://www.damocles-eu.org/>

surface, along with a receiver. Because travel velocity of sound depends on temperature (for a given salinity), scientists are

now able to monitor the water temperature at great distance with high accuracy and minimum resource expenditure.



Promoting environmental justice worldwide

The increasing social metabolism of the world economy and the global competition for resources is placing ever-greater pressure on the environment and on vulnerable communities. This trend is set to continue, increasing the potential for more conflicts over scarce resources and environmental protection.

Environmental justice organisations are civil society groups active in conflicts between communities, states and companies over issues such as resource extraction and waste disposal. They play a crucial role in raising awareness that environmental security is a basic human right.

However, they often lack enough resources to be fully effective. The EU-funded project EJOLT¹ was launched in 2011 to study environmental conflicts worldwide and support organisations and communities struggling for environmental justice.

Project coordinator Joan Martínez Alier, from the Institute of Environmental Science and Technology at Universitat Autònoma de Barcelona, says these goals are best achieved by fostering collaboration on

environmental health monitoring, legal strategies and evaluation of environmental services.

'Academically, this project is pushing the field of statistical political ecology,' explains Alier. 'In social terms, it makes environmental conflicts more visible. Environmental justice is a major force in making the global economy more sustainable.'

The researchers hope to empower organisations and the communities they support to better reclaim and defend their rights. Along the entire global production chain — from extraction, to processing, to disposal — vulnerable communities often bear an unfair share of the fallout from pollution and environmental damage, Alier says.

Those most heavily affected are marginalised sectors of



the population, including poor citizens, women, minorities and indigenous peoples who depend more directly on natural resources for their livelihood.

EJOLT's deputy coordinator Leah Temper adds: 'Often, these communities — such as indigenous groups or peasants — use the economy >

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sustainably. Conflicts arise when industry seeks to appropriate environmental resources from such communities, resulting in dispossession and contamination. Thus, we say that these conflicts take place more and more on the commodity frontiers — places that are remote but that have the remaining pristine eco-systems on the planet.'

The project has already made an impact. In the first two years, EJOLT has produced eight major reports on its research, as scheduled. These include reports on fossil fuels, conflicts over mining, and on the impact of industrial tree plantations.

The EJOLT team has also made recommendations on the legal means organisations and

communities could use to claim compensation for environmental damages.

Project researchers are preparing an inventory of environmental conflicts worldwide, listing about 2000 locations. The first map to be completed focuses on environmental conflicts in Turkey. Following recent demonstrations and protests sparked by a government plan to demolish Istanbul's Gezi Park, the work was featured in a major national newspaper. The second and the third maps are from Ecuador and Colombia.

The project distributes the results of its work online and has produced several documentaries on environmental justice — such as those featuring urban recyclers'

rights and resistance by indigenous people to oil extraction and uranium mining.

The aim is to make environmental justice — and related concepts such as ecological debt and ecologically unequal trade — accessible to everyone.

'EJOLT also aims to break through what we call consumer blindness,' explains Temper. 'When you go to the gas station, you don't know whether your oil comes from polluted communities in the Niger Delta or from the environmental disaster that are the Canadian tar sands. Thus we aim to make the social metabolism of society more apparent and to make visible the related conflicts that are the other side of consumption.'

EJOLT is scheduled to run until 2015, and is made up of 23 academic organisations, think-tanks and activist organisations involved in environmental justice. The project received around EUR 3.7 million in funding from the EU.

The project is coordinated by the Autonomous University of Barcelona in Spain.

1 'Environmental justice organizations, liabilities and trade'.

Funded under the FP7 specific programme 'Capacities' under the theme 'Science in Society'.
<http://cordis.europa.eu/news/search/36104>
Project website: <http://www.ejolt.org/>



Improving waste management in western Africa

Reducing waste generation is a key step to preventing pollution and environmental degradation. A recent EU-funded project looked at how various stakeholders could contribute to sustainable 'solid-waste management' (SWM) in western Africa.

Living conditions for most people in most African countries are poor. One contributor to this is the lack of appropriate waste-management structures

at national and regional levels. This leads to an accumulation of waste resulting in, among other things, uncontrolled burning, open dump sites and loss of

valuable resources due to inefficient recycling.

The IWWA¹ project set out to address this issue by bringing together various authorities to help in selecting and promoting appropriate waste-management systems. The project focused on four countries: Ghana, Ivory Coast, Nigeria and Senegal.

Project partners identified possible policies, technology options and systems based on the regional situation and needs of the targeted countries. They also developed guidelines for the selection and implementation of the relevant systems and assessed the potential influence these systems could have on waste sectors.

Project successes were possible through the participation of a number of stakeholders, both local and international. Best practices related to waste management were identified in European and non-European countries and knowledge and

expertise was shared among the stakeholders.

IWWA has permitted the strengthening of formal and informal networks on waste management in the four target countries. Stakeholders have improved their understanding of waste-management and treatment technologies so that they can now implement the proposed measures to positively influence SWM.

The project was coordinated by the Technology Center Bremerhaven in Germany.

1 'Integrated waste management in western Africa'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
http://cordis.europa.eu/result/brief/rcn/11564_en.html
Project website: <http://www.iwwa.eu/>





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Towards EU-China cooperation in ICT

FP7 projects are not all about concrete research and new technologies. Some initiatives — equally important — aim to forge bonds between scientific communities, whether from different disciplines or different regions. The OPENCHINAICT project is one example.

'Information and communication technologies' (ICTs) are one of the most competitive and innovative markets in the world. The statistics speak for themselves: over 2.7 billion people are using the internet in 2013, and more than 6 billion have access to a mobile phone. According to European Commission Vice-President Neelie Kroes, fully completing the EU's single market in digital communications could boost our economy by up to EUR 110 billion a year; over 0.8% of the EU's GDP.

Innovation, better infrastructures and investment in R&D are key to achieving this objective, as the sector does not allow for 'second thoughts'. International competition is fierce, with countries such as China expected to spend as much as EUR 234 billion on ICTs in 2013. But is there room for cooperation as well?

The FP7-funded project OPENCHINAICT¹ has spent almost two years emphasising

the mutual benefits increased cooperation could bring to the two regions. Europe has much to learn from China's efforts in ICT research to prepare for future challenges, and Chinese ICT research can benefit from integration into the European research environment. Kay Matzner, coordinator of OPENCHINAICT, told *research*eu results magazine* about the actions taken by the project to enhance direct dialogue among stakeholders — including policy-makers and researchers — from both the EU and China.

What are the main objectives of the project?

The overall objective of OPENCHINAICT was to significantly and measurably contribute to the facilitation of ICT-related research cooperation between Europe and China. This has been implemented by the creation of both a European and a Chinese roadmap survey to review ICT research landscapes on both sides. To enhance

further cooperation and initiate policy dialogues, the project organised a major conference and two thematic workshops related respectively to 'Smart and sustainable cities' and to the 'Internet of Things', in different Chinese regions. Furthermore, policy consultation meetings between official stakeholders from Europe and China have been supported by the consortium.

The project outputs have been used to draft the 'EU-China ICT cooperation plan', which is intended as a guideline for the European Commission's DG CONNECT to promote international Europe-China cooperation in ICT.

Can international competition coexist with increased cooperation?

All economic and econometric theories and data support internationalisation in view of the benefits for all in terms of economic integration and research. In



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Kay Matzner

research, such collaborations are crucial for making breakthroughs and tackling global challenges, as they give access to the best competences and minds available. Internationalisation has fully impacted R&D systems everywhere in the world, and innovation value chains are now interconnected.

The overall economic impact of internationalisation for all actors involved is positive due to capacity effects, reverse technology transfers, market access effects and other advantages. In the case of China, an important driver for successful European economies has been increased trade in high-technology products. It helped us cope with the recent global financial crisis, but this entails

Europe being able to assess its own innovation systems. Some less successful European economies still have room for improvement in this regard.

What mutual benefits do you expect from ICT collaboration with China?

The OPENCHINAICT consortia carried out a thorough analysis in China and Europe to review and better understand all important aspects of such collaboration. Chinese and European contributors identified potential mutual benefits such as market-access opportunities, mutual implementation of standards, mutual know-how access and exchange, improved political dialogues, and mutual access to human and in-kind resources.

However, such collaborations are challenged on both sides by cultural misunderstandings, unintended know-how transfers, competition and political conflicts. Whilst Europeans seem rather supportive of such collaborations, our Chinese interlocutors don't fully understand the added value of European Commission-funded research for them and are therefore reluctant to support such collaborations on a European level with their own resources.

What difficulties did you encounter and how did you solve them?

Projects with partners from emerging economies such as China are always challenging. This is notably due to differences in terms of working cultures, organisational structures, methodologies, backgrounds and legal environments. Such challenges may lead to delays in project implementation, and cannot always be

anticipated when setting up such projects, as people and partners are always different. OPENCHINAICT was no exception in this regard, but we managed to solve these issues by intensifying our communication and management efforts.

What are the concrete results from the project so far?

OPENCHINAICT is not conducting concrete research but rather working on the facilitation of a dialogue between European and Chinese stakeholders to facilitate and develop real research cooperation. The main tangible result is the cooperation plan we put together, but we also enhanced networking channels for Chinese and European officials and researchers.

How will the project benefit ICT research and cooperation?

The project consortium presumes that the cooperation plan will be widely received and accepted by the European Commission and Chinese officials. It will provide them with guidance on how to improve research collaborations.

What are the next steps in the project?

The project is progressing with its two most important goals: publication of the final cooperation plan and the final OPENCHINAICT conference which will be held in Vilnius on 5 November. Participants interested in our conference or in accessing our project documents should check our project webpage.

The project is coordinated by Fraunhofer in Germany.



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OPENCHINAICT consortium

1 'Opening European-Chinese cooperation on ICT research'.

Funded under the FP7-specific programme 'Cooperation' under the research theme 'Information and communication technologies' (ICT).
Project website: <http://openchina-ict.eu/>

The trouble with searching through multimedia

The amount of multimedia content has exploded, but searching this galaxy of footage to find relevant information is difficult since searches are textual rather than audio or visual. An EU-funded project has come up with a new search methodology to help resolve this challenge.

Mind-boggling quantities of multimedia content are generated every day. For example, some 60 hours of video are uploaded every minute on YouTube alone.

However, the contemporary many-to-many paradigm of information flow presents a number of significant challenges, particularly when it comes to searching for

and finding relevant information. This is especially tricky for multimedia content, since searches are mostly conducted using text, not images or sounds.

With EU backing, the MIESON¹ project aimed to bolster the effectiveness of tools designed to access, discover or create multimedia content in real-world applications. The project focused on leveraging cutting-edge technology to create a novel user-centric approach to information retrieval.

Project members developed methods for learning to develop statistical models from the combination of content and context information. This has resulted in three new methods, including an approach that leverages unstructured contextual information from user-generated content.

To date, two scientific articles and a conference paper on the project have been published, and the MIESON team has attended several talks and various scientific research events.

Once incorporated into applications, the findings of the project should help make the searching of multimedia content that bit more intuitive.

The project was coordinated by Telefónica I+D in Spain.

- 1 'Multimedia information extraction from social networks'.

Funded under the FP7 specific programme 'People' (Marie-Curie actions).
http://cordis.europa.eu/result/brief/rcn/11735_en.html



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Crystal quantum memories for quantum communication

Research into the strange phenomenon known as quantum entanglement — once described as 'spooky' by Albert Einstein — could revolutionise ICT over the coming years, enabling everything from ultra-fast computing to completely secure long-distance communications. EU-funded researchers are carrying out cutting-edge work on quantum technologies, with one team recently demonstrating a key breakthrough in extending the range of quantum communications.

In essence, quantum entanglement occurs when particles such as photons or electrons interact physically and remain intimately connected after they have become separated, even if they are thousands of kilometres apart. It defies

our common-sense instincts and everyday experience of the physical world, but one particle located in Tokyo, if measured by an observer, would exhibit the exact qualities of its entangled counterpart in Brussels.

A pair of quantum systems using photons in an entangled state can be used as a quantum information channel to perform computational, communication and cryptographic tasks that are impossible for classical systems. And, crucially for communications purposes, since the photon pairs are intrinsically linked, they provide complete security and fidelity — because when one photon is measured it reveals with absolute certainty what the other photon would reveal if measured. In addition, if the signal were intercepted by a third party, it would immediately be detected, as the entanglement would have to be broken in order to intercept the message. Once the entanglement is

broken, it cannot be restored. These properties open up a whole new world of applications.

'Applications of quantum technologies are still in their infancy. Hence, it is likely that we are not yet aware of most future applications,' notes Professor Nicolas Gisin of the Group of Applied Physics at the University of Geneva in Switzerland. 'These future applications of quantum technology would probably look like magic to people who are around today.'

Quantum computing could enable us to solve a query — in code-breaking, for example — by looking at all possible input



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combinations at the same time. Whereas current computers could take years to investigate every possible input combination, in the quantum computer they are all tested at once. And quantum entanglement might permit instantaneous communication, or even allow us to teleport solid objects from one place to another.

Prof. Gisin and a team of researchers from four European countries — France, Germany, Sweden and Switzerland — have taken an important step forward in making that magic happen. Their work is expected to contribute to the development of commercial applications for quantum communications technology within the next 10 years.

Working on the QUREP¹ project, with the support of EUR 1.9 million in funding from the European Commission, the consortium has taken important steps towards a quantum repeater that can boost quantum signals across greater distances, bringing long-distance quantum communication closer to reality.

Quantum communication has already been proven possible over short distances, but the means to reliably separate entangled photons by greater distances had been lacking until now. The QUREP researchers have made significant strides toward solving the problem by developing key components of a quantum repeater. The quantum repeater is similar to the repeaters used in standard communications today and its role is to boost an

incoming signal and repeat it on the other side, so the signal does not lose its strength as it travels.

‘Quantum repeaters are the elementary building blocks of long-distance quantum communications. They require the ability to distribute entanglement over tens of kilometres, quantum memories and entanglement swapping by joint measurements on two photons. We concentrated on quantum memories, which represent the biggest challenge,’ Prof. Gisin explains. ‘Results are very encouraging, although it is clear that a lot remains to be done to bring this technology to a level suitable for industrialisation.’

The team developed solid-state quantum memories from rare-earth ion-doped crystals, which absorb a photon on the input side of the signal and emit a new photon with identical entanglement properties on the other side.

‘The bandwidth of quantum memories is a great challenge,’ Prof. Gisin notes. ‘Our quantum memories have a bandwidth relatively large compared to alternative approaches. Nevertheless, they are limited to some hundreds of megahertz (MHz). Hence, developing sources of entangled photons with compatible bandwidths and high stability was one of our challenges. Overcoming it, we could demonstrate entanglement between two of our quantum memories.’

In tests, the team was able to send a signal photon to the crystal to

be stored, while the other photon, known as the idler, was kept back. The signal photon could then be detected at a laboratory 50 metres away from the Group of Applied Physics, which when measured revealed with absolute certainty the outcome of the measurement of the idler photon.

‘Using large ensembles of ions greatly simplifies the coupling between the photons and the memory, both for storing and retrieval. And we work at about 3 kelvin (−270°C), a temperature rather easily reached and compatible with the best superconducting single-photon detectors,’ Prof. Gisin says. ‘There are not too many projects that can bring together all of the technologies and know-how necessary to demonstrate quantum repeaters and that is something that QUREP certainly achieved.’

However, for the technology to move out of the lab and into real-world applications, several key challenges still need to be overcome.

‘Challenges that remain are longer memory times (up to one second), higher efficiencies (up to 80%) and still more efficient signal sources. Even then, it will be a great engineering challenge to have everything working together,’ Prof. Gisin acknowledges.

Members of the consortium, which includes leading research institutes and companies, plan to continue their research into quantum repeaters and may look at commercial

spin-offs from their work further down the line.

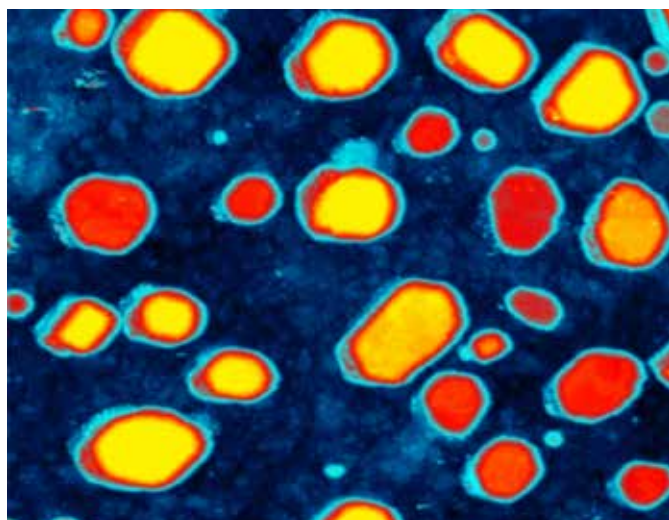
For commercial applications to materialise, the QUREP coordinator foresees the need for a feasibility demonstration of a quantum repeater for direct communication, as well as a fine analysis of simplifications, industrialisation and lower development and manufacturing costs.

‘I believe this is all feasible, but still requires quite some time for physicists,’ he says. ‘The gap between academic research and industry is huge. I believe we have made a great step towards bridging this gap, although a second step of similar amplitude is still needed before an engineering project could develop a product. In the first step, the one conducted during QUREP, we have identified precisely the challenges that remain to be overcome and the promising paths to overcome them.’

The project was coordinated by the University of Geneva in Switzerland.

1 ‘Quantum repeaters for long-distance fibre-based quantum communication’.

Funded under the FP7 specific programme ‘Cooperation’ under the research theme ‘Information and communication technologies’ (ICT).
http://cordis.europa.eu/result/brief/rcn/11667_en.html
 Project website:
<http://quantumrepeaters.eu/>



Two-in-one measurement system for novel nanowires

Miniature semiconductor wires offer exciting potential for new devices in a variety of fields. Simultaneous measurement of structural and electrical data will facilitate rapid and accurate characterisation of properties, speeding up design.

Semiconductor nanowires are extremely thin wires with diameters on the scale of 20–80 nanometres (nm) and up to several micrometres in length. This makes them particularly

interesting for applications in optoelectronics, sensors, biomedicine and energy. Exploitation requires careful characterisation and rational design yet, until now, measurements of structure and

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electrical properties could only be done separately.

Scientists have now combined approaches in a single set-up to enable the simultaneous measurement of atomic surface structure, local electronic properties of individual nanowires, and global electronic properties of a device made of such wires. EU funding of the NANOWIREDEVICESTM¹ project enabled researchers to use 'scanning tunnelling microscopy' (STM) and 'scanning tunnelling spectroscopy' (STS) together with external voltage application to obtain information on chemical and atomic composition and structure as well as

charge distributions and device performance.

Researchers prepared nanowires and conducted STM experiments on various compositions, observing atomic-scale crystal structure while moving along the length of 'very-large'-diameter (more than 250 nm) nanowires. STS on freely suspended nanowires was optimised to yield important information about the transition in crystal structures along the length of a wire. 'Ultra-high-vacuum' (UHV) conditions are favourable for nanowire surface cleaning. Experiments to measure conductivity and transport have yielded very promising

results with no device breakdown observed until about 150 °C above the required cleaning temperatures.

Investigators developed the set-up to conduct combined measurements using STM/STS and 'atomic-force microscopy' (AFM), and used it to study individually contacted nanowires. In addition, scientists used a combined STM/AFM probe tip to both influence local conductivity and simultaneously measure resulting current through the device.

The technology delivered by NANOWIREDEVICESTM scientists will play a pivotal role in

speeding up the development time of novel components and devices.

The project was coordinated by Lund University in Sweden.

- 1 'Combined structural and electronic characterisation of semiconductor nanowire devices on the atomic scale using scanning tunnelling microscopy and spectroscopy'.

Funded under the FP7 specific programme 'People' (Marie-Curie actions).
http://cordis.europa.eu/result/brief/rcn/11724_en.html

Putting a seal of security on the 'Internet of Services'

Book a flight online, perform an internet banking transaction or make an appointment with your doctor and, in the not-too-distant future, the 'Internet of Services' (IoS) will come into play. A paradigm shift in the way ICT systems and applications are designed, implemented, deployed and consumed, IoS promises many opportunities but also throws up big challenges — not least ensuring security and privacy. Such issues are currently being tackled by EU-funded researchers.

IoS is a vision of the future internet in which information, data and software applications — and the tools to develop them — are always accessible, whether locally stored on your own device, in the cloud, or arriving in real time from sensors. Whereas traditional software applications are designed largely to be used in isolation, IoS brings down the barriers, thereby lowering costs and stimulating innovation.

Building on the success of cloud computing, IoS applications are constructed by composing services that are distributed over the network and aggregated and consumed at run-time in a demand-driven, flexible way. This new approach to software will make the development of applications and services easier — so that new and innovative services, not possible today, can be offered. It is likely to make a huge contribution to the

EU's strategy to make Europe's software sector more competitive.

IoS services can be designed and implemented by producers, deployed by providers, aggregated by intermediaries and used by consumers. Anybody who wants to develop applications can use the resources in the Internet of Services to develop them, with little upfront investment and the possibility to build upon other people's efforts.

In many ways, IoS solves the challenges of interoperability and inefficiency that can plague traditional software systems, but it can also create new vulnerabilities. How, for instance, can you trust that a service you are using is error free? Or that the different components from different developers that you are aggregating into a new application have all been tested for security vulnerabilities?

'Although it is always difficult to quantify exactly the impact of the absence of something, it is clear that the lack of efficient security-validation technologies has been slowing down considerably the wide adoption of web services by citizens, many of whom still do not trust the internet in general or the Internet of Services in particular,' warns Professor Luca Viganò at the Università degli Studi di Verona in Italy. 'It is thus not enough to develop good web-based services, or services that have been proved secure or which have been tested; rather, we also need a way to convince the citizen that they are indeed secure or have been thoroughly tested. The existence and use of automated tools



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that can put their “seal of guarantee” on newly developed services, or on services that have been downloaded from the web, will certainly guarantee higher confidence and trust.’

Prof. Viganò and a team of researchers from five European countries are putting the finishing touches to tools to provide precisely that much-needed ‘seal of guarantee’ on web services. Their work, carried out in the SPACIOS¹ project and supported by EUR 3.6 million in funding from the European Commission, combines novel, state-of-the-art technologies for penetration security testing, vulnerability-driven security testing, mutation-based security testing, automatic learning for model inference, model checking and code-extraction techniques.

A unique tool for security-testing web services

‘It is important to note that state-of-the-art security validation technologies exist, but they are typically used in isolation and at production time, whereas we need tools that can be employed to validate services at run-time,’ Prof. Viganò explains. ‘There are a number of other tools that have been used extremely proficiently for security testing, but none, to our knowledge, that combines all these techniques into one single tool, using one single formal language in input and output. The SPACIOS tool, we believe, possesses capabilities that no other tools exhibit.’

In grossly simplified terms, a user starts with a formal specification of the system to be tested in which its properties are specified as logical formulae. If no formal specification exists, the SPACIOS tool can generate a model automatically from the source code. The model is then tested for vulnerabilities using a state-of-the-art model-checking platform called AVANTSSAR (which Prof. Viganò helped develop in a previous project).

If an attack is found, the model checker outputs an attack trace, which can be used to generate test cases for the system. If no attack is found, the model is mutated to force standard vulnerabilities in the specification and the tests are repeated. Any attack traces that are uncovered are used to generate test cases, which are then rerun against the system. The process is repeated until all parameters and potential security vulnerabilities have been checked.

‘It is important to note that the different components of the tool can be used separately. They are integrated into an Eclipse platform, which allows the user to choose exactly what they want to do,’ the SPACIOS coordinator says.

The team tested the tool in various industry-relevant application scenarios with real-world applications. They looked, for example, for security vulnerabilities in SAML 2.0 Web Single Sign-On (an emerging standard that enables online business partners to authenticate

their users once within a federated identity environment), and in OpenID (an open and user-centric web-browser-based Single Sign-On protocol that provides a way to authenticate a user by asking them to prove that they control a unique identifier). Among other scenarios, they also applied the SPACIOS tool to a set of open-source web applications that include an online bookstore, a site for classifieds and an employee directory. These web applications have previously been used as targets for both source-code analysis and vulnerability testing.

Siemens and SAP, German industrial partners involved in SPACIOS, also put forward three other applications scenarios to validate the tool: Pervasive Retail (which contains a novel on-demand marketing management platform to create interactivity between consumers, retailers, and product providers through mobile phones), Infobase Document Repository (which implements a Document Management System that allows for the secure management and sharing of documents or data files using web browsers), and eHealth (based on mash-up systems that, on the one hand, create and use electronic health records and, on the other hand, aggregate other functionalities, like decision support for the practitioner, analysis of images and billing systems).

Given the breadth of the Internet of Services and its likely rapid expansion over the coming years, the

potential application scenarios for the SPACIOS tool are almost endless. Deployed widely, it would offer users better security and considerably lower web service development costs.

‘The SPACIOS approach will allow for smooth integration within the service development cycle, ranging from analysis at design time to testing at run-time, thus allowing developers to considerably reduce their costs. It is difficult to estimate this quantitatively, but we expect to be able to provide some measures once the integration has been taken up by the projects’ industrial partners,’ Prof. Viganò concludes.

Although the partners have no immediate plans to directly commercialise the tool, according to Prof. Viganò it is already being used in industry by Siemens, SAP and others. The project partners are also discussing the possibility of a follow-up project to further enhance the fault and vulnerability testing technology.

The project was coordinated by the University of Verona in Italy.

1 ‘Secure provision and consumption in the Internet of Services’.

Funded under the FP7 specific programme ‘Cooperation’ under the research theme ‘Information and communication technologies’ (ICT).
http://cordis.europa.eu/result/brief/rcn/11633_en.html
 Project website: <http://www.spacios.eu/>

Towards new-generation mini communication devices

Light, electrons and magnetism can interact in novel ways at small scales, with promising potential for advanced communications networks. EU-funded scientists have provided important control mechanisms to harness that potential.

Electronics are the technology of choice for most miniature communication networks (nano-networks). However, chips are plagued by losses in signal transmission due to resistance (dissipation losses) as well as relatively low signal-transmission

speeds. Optical networks on the nano-scale are limited in size by the wavelength of light.

Plasmonic materials are man-made metamaterials that exploit coherent electron oscillations called ‘surface plasmons’ (SPs)



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at the interface between a metal and a dielectric. When the SPs couple with a photon, a 'surface plasmon polariton' (SPP) is born. The SPP can propagate along the surface of the metal enabling a novel form of high-speed information transfer in nano-scale structures.

For them to be useful in communications networks, their propagation must be controllable with switches. One potential way to control the plasmons is with a magnetic field. Scientists initiated the EU-funded project

TASMANIA¹ to investigate this potential.

Researchers studied the optical properties and propagation of SPs in magnetic waveguides and cavities. This provided important insight into conditions leading to different types of propagation as well as electric- and magnetic-field distribution variations. Scientists demonstrated a switching effect as a result of electric-field asymmetry. They also modified radiation from the cavity by tuning magnetisation of the waveguide,

demonstrating the potential of magnetic control to switch field propagation.

The application of plasmonics in nano-scale communications networks offers high-speed data transmission with minimal loss in miniature devices compared to conventional electrical or optical technology. TASMANIA provided theoretical and numerical evidence supporting the use of magnetic switches in controlling SPP propagation that will significantly improve the future of nano-scale communication.

The project was coordinated by University College London in the United Kingdom.

- 1 'Theoretical study of molecular spin plasmonics for nanoscale communications'.

Funded under the FP7 specific programme 'People' (Marie-Curie actions).
http://cordis.europa.eu/result/brief/rcn/11710_en.html

Understanding how reading, knowledge and memory work

How do our brains assimilate knowledge from what we read? Combining computer modelling and experimental data, an EU-funded research project has delved into the processes behind text comprehension.



There is little agreement among experts on how humans build their knowledge through reading. In fact, scientists still have much to discover about the cognitive processes that go on inside our skulls and are essential to our functioning.

An EU-funded research project, CMOIG¹, set out to expand understanding in these areas. The multi-disciplinary project explored 'inference generation', looking at the extent and types of knowledge-based inferences that are constructed online during reading. The aim was to reconcile the three main conflicting theories of reading comprehension — memory-based, explanation-based and coherence-based — under common principles concerning the role of short-term and long-term semantic and episodic memories.

To further investigate the links between reading and different memory processes, a new computational model was developed that integrated previous work in this area. The findings were combined with experiments that used eye-tracking to measure different reading patterns.

The work succeeded in developing for the first time a

computational model that integrates dynamic reading processes with knowledge-based structures. Since the findings and new methods developed are applicable to other comprehension phenomena, they can be used to form the basis of future investigations.

Knowledge is essential for progress in our societies, so by improving our understanding of how humans acquire it, this project will bring benefits in many areas, including educational strategies and machine intelligence.

The project was coordinated by Leiden University in the Netherlands.

- 1 'Computational modelling of knowledge-based inference generation during reading comprehension'.

Funded under the FP7 specific programme 'People' (Marie-Curie actions).
http://cordis.europa.eu/result/brief/rcn/11730_en.html

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Save energy: commercial cooler chills beverage in just 50 seconds!

Commercial fridges and freezers keep food fresh and beverages cool. They are vital to modern commerce but troublesome for the environment. European industrial researchers set out to turn these power-hungry machines into a green technology of the future. The trademarked 'V-TeX' cooler they developed can chill a standard-sized beverage in under a minute. This is super-fast and means small quantities can be chilled on demand, saving huge amounts of energy.

Supermarkets, convenience stores, service stations, restaurants, hotels... wherever you find people with money to spend, you will find fridges, freezers and chilled vending machines filled with goods to sell. They are convenient and essential for preserving and serving food and beverages that meet the expectations of customers and relevant authorities. But there is a big problem with these handy machines — they consume massive amounts of power.

That whirring sound coming from the corner of a convenience store is a drinks fridge struggling to cool itself when the door is continually opened or new stock is added that needs chilling. The vending machines and open refrigerated cabinets in supermarkets are also working overtime trying to keep

their contents at recommended temperatures to preserve the quality.

Combined, commercial refrigerator/freezers like these are estimated to consume 85 terawatt hours (TWh) of electricity every year. That is roughly equivalent to the total yearly output of eight or nine late-generation nuclear power plants. This places a huge burden on power grids and the environment, and does not appear to be slowing.

The fact is, advances in refrigeration technology have struggled to offset the increasing number of units being introduced each year. For example, vending machine sales (EU-27) are expected to continue growing, from 126 000 in 2009 to 200 000 in 2020. This is where the EU-funded RAPIDCOOL¹

project stepped in to tackle the challenge by developing a new technology for cooling beverages efficiently and rapidly, which has attracted considerable interest from beverage-makers. The team realised the key to reversing this trend would be to break away from the traditional approach.

RAPIDCOOL focused on the problem of chilling small quantities on demand, removing the need for heavily stocked chillers to run continuously in order to supply 'cooled' drinks during business hours. The technology developed delivers considerable energy savings while, at the same time, keeps up with growing consumer demand.

Game-changing green technology like this could have a direct impact on the EU's 2020

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commitment to reducing energy use and greenhouse gas emissions while improving overall energy security, the team suggests.

EU Member States are preparing a combination of voluntary and mandatory initiatives to force a step change in energy consumption and the use of commercial refrigerated equipment. Probably the most prominent of these is the Energy Using Products (EUP) Directive which is expected to enter into force in 2014.

Up to 90% energy saving

RAPIDCOOL developed an autonomous, modular-cooling apparatus for cooling drink cans and bottles from room temperature to around 4 °C in some 50 seconds. The project's trademarked V-Tex technology recorded energy savings of 80-90% compared with open-front commercial refrigerators. Their modular system is easy to clean (and thus to meet hygiene standards),

simple to use, and has enhanced safety functions.

Although designed to work as a stand-alone unit, the cooling chamber can also be integrated into existing self-serve chillers. This has proved a real innovation, according to the team, and could potentially replace most, if not all, open-cabinet-style drinks fridges used around the world.

With V-Tex, notes the team, you get a cold drink every time with considerable reductions in energy use, therefore V-Tex not only matches but surpasses existing consumer expectations. It meets a broad spectrum of end-user requirements and has thus gained considerable interest from major corporations, including a leading global distributor of beer.

Agreements are in place to manufacture the system, and a family of related products are under way which target domestic use as

well as commercial/retail applications. Two patents have already been granted, with two more pending. Kelvin Hall, founder and managing director of Enviro-Cool Ltd (UK), who owns the patents, says: 'These patents were filed worldwide because of the massive appeal and environmental benefits of this green technology. The RAPIDCOOL project will be significantly beneficial to all SMEs involved.'

The project is coordinated by Vending Marketing in Slovenia.

- 1 'Development of a rapid cooling technology for commercial refrigeration applications'.

Funded under the FP7 specific programme 'Capacities' under the theme 'Research for the benefit of SMEs'.
<http://ec.europa.eu/research/infocentre> > search > offers > 31173
 Project website: <http://www.rapidcool.eu/>



Self-cleaning, water-resistant plastics for cars

Micro- or nano-machining involves adding nanotechnological properties to materials and surfaces, as well as the nano-modification of materials. Researchers have used nano-scale hydrophobicity structures like those found on a lotus leaf to produce a non-wetting plastic for the automotive industry.

The most famous natural example of self-cleaning can be found on the leaf of the lotus flower. Researchers have attributed this feature to highly water-resistant nanostructures known as micro-pillars. Water resistance and self-cleaning are desirable features for

plastics, so scientists have begun exploring ways to synthetically engineer nanostructures that would enable these features.

A project called NANOCLEAN¹ was funded by the EU to optimise and upscale the technologies needed

to produce nano-structured self-cleaning plastics for use in cars. This research has enabled the setting up of several small companies that are carrying the research forward to commercialisation.

Specifically, the project tested technologies such as laser pulsing, and industrial injection moulding on nano-structured surface moulds to produce a self-cleaning, hydrophobic plastic based on the lotus structures. Several specially formulated and modified polymers were also developed and tested for hydrophobicity.

One main conclusion of the research is that micro- and nano-textures can be applied to three-dimensional (3D) curved surfaces and that these textures are durable. NANOCLEAN technology prototypes showed wettability and easy-to-clean properties, as well as optical effects that could be used for other applications.

Overall, the project demonstrated that injection moulding represents

a promising technology to develop a nano/micro-structured surface with high performances and potentially low costs. The NANOCLEAN approach should provide solutions in passenger and industrial vehicles, and could have other applications in areas like biomedicine, electronics and white appliances.

The project was coordinated by Maier S. Coop. in Spain.

- 1 'Optimisation and up-scaling of self-cleaning surfaces for automotive sector by combining tailored nanostructured machined injection tools and functional thermoplastic nano-compounds'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP).
http://cordis.europa.eu/result/brief/rcn/11064_en.html
 Project website: <http://www.nanoclean-project.eu/>



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Promoting smart textile research and collaboration

European researchers shared their expertise to work towards developing a number of smart textile prototypes as a basis for international capacity building in the field.

The EU-funded PROCOTEX¹ project brought researchers together to share knowledge and techniques for smart textile manufacture. Ghent University

(Belgium), the Technological Education Institute of Piraeus (Greece), and Rhodes University (South Africa) participated in the project.

Each laboratory offered specific expertise and labs were established at the different partner institutions to allow access to one another's technologies. This enabled research towards three new smart textile prototype technologies: a textile fibre that could function as an 'on/off switch', a nano-fibre nitric oxide sensor and a nano-fibre nitric oxide filter. The collaborations and development of these prototypes were used as a framework to train students, as well as early-stage and experienced researchers.

PROCOTEX has resulted in 12 direct and 6 indirect publications

in high-impact-factor international journals, as well as patent applications. As such, the project not only succeeded in improving research capacities and infrastructure, but also in producing tangible scientific outputs.

The project was coordinated by Ghent University in Belgium.



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1 'Products of coated textiles'.

Funded under the FP7 specific programme 'People' (Marie-Curie actions).
http://cordis.europa.eu/result/brief/rcn/11729_en.html
 Project website: <http://www.procotex.eu/>

An aircraft sensor for atmospheric hazards

Researchers have developed a sensor for aircraft for the real-time detection of wind shear and wake vortex — two little-understood atmospheric hazards. The innovative system will improve passenger and crew safety as well as airport efficiency.



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Two major hazards for aircraft are wake vortex — powerful turbulence that follows behind an aircraft in motion through the air — and wind shear — rapid horizontal or vertical changes in wind speed. Both of these are major causes of accidents, especially at the critical phases of take-off and landing. However, little

is understood about either, and until now the main measures to reduce risks have involved mandatory spacing between aircraft, which reduces airport efficiency.

An EU-funded research project, GREEN-WAKE¹, designed innovative technologies to provide real-time detection of these

atmospheric hazards and a new concept in three-dimensional (3D) visualisation for aerospace applications.

Researchers from industry and institutes in different European countries collaborated on the four-year project. They developed an on-board sensor for aircraft based on a 'Light detection and ranging' (LIDAR) system, using remote sensing with reflected lasers and two ultra-lightweight mirrors.

GREEN-WAKE team members also developed an innovative system for the 3D visualisation of atmospheric hazards and carried out extensive testing in wind tunnels to refine their system in real-life conditions.

The project has enabled, for the first time, the real-time detection of atmospheric hazards at short range. This should enhance the safety of air travel for citizens

as well as improve the efficiency of airports. In addition, there is potential for the technology to be exploited in other aeronautics and space applications.

The project was coordinated by Sula Systems in the United Kingdom.

1 'Demonstration of LIDAR-based wake-vortex detection system incorporating an atmospheric hazard map'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Transport'.
http://cordis.europa.eu/result/brief/rcn/11707_en.html
 Project website: <http://www.greenwake.org/>

Revolutionary new magnetic materials

EU-funded scientists have conducted cutting-edge research and developed manufacturing, characterisation and modelling techniques for a completely new class of man-made magnetic materials.

Metamaterials are a relatively new class of man-made materials with artificial periodic structures. Their revolutionary electromagnetic (EM) functionalities are due to light (photonic metamaterials) and electron (electronic metamaterials) propagation.

Scientists set out to develop magnetic metamaterials with novel functionalities supported by EU-funding of the MAGNONICS¹ project.

The MAGNONICS consortium adopted existing or developed new nano-manufacturing techniques

specifically suited to magnetic metamaterials production. These included various lithography and etching techniques, deposition processes, and conventional sputtering and evaporation techniques. In addition, scientists developed new or adapted existing dynamic characterisation techniques enabling ground-breaking experiments that promise to guide future research and development in the field. Experimental characterisation has been complemented by the development of theoretical tools to describe and predict the behaviours seen during dynamical testing.

Finally, using the manufacturing techniques and the experimental and theoretical tools, project partners created magnetic metamaterials. These were incorporated into working miniature devices instead of conventional continuous magnetic materials in microwave telecommunications or magnetic (magnonic) logic devices.

MAGNONICS contributed ground-breaking tools, techniques and new materials to the rapidly growing field of magnetic metamaterials. Outcomes promise to pave the way for the exploitation of these in future devices for exciting new functionalities.

The project was coordinated by the University of Exeter in the United Kingdom.



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- 1 'Mastering magnons in magnetic metamaterials'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP).
http://cordis.europa.eu/result/brief/rcn/11708_en.html
 Project website:
<http://www.magnonics.org/>

An alternative to pasteurisation

Researchers have developed a new approach to milk treatment in response to a growing preference to consume milk that is safe but which retains more of the natural characteristics of raw milk. Their prototype machine uses lower temperatures than pasteurisation, resulting in less thermal damage to the milk.

Rural populations across Europe still drink raw milk, and other consumers prefer unpasteurised milk, believing it to have a higher nutritional value. However, the consumption of raw or inadequately pasteurised milk has been associated with food-borne illness such as salmonella.

Pasteurisation prevents this by killing bacteria, yeast and fungi, but the high temperatures used also change the taste, and reduce the levels of vitamins and bioactive compounds. The EU-funded SMARTMILK¹ initiative investigated an alternative milk-treatment technology that would retain the natural flavours and components of milk, while ensuring consumer safety.

The SMARTMILK prototype combines a 'pulsed electric field' (PEF), ultrasound and moderate heat.

This approach uses less stringent techniques to inactivate micro-organisms, but results in a similar shelf-life as that achieved with conventional pasteurisation.

Project developers were committed to making the system affordable, robust and easy to maintain. In the initial stages, they surveyed milk processors, cheesemakers, yoghurt manufacturers and dairy-equipment providers in order to define the industrial specifications. From this, they developed a modular prototype unit that can be easily transported and used in typical industrial dairy plants.

The functionality and technology of the system was validated in a pilot plant facility in Spain. It was tested for the treatment of milk, as well as for its suitability in cheesemaking and yoghurt manufacture.



© Carlota Feliu Aguilá

The results of the validation tests indicated that the SMARTMILK system can be used to inactivate the micro-organisms present in the raw milk. The sensory characteristics of cheese made from pasteurised milk were preferred over SMARTMILK cheese. Unlike conventionally pasteurised dairy products, SMARTMILK yoghurt showed lower viscosity and a smoother texture.

At this stage, the prototype proved the concept in industrial conditions, but it is not yet suitable for systematic industrial exploitation. During the post-project phase, more work will be done to scale the technology up to commercial scale for market exploitation. The potential for this system to be used in the treatment of other liquid products,

such as fruit juices, wine and beer, is high. The SMARTMILK approach is expected to benefit consumer safety and confidence, which could in turn improve the competitiveness of thousands of European milk-processing small to medium-sized enterprises (SMEs).

The project was coordinated by IRIS in Spain.

- 1 'A novel system for the treatment of milk based on the combination of ultrasounds and pulsed electric field technologies'.

Funded under the FP7 specific programme 'Capacities' under the theme 'Research for the benefit of SMEs'.
http://cordis.europa.eu/result/brief/rcn/11720_en.html

SPACE



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Ensuring sky-high return on investment for the ISS

Since the first team of astronauts went on-board in 2000, the International Space Station has cost the international community over EUR 7 billion. Whilst a significant amount of data has been generated, ensuring a return on the investment requires the storage, dissemination and exploitation of this new knowledge.

Most people see the International Space Station (ISS) as the shiniest and most expensive example of post-Cold-War space cooperation between nations. But what is less well-known is the amount of valuable scientific data that is harnessed thanks to this joint undertaking. Over 400 scientific experiments in fields such as biology, human physiology, physical and materials science, and Earth and space science have been conducted on the ISS over the last decade.

Initiated in July 2012, the CIRCE¹ project aims to build and develop an international e-infrastructure capable of supporting and promoting the exploitation of the scientific data generated by the ISS and other major space missions. The stakes are high, and so are the obstacles: a large number of partners can be difficult to coordinate, and there is currently a lack of regulations and guidelines for data dissemination and exploitation.

Luigi Carotenuto, technical manager of CIRCE, explains how the project is contributing to an e-infrastructure roadmap and the definition of guidelines for future research programmes.

What are the main objectives of CIRCE?

CIRCE is a coordination action promoted by Telespazio and the German and French space agencies (DLR and CNES respectively). It is co-funded by the European Commission under FP7, and has two major objectives. The first involves designing a roadmap for establishing a European e-infrastructure capable of ensuring the long-term preservation and exploitation of the scientific data produced on-board the International Space Station. Secondly, we aim to foster co-operation with the international partners of the ISS in order to achieve a common vision of data e-infrastructure.

Why was it important to initiate this project?

Space data are an important scientific asset. Not only do they demand a huge amount of resources — making them almost impossible to repeat — but they are also submitted to rigorous peer review, which provides for unique scientific content. And they concern a broad spectrum of scientific domains, from life and material sciences to physics. The use of space data should be maximised as it contributes to the development of knowledge and applications that directly benefit citizens.

The ISS is the most complex and powerful laboratory for research in space, but preservation of the data over the long term is not assured. Data preservation and accumulation would provide the basis for further research and knowledge development. However, achieving this requires a data

e-infrastructure able to support systematic preservation of data from the ISS and other space platforms and allowing users to find, access and exploit such data.

CIRCE stems from the previous ULISSE² project, which was promoted by the European centres for scientific operations on ISS and co-funded by the European Commission. Being the first initiative of its kind, ULISSE explored the main issues of data preservation for the ISS, identifying possible solutions and tools. It also implemented a demonstrator which provides the main services for data access and use by integrating a set of distributed resources. The demonstrator has shown the feasibility and usefulness of an e-infrastructure to interoperate with ISS-distributed repositories in accordance with relevant legal constraints.

The ULISSE experience also indicated that establishing an operative data e-infrastructure would require close cooperation between the main ISS stakeholders — CIRCE intends to respond to this need.

What is new about the way CIRCE addresses ISS-related cooperation?

For the first time with the ISS, we are promoting a new vision for research based on an enhanced sharing of space data to promote its further use. The European Commission, space agencies, ICT companies and experts, and various scientific communities have all come together for this project, which is essential to the realisation of a data e-infrastructure although it has never been attempted before.

CIRCE ensures the constant involvement of all the necessary parties and the promotion of these coordinated initiatives.

What difficulties did you encounter and how did you solve them?

A common vision for ISS data exploitation and the possible benefits of a cooperative approach has not been consolidated yet. This is reflected, for example, by the diversity of policies for data dissemination used by different stakeholders.

The CIRCE project has collected the various standpoints on the subject; moreover, through its international workshops the project is stimulating a joint discussion with all the ISS research stakeholders, proposing possible solutions and future initiatives for their implementation.

What are the concrete results from your research so far?

The project has already achieved technical results and taken important coordination initiatives. From a technical point of view, we have assessed user communities and their needs in terms of data exploitation, defined the services to be deployed by a data e-infrastructure, and identified a new data model.

In terms of coordination initiatives, we prepared a position paper that has been signed by all European scientific operation centres, which drew attention to the relevance of ISS data preservation ahead of the ESA Ministerial Conference held in November 2012.

A first workshop was also held successfully at the European Commission in Brussels in February 2013. It gathered together representatives of various space agencies (ESA, ASI, CNES, DLR, CSA and Roscosmos), the scientific community engaged in ISS research, and experts in relevant information technologies. Requirements and key issues — such as the need to harmonise data policies, engage the user community through the proper recognition of scientific merits, and enable users to find and retrieve space data — were identified by the participants.

What are the main outcomes you expect from this project?

The project will identify the main programmatic steps and technical solutions. It will draft an implementation roadmap and will identify the possible funding opportunities for the development of a data e-infrastructure for the ISS. In addition, CIRCE will contribute to international cooperation among ISS partners to improve the dissemination and utilisation of scientific space data.



© Luigi Carotenuto

Luigi Carotenuto

What are the next steps for the project?

The project is now preparing the second international workshop on the exploitation of ISS data, which will be held in Brussels at the Belgium Royal Observatory on 26-27 November.

After the completion of CIRCE, we plan to deepen the knowledge representation in the domain of ISS experimentation in order to improve data models. On this basis, we will keep pursuing opportunities to develop an e-infrastructure for the exploitation of ISS science data.

CIRCE is coordinated by Telespazio in Italy.

- 1 'Cooperative International Space Station research data conservation and exploitation' funded under the FP7-specific programme 'Capacities' under the theme 'Infrastructures'.
- 2 'The USOCs knowledge integration and dissemination for space-science experimentation'.

Funded under the FP7-specific programme 'Cooperation' under the research theme 'Space'.
Project website: <http://www.circe-space.eu/>

New dawn for space research

Space science experimentation and its results can now be accessed much more readily by stakeholders, enhancing the European Research Area (ERA) and the continent's knowledge economy.

As the largest space initiative currently in operation, the International Space Station (ISS) has helped produce large amounts of important research and data about our world. This achievement has been

supported by the European 'User support and operation centres' (USOCs) for the ISS, thanks to strong links among all stakeholders in space research. Against this backdrop, the EU-funded project

ULISSE¹ has improved the exploitation of research results from the ISS and other space platforms.

The project team surveyed users and analysed their needs

to understand how to improve the use of emerging data. It aimed at documenting and harmonising legal constraints for disseminating ISS data, identifying high-tech tools to manage knowledge efficiently and exploit data effectively. The endeavour involved the production of a research project catalogue, while the defining of a metadata



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standard helped describe experiments in the catalogue.

ULISSE also established a portal to promote the project and involve the user community. It developed a set of online

services through this portal designed to support searching, browsing and managing knowledge bases. Specifically, the portal was established to provide scientific and technical data concerning most scientific

disciplines, from space medicine and exobiology to biotechnology and materials sciences.

Overall, the project team proved that building an e-infra-structure for scientific data

preservation and exploitation is feasible, and can become a valuable tool for research. This will pave the way for a more sophisticated research mechanism that will support space research and strengthen the European knowledge economy, with direct benefits for scientific productivity and education. The project's website has a private area for users.

The project was coordinated by Telespazio in Italy.

- 1 'The USOCs knowledge integration and dissemination for space science experimentation'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.

http://cordis.europa.eu/result/brief/rcn/10004_en.html

Project website:
<http://www.ulisse-space.eu/>



ALMA observatory opens window to universe's darkest secrets

The Atacama Large Millimeter/submillimeter Array (ALMA) in the Chilean Andes allows astronomers to peer into some of the darkest and furthest parts of the universe, unveiling some previously hidden secrets.

ALMA produces high-quality interferometer images at wavelengths in the range between infra-red light and radio waves. The observatory, a partnership of European, North American, and East Asian countries, was officially inaugurated in March 2013.

The EU-funded project ALMA ENHANCEMENT¹ was part of Europe's contribution to the observatory. The project, coordinated by the European Southern Observatory, built the hardware and software components that produce high-fidelity images and high-resolution measurements of water vapour spectral lines.

Water is an important constituent of star-forming regions and comets, so measuring the best



© ESO and C. Malin

and most complete data set of their spectral lines is crucial to discovering more about the universe's origins.

Gie Han Tan, ALMA's system engineer and European front-end project manager at the European Southern

Observatory, says ALMA's construction, which started in 2003, was quite a feat and marked a milestone in international scientific cooperation.

'In about 10 years, the largest and most-advanced millimetre and submillimetre radio

observatory has been built from scratch in the remote Atacama desert in Chile,' he says.

ALMA ENHANCEMENT played its part by contributing to some of the observatory's early scientific work, which began in

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2011, and giving Europe's astronomers access to state-of-the-art instrumentation.

'Under ALMA, European industry and research organisations have developed advanced technology such as receivers and antennas that could have potential spin-off for other, commercial, applications,' adds Tan. The project has also injected hundreds of millions of euros into the European construction industry.

Now, the ALMA observatory is producing a steady stream of scientifically significant results. These include giving

scientists the best view yet of an embryonic monster star in the process of formation, and pinpointing the location of more than 100 of the most fertile star-forming galaxies in the universe.

Another breakthrough was the detection of sugar molecules in the gas surrounding a young star, revealing that these building blocks of life could be incorporated into any planets forming around the star.

In July, the radio telescope gave astronomers the best view of how vigorous star formation can blast gas out of a

galaxy and starve future generations of stars of the fuel they need to grow.

These findings, and many others that continue to emerge, could help scientists and citizens in many ways. 'ALMA develops society and furthers education by contributing to basic science such as in the areas of physics and chemistry,' says Tan.

With the inauguration this year, ALMA is officially open to the global astronomical community, which will benefit from its unique capabilities for at least 30 years. The world can expect

even more exciting and unprecedented discoveries about our universe.

The project was coordinated by the European Southern Observatory, based in Germany.

1 'Enhancement of ALMA early science'.

Funded under the FP6 specific programme 'Research infrastructures'.
<http://cordis.europa.eu/news> > search > offers > 36094
 ALMA website:
<http://www.almaobservatory.org/>

Satellite security boost at sea

Pirates, terrorists and disaster situations at sea can be scrutinised much more closely with the development of a next-generation radar satellite system.

The high seas are not as safe as they once were, particularly with emerging threats such as piracy and terrorism increasingly plaguing ships worldwide. One technology that has

helped combat these challenges involves spaced-based 'Global monitoring for environment and security' (GMES) systems. The EU-funded project SIMTISYS¹ is developing

a high-tech solution that improves early-warning systems and services connected to GMES.

Project members are looking at shortcomings, such as inadequate space-data acquisition off Somalian shores where piracy is rife. They are studying the barriers and issues of space-based capabilities in order to cover today's needs using computer modelling and simulations. This will help users identify possible threats and benefit from much more advanced sensing systems.

In more specific terms, SIMTISYS has worked on developing a system simulator that can emulate different realistic scenarios and alternative data-collection mechanisms from satellites in line with end-users' needs. This included the study of sensing systems and the information management chain, covering service quality, observation range, sea conditions, data processing, detection and tracking.

To achieve its aims, the project team has already collected user requirements and operational scenarios. It then defined the simulator's architecture, platform and interfaces, integrating



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the components before validating the system.

Much progress has been made already in developing the simulator. A comprehensive website also features details of all the workshops and events organised by the project, including information

about design, simulation and validation.

The final product is close to completion, providing innovative spaced-based 'Ground moving-target indication' (GMTI) techniques and next-generation radar satellite systems that could redefine

current GMES systems. Once in service, the system is expected to enhance safety and security at sea considerably.

The project is coordinated by Thales Alenia Space in Italy.

1 'Simulator for moving-target indicator system'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
http://cordis.europa.eu/result/brief/rcn/11628_en.html
 Project website:
<http://www.simtisys.eu>

Spacecraft braking simulation marks key step towards real flight test

Researchers in the EU-funded project AEROFAST have successfully simulated a flight manoeuvre in which a space vehicle uses a planet's atmosphere to slow itself down.

The project's laboratory simulation of the manoeuvre — known as aerocapture — marks an important step towards a real flight demonstration on a planet with atmosphere, such as Earth or Mars. Using the technique would allow space missions to save fuel, and weight, as well as expanding our ability to explore our solar system.

The project's researchers believe aerocapture technologies could eventually become a core capability for planetary transportation, moving

humans and cargo between geostationary Earth orbit and low Earth orbit, and also between the Earth and the Moon or Mars.

Led by France's Astrium, the researchers integrated expertise from a range of scientific disciplines, including areas such as aerodynamics and aerothermal environments.

The team designed and simulated a typical space mission to test the concept. They first established the

initial conditions required to perform each phase of a future outer space mission, including the launch, cruise and aerocapture phases.

They then worked on improving spacecraft design to meet these requirements. For example, they tested and improved algorithms for guidance, navigation and control (GNC) systems in a laboratory simulator. Then they simulated a complete mission under laboratory conditions to test spacecraft performance.

The tests confirmed that an aerocapture manoeuvre could work. The simulated mission was successful even in worst-case scenarios, while remaining within mass and budgetary constraints. The tests showed that their design of a biconic (aerodynamic) shape as the most appropriate choice for a spacecraft.

The project's prototype (a reduced-scale model) of a spacecraft's thermal-protection system based on cork also provided interesting results that should be considered further, the researchers say.

AEROFAST¹ project results already stand as a reference work for upcoming missions, including the European Space Agency's planned Mars exploration missions. The project's research has resulted in 14 articles being published in peer-reviewed journals.

AEROFAST received around EUR 1.9 million in EU funding and ran from 2009 until 2011.

The project was coordinated by Astrium in France.

1 'Aerocapture for future space transportation'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
<http://cordis.europa.eu/news/search/36074>
 Project website:
<http://www.aerofast.eu/>





Russian-EU cooperation for better earthquake prediction

An EU-funded project, PRE-EARTHQUAKES, has combined geophysical observations and parameters with refined data-analysis methods to improve earthquake prediction. For this purpose, observations from more than 20 different satellite systems (in particular those from European, Russia and US space agencies) and about 100 ground-based stations were systematically collected, integrated and analysed.

The PRE-EARTHQUAKES¹ project aimed to reduce the number of false alarms and improve reliability in earthquake prediction. To achieve this, it incorporated information from satellite and ground-based systems.

Researchers used the invaluable resources provided by the European Space Agency (ESA) and the Russian Federal Space Agency, ROSKOSMOS, to study their archived satellite data to amass data relevant to the preparatory phase of earthquakes. Another major goal was to create a global 'earthquake observation system' (EQUOS) as part of the 'Global earth observation system of systems' (GEOSS).

Altogether, observations from 20 satellite systems were used to study both surface and atmospheric — up to the ionosphere — anomalies that are regarded as possible precursors to earthquakes. The prime test areas were in Italy, eastern Russia and Turkey.

During the first year of PRE-EARTHQUAKES, the scientists collected a massive amount of data. A total of 6165 kinds of observations were performed, differing in measured parameter, observation technology, analysis method, geographic area or test period.

The data can be viewed and compared at the common integration platform,

PRE-EARTHQUAKES Geo-Portal (PEG). The project has also been presented at several international conferences, and an invitation to collaborate on a global scale as 'network members' within the EQUOS initiative was very successful, with all the main scientific players expressing interest.

PRE-EARTHQUAKES was the first initiative to draw together researchers from different countries to tackle a study of the preparatory phase of earthquakes without bias. The main course of prevention against earthquake damage is to build safe constructions. As that is not economically possible at present, better earthquake prediction promises to

offer the best protection for European citizens.

The project was coordinated by the University of Basilicata in Italy.

- 1 'Processing Russian and European Earth observations for earthquake precursors' studies.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
http://cordis.europa.eu/result/brief/rcn/11446_en.html
 Project website:
<http://www.pre-earthquakes.org/>



EVENTS

Dementia Europe: sharing best practice

A conference entitled 'Dementia Europe: sharing best practice' will be held on 27 November 2013 in London, the United Kingdom.

The impact of dementia on society means it is a public-health priority for countries across Europe, with more than 7 million Europeans affected by the disorder.

This conference will focus on the need for targeted research in Europe and around the world on dementia and its related conditions. Drawing on examples of best practice from service providers, social-care professionals and patient groups, the meeting aims to foster cross-field collaboration in advancing dementia research.

For further information, please visit:

<http://www.publicserviceevents.co.uk/273/dementia-europe>

Rehabilitation in cancer care

A conference on 'Rehabilitation in cancer care' will be held on 28 and 29 November 2013 in Manchester, the United Kingdom.

This conference aims to bring together health-care professionals new to the field of oncology and palliative care to provide an introduction to rehabilitation techniques in cancer care.

Rehabilitation in cancer treatment requires a multi-disciplinary approach. Areas to be discussed include psychological and spiritual support, cancer-related-pain relief, and best practice methods of communication.

For further information, please visit:

<http://www.christie.nhs.uk/school-of-oncology/education-events/rehabilitation-in-cancer-care.aspx>

International fluid academy days

The third 'International fluid academy days' will be held on 29 and 30 November 2013 in Antwerp, Belgium.

Fluid therapy consists of administering liquids to patients as a treatment or preventative measure. It can be conducted through intravenous, sub-cutaneous and oral routes. As the medical community shifts from seeing fluids simply as a method of stabilisation to the appreciation of the relevant side effects, this therapy has become increasingly common.

The conference will be a forum for specialists such as anaesthesiologists, emergency physicians and burn-care specialists to discuss the questions surrounding the use of fluid therapy. Topics of discussion include monitoring processes, infection prevention, transfusion strategies and fluid reactions.

For further information, please visit:

<http://www.fluid-academy.org/>

Implementation of eCall

An event on 'Implementation of eCall' will be held on 3 December 2013 in London, the United Kingdom.

eCall is a pan-European in-vehicle emergency call service based on '112' — the common European emergency number. In the event of an accident, data transmitted through the eCall system enables emergency services to assist vehicle drivers and passengers more precisely and quickly, thus helping to save lives and to treat injuries rapidly.

This event will provide attendees with the latest information on the HEERO projects — EU-financed initiatives aimed at the mass deployment of eCall systems in all automobiles in Europe by 2015. It will also cover issues on the legislation and standardisation of eCall.

For further information, please visit:

<http://www.smi-online.co.uk/utility/uk/masterclass/implementation-of-ecall>

International conference on environment, chemistry and biology

The second 'International conference on environment, chemistry and biology' (ICECB 2013) will be held on 13 and 14 December 2013 in Stockholm, Sweden.

This interdisciplinary meeting will bring together leading scientists, engineers and academics to present their research results and development activities. It will provide the basis for participants to establish business and research networks for future collaboration. It will cover topics such as sustainable cities, nanotechnology and biochemical engineering.

For further information, please visit:
<http://www.icecb.org/>

International conference on underground-space technology

The 2013 'International conference on underground-space technology' will be held on 13 and 14 December 2013 in Stockholm, Sweden.

As city development and regeneration projects become more ambitious, the use of underground space will require a greater consideration of the engineering aspects.

This conference will provide a meeting place for engineers, planners and developers to present their research findings and discuss their underground-space technology applications.

For further information, please visit:
<http://www.icust.org/>

MacroTrend conference on applied science: Paris 2013

The 'MacroTrend conference on applied science: Paris 2013' will be held on 20 and 21 December 2013 in Paris, France.

This conference takes a multi-disciplinary approach to research — covering applied science to benefit society, economy, business and overall human progress.

It will cover a diverse range of disciplines including chemistry, earth science and oceanography. With the aim of attracting an equally diverse audience, participants will discuss the importance of academic research in shaping modern public policy.

For further information, please visit:
http://www.macrojournals.com/conferences/applied_science_paris_2013

International conference on nanotechnology and biosensors

The fourth 'International conference on nanotechnology and biosensors' (ICNB 2013) will be held on 20 and 21 December 2013 in Paris, France.

This conference aims to bridge the gap between materials science and life sciences by demonstrating the increasingly important role of nanotechnology in the development of biosensors.

The event will bring together participants from a variety of disciplines to foster cross-field collaboration between different research fields and promote discussion on the latest theories and applications of nanotechnology in biosensors.

For further information, please visit:
<http://www.icnb.org/index.htm>

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