

research^{eu}

RESULTS MAGAZINE

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Special feature



Exploration of space: embarking on the final frontier
Interview with Manuel Collados of the European Solar Telescope project

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Publications Office



Published by
CORDIS Unit
Publications Office of the European Union
2, rue Mercier
2985 Luxembourg
LUXEMBOURG
E-mail: cordis-helpdesk@publications.europa.eu

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All issues of the *research*eu results magazine* are available online at:
<http://cordis.europa.eu/news/research-eu>

The *research*eu results magazine* is published by the Publications Office of the European Union, as part of the EU-funded research programmes. Content is prepared using several sources, including the Technology Marketplace on CORDIS, the Research Information Centre, as well as original material collected specifically for this publication.

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Shooting for the stars

This is an exciting year for European space research. In April, the European Commission announced it would identity and support actions at the EU level in the field of space exploration. The Commission also said it would further support research and development in the field.

'Space activities create high-skilled jobs, innovation, new commercial opportunities, and improve citizens' well-being and security,' said Commission Vice-President Antonio Tajani, responsible for Industry and Entrepreneurship. 'This is why we need to reinforce European space policy to best exploit its social and economic opportunities for industry and SMEs. In order to achieve our goals, Europe needs to keep an independent access to space,' he stressed.

*The EU already contributes immensely towards space exploration and research. The Very Large Telescope array (VLT) is a flagship facility for European ground-based astronomy. It is currently the world's most advanced optical instrument with mirrors 8.2 metres in diameter. But there is so much more to European space initiatives and research*eu results magazine wants to highlight just a few of those.*

This is why we are dedicating this issue's theme to 'Exploration of space: embarking on the final frontier.' We also want to point out that the World Space Week will take place in the first half of October. The World Space Week is the largest public space event and is celebrated in 55 countries.

We speak to Manuel Collados, project coordinator at the EU-funded 'European Solar Telescope' (EST) project. EST will become a 4-metre class solar telescope in the Canary Islands. It will measure the thermal, dynamic and magnetic properties of the Sun's plasma. The telescope is now in its conceptual design study stage. Mr Collados gives us compelling insight into the future of European ground-based astronomy and the technological wonders that continue to inspire a new generation of researchers.

However, first we start off the issue with an article in the biology and medicine section on new treatments that could block the transmission of malaria — a deadly and yet utterly preventable disease.

The energy and transport section leads with an article on integrating photovoltaic panels into textiles.

Next in the environment and society section we take a closer look at Saturn. Astronomers have been observing a massive storm brewing in its atmosphere since last December.

In our IT and telecommunications section, EU researchers are proving that learning can be an integral part of working life.

The industrial technology section leads with a story on how a new project is exploiting nanotechnology to make super composite materials and polymers. The results could sustainably reduce industry polymer costs.

The issue then ends with a list of events and upcoming conferences in the field of research and technology.

*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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- Technology Marketplace: <http://cordis.europa.eu/marketplace>
- Research Information Centre: <http://ec.europa.eu/research/infocentre>
- Thank you to Manuel Collados of the European Solar Telescope project for his contribution to the 'special' dossier in this issue

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Frequent acronyms

ERA	European Research Area	ICT	information and communication technologies
FP5/6/7	Fifth/Sixth/Seventh Framework Programme of the European Community for research, technological development and demonstration activities	IST	information society technologies
		R & D	research and development
		SMEs	small and medium-sized enterprises

Is this the end of malaria?

*Can the deadly scourge of malaria finally become a thing of the past?
New treatments developed by EU and African researchers show promise
in blocking transmission of the disease.*

Malaria begins with the bite of an infected mosquito, enabling a small number of the *Plasmodium* parasite to enter the human body and travel to the liver, where they multiply. The parasites become transformed and infect red blood cells, feasting on the haemoglobin and increasing in even greater numbers.

A single person can contain billions of the parasites, by which time he will usually display the symptoms of malaria. The result can be fever and headaches, with severe cases leading to hallucinations, coma and death as the waste from the broken red blood cells poisons the body. The disease cycle is continued when a mosquito then bites an infected individual and moves on to bite and infect others.

The EU-funded TransmalariaBLOC⁽¹⁾ project has investigated new ways to eliminate the scourge of malaria by making mosquitoes unable to transmit the deadly disease. Drugs and vaccines are being developed that target the *Plasmodium* parasite whilst it is inside the mosquito's gut, where it is in small numbers and cannot easily develop resistance. This is the time when the parasite is at its most vulnerable.

An additional approach is to make mosquitoes resistant to infection by the parasite. This can either be achieved by boosting the insects' natural immune system or by giving them new resistance properties. Scientists are also conducting rigorous mathematical modelling to study the effect that such treatments can have on malaria transmission.

Researchers from Europe have worked closely with African partner institutions to improve field-based malaria research and mosquito infection facilities, and to train personnel in the latest transmission-blocking techniques. Scientists discovered that transmission blocking depends upon the parasite densities.

New treatments and the training of local staff will help defeat this terrible disease, dramatically improving the quality of life of those living in areas where the disease is found.

As a result vaccines based on plant extracts and chemical molecules which possess the ability to block transmission are being investigated. Project partners are also studying molecular systems that allow the expression of genes in genetically modified mosquitoes, which can reduce infection by malaria parasites. If enough individuals are vaccinated an ever-decreasing number of mosquitoes will be capable of passing the parasite to new sufferers, until none have the disease.

Findings by the TransmalariaBLOC project can help scientists increase their understanding of the *Plasmodium* parasite and the workings of a new generation of anti-malaria drugs. New treatments and the training of local staff will help defeat this terrible disease, dramatically improving the quality of life of those living in areas where the disease is found.



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(1) 'Malaria transmission blocking by vaccines, drugs and immune mosquitoes: efficacy assessment and targets'.

Funded under the FP7 specific programme Cooperation under the theme Health.

<http://cordis.europa.eu/marketplace> > search > offers > 6266

Flying expertise back home

A well-respected expert in insects and how they affect our crops has returned to Europe from Africa to continue his valuable work. And the EU is supporting this positive development.

After 15 years in Kenya studying insect behaviour around crops, Dr Slawomir Lux returned to Europe bringing with him a wealth of experience. The EU jumped on the opportunity to fund his ongoing research initiatives, which Dr Lux had honed at Kenya's Centre for Insect Physiology and Ecology over the years.

Specifically, the EU is funding Dr Lux's Fruit Flies SGGW ⁽¹⁾ project, which looks at fruit fly behaviour and their response to integrated pest management (IPM) on farms. IPM is a more eco-friendly and intelligent approach to

controlling pests on crops and farms. Its use is highly recommended over traditional pest control methods that use strong pesticides.

The project is investigating insect behaviour, what attracts these insects and how attractants can be used in horticulture. Funding from the EU was deemed necessary to set up Dr Lux's base in his native Poland, where areas under his expertise remain under-represented.

With the EU's backing, in 2007 the Fruit Flies SGGW initiative established formal ties with the Warsaw University of Life Sciences, formerly the Warsaw Agricultural University. Dr Lux underwent specialised training in relevant fields, among other experience-building endeavours, paving the way to earning a formal degree as Doctor *habilitatus*. He has been building professional contacts and presence

through conferences relating to the field. This is aimed at supporting and encouraging projects and grants at Dr Lux's new research base at the university. Noteworthy too is his solid integration in the university's Department of Applied Entomology.

Dr Lux is expanding his qualifications on micro-encapsulation of biologically active compounds that assist in IPM. He is vigorously active in international events and organisations, having jointly published important findings and observations in many scientific journals. Subjects treated include attractants and traps for certain African fruit flies, effects of food deprivation on specific fruit flies and competitive displacement of invasive fruit flies among others.

This EU project brings us closer to perfecting IPM and protecting crops. It is also a model example of EU support for experts who boast unique experience that can be of benefit to the continent.

(1) 'Stochastic model of on-farm fruit fly behaviour and their response to IPM interventions'.

Funded under the FP7 specific programme People (Marie-Curie actions).

<http://cordis.europa.eu/marketplace> > search > offers > 6236



Mouse model highlights vascular function in diabetes

Diabetes mellitus is a metabolic disorder affecting some 20 % of the global population. Associated vascular diseases are the main cause of disability and mortality.

In diabetes, vascular structures and functioning are radically altered, making the human body prone to a host of potentially debilitating and even life-threatening situations. The ways in which signals are carried along the relevant pathways play a role in increasing reactive oxygen species (ROS) in the vasculature. ROS are a natural by-product of the normal metabolism of oxygen, but their

proliferation can severely damage cell structure and lead to oxidative stress.

The EU-funded NRFDIABVASC ⁽¹⁾ project is focusing on the implications of this ROS imbalance and resulting antioxidant cellular defences and how the Nrf2 transcription factor is involved. Initially, the project aimed to investigate how cytokines and glucose, both elevated in diabetic patients, regulate antioxidant gene expression in vascular endothelial and smooth muscle cells. To do this, researchers successfully established a diabetic animal model in knock-out mice, which served as the basis for a series of experiments.

Results showed that Nrf2 knock-out mice have reduced antioxidant gene expression, and that gain and loss of Nrf2 function regulates antioxidant stress proteins in endothelial cells.



Importantly, work on Nrf2 gene transfers showed that Nrf2 may protect against a hyperglycaemic and pro-inflammatory status in endothelial cells. First-phase results suggest that Nrf2 plays a significant role in the endogenous antioxidant system in the vasculature of diabetic mice.

The second aim of the project is to analyse vascular reactivity and define

the crucial role Nrf2 plays in the vasculature, helping to maintain vascular homeostasis and protecting against its dysfunction on hyperglycaemia and pro-inflammatory signals, as in diabetes. Project partners are presently conducting experiments to monitor endothelial-dependent and independent vasodilation. Successful outcomes will allow NRFDIABVASC to establish the biological significance of depletion

of antioxidant genes and how it affects diabetic vasculature in an Nrf2 knock-out mice type 1 model of diabetes.

(1) 'Role of Nrf2 transcription factor in diabetic vasculopathy, oxidative stress and inflammation'.

Funded under the FP7 specific programme People (Marie-Curie actions).

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Genotyping to enhance safety of anticoagulant therapy

Oral anticoagulants are well established in the management of thrombotic disorders brought on by blood clots. However, they may prove dangerous under certain conditions.

Recently, studies have found that certain genetic factors are associated with an increased risk of severe over-anticoagulation and bleeding. This raises concern for the use, effectiveness and safety of coumarin therapy as bleeding caused by coumarins is a major cause of drug-related death.

The EU-funded EU-PACT ⁽¹⁾ project is investigating whether or not knowing a patient's genotype at the start of coumarin treatment will enhance the safe use of such compounds. Researchers are determining if such gene testing is cost-effective.

DNA samples to identify genetic differences in order to understand why some patients are either resistant or sensitive to the anticoagulants.

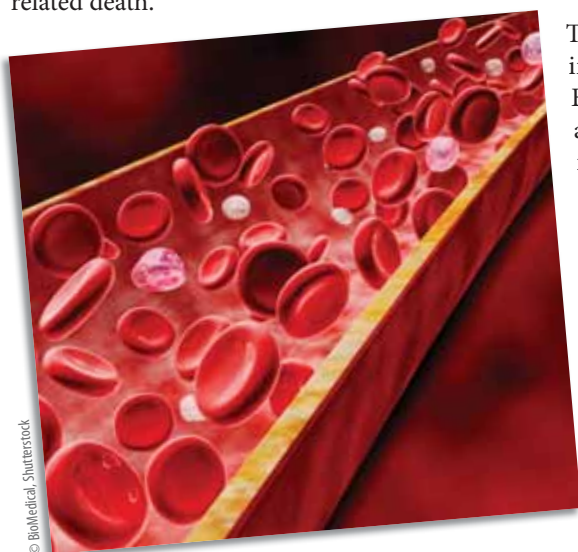
The project has developed algorithms for individual coumarin dosing. Genotyping instruments have been sent to several participants and are being validated. EU-PACT also completed the protocol in the first phase of the project, and the study design of the trial has been published in *Pharmacogenomics*.

The partners have also written a review of available information on the cost-effectiveness of pharmacogenetic-guided dosing of coumarins. The EU-PACT project expects to find that coumarin treatment dosing according to genotype will improve patient safety by reducing the risk of thromboembolic events and bleeding.

(1) 'A pharmacogenomic approach to coumarin anticoagulant therapy'.

Funded under the FP7 specific programme Cooperation under the theme Health.

<http://cordis.europa.eu/marketplace> > search > offers > 6167



This can be done by performing a clinical trial in seven European countries. Patients are randomised. One group receives coumarin treatment based on an algorithm containing information on their genotype, while a second group receives treatment where this information is not included. EU-PACT also aims to assess the usefulness of a point-of-care genotyping instrument. Another objective is to develop an archive of

Nanotechnology and sea salts to heal the skin

Healing salts and nanotechnology combine to create skin creams that could counter skin ageing and relieve a variety of skin ailments.

Skin diseases are adversely affecting Europeans more than before. This is partly because of prolonged life expectancy and increased exposure to UV radiation from sunlight.

A new, more personalised concept in health care and drug administration is

now possible thanks to technological advances and biomedicine.

The EU-funded Skintreat ⁽¹⁾ project is developing biotechnology and nanochemical drugs tailor-made to match patients' needs. They are also working on how to deliver these drugs more efficiently.

The project is focusing on combining conventional drugs and Dead Sea salts with new technologies and disciplines.

The team is designing a new generation of personalised pharmaceutical products matching customers with their ideal treatments.

The development of personalised skin therapy protocols requires accurate diagnosis of skin conditions plus an extensive analysis of biological markers.





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Non-invasive methods and minimally invasive skin sampling have identified a range of biological profiles corresponding to skin diseases and subclinical skin conditions. Statistical data processing has enabled researchers to observe biomarker patterns specifically associated with various clinical conditions.

A bio-informatics data-mining approach combined with biomarker analysis software is also supporting a refined, personalised diagnosis method. In addition, computer data analysis is used to create a decision-support system to help dermatologists and pharmacists prescribe personalised treatments.

The Skintreat approach is being evaluated for selected skin disorders such as psoriasis, contact dermatitis, and

UV skin photo-ageing, and a feasibility study is being conducted.

Retinyl palmitate, a preformed version of vitamin A, is being studied as a conventional dermal drug to be combined with more unconventional substances like Dead Sea minerals. All drug delivery systems will contain Dead Sea minerals. The team studied several capsule and nano-emulsion for application and delivery, narrowing them down to seven water-based and five oil-based systems. Both nano-emulsions and nano-dispersions containing Dead Sea minerals and retinyl palmitate were successfully prepared and deemed safe after testing.

(1) 'Novel approaches for the development of customised skin treatments and services.'

Funded under the FP7 specific programme Cooperation under the theme 'Nanoscience, nanotechnologies, materials and new production technologies.'

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Better tools to explain membrane protein dynamics

The dynamics of conformation fluctuations for soluble proteins have been successfully detected and characterised. Experimental limitations of nuclear magnetic resonance (NMR) spectroscopy, however, do not afford an equal level of understanding of the dynamics of membrane proteins.

Protein dynamics is basically linked to protein function, aggregation and folding, and time-resolved spectroscopy is especially suited to reveal these

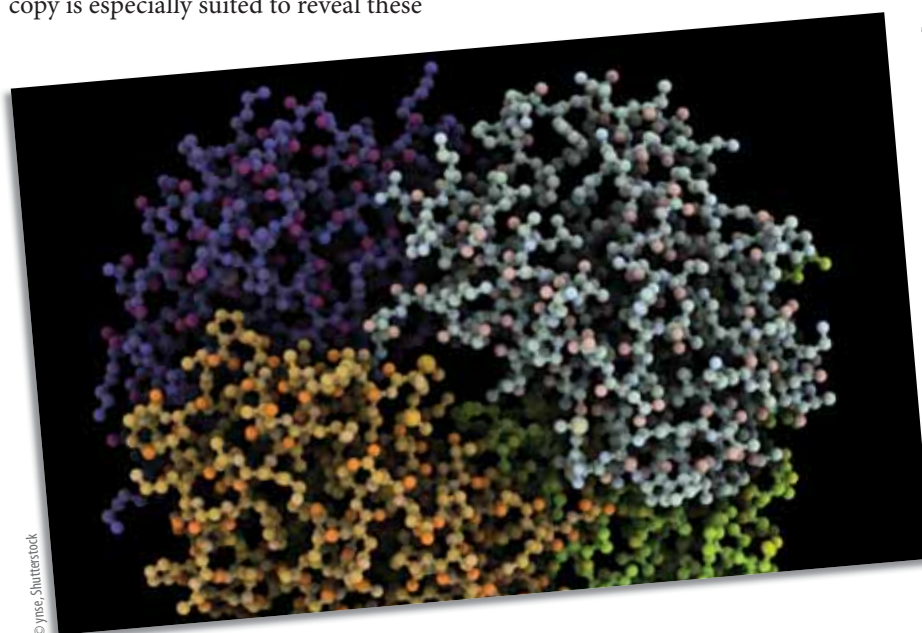
dynamics. Protein dynamics also manifest themselves when a fast perturbation is applied.

An example of this is when a laser pulse is applied to proteins with photocycles.

Both in hydrogen/deuterium exchange (HDX) and in perturbation experiments the time-resolved response of the system is a multi-exponential relaxation process. The information to be characterised is the number, value and nature of the rate constants of the relaxation process, not the process itself.

The EU-funded NAGOYA2BCN ⁽¹⁾ project aimed to improve, develop and apply maximum entropy and Bayesian methods to analyse the multi-exponential data arising in the HDX of membrane proteins, and in the photocycles of membrane proteins.

At the same time, it set out to use new experimental HDX approaches to obtain dynamics information of membrane proteins by infrared (IR) spectroscopy, and then apply them to at least three membrane protein systems: the melibiose transporter, bacteriorhodopsin, and a G-protein coupled receptor chimera.



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Results reveal that the time-scale of protein fluctuations that can be monitored and characterised increases relevant to a longer time window covered in the HDX experiments.

Although obstacles were encountered in designing an experimental set-up for IR spectroscopy to improve the time-window of HDX experiments, the researchers developed an approach changing the protein from a H₂O medium to a 95 % D₂O medium in a few seconds.

Achievements have also been noted during collaboration with Professor Kandori in Nagoya, Japan, in Bayesian inference with Markov Chain Monte Carlo sampling.

In other work, headway has been made in improving/developing various tools and software that facilitate the analysis of the HDX data and the bR photocycle. These improvements have been included in a visual program running in Matlab.

The NAGOYA2BCN project offers unique and essential information to better grasp membrane protein dynamics.

(1) 'Characterisation of membrane protein dynamics by hydrogen/deuterium exchange and time-resolved infrared spectroscopy, assisted by maximum entropy and Bayesian methods of analysis'.

Funded under the FP7 specific programme People (Marie-Curie actions).

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What connects sign language and trafficking? Proteins

Proteins use a special sign language when interacting within a cell. One key signal is a small protein called ubiquitin (Ub).

Abnormalities in the ubiquitin system are implicated in a wide range of pathologies, including certain cancers. Examples include breast and colon cancer, Parkinson's disease, Alzheimer's disease, diabetes and even infectious diseases such as HIV and Ebola. More knowledge about the way proteins signal and how cells decode these signals

could unlock the path to new treatments for such major diseases.

The EU-funded Auto-ubiquitylation (1) project is investigating how decoding mechanisms function at the molecular cellular level. This is important because Ub-receptors are known to decode the signals for thousands of ubiquitylated proteins.

A detailed study of how Ub-receptors function reveals much about their role in disease (prevention). Research is being done with biochemical and biophysical assays to investigate whether open and closed structures are involved in the function of Ub-receptors.

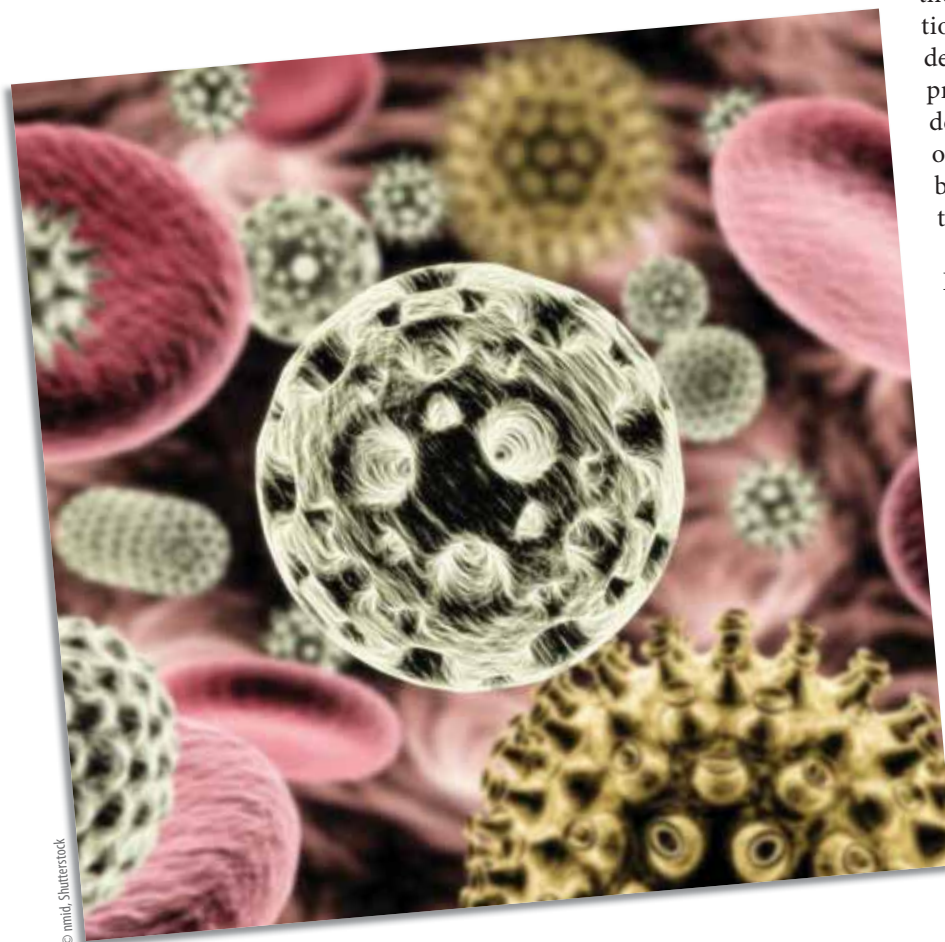
The project is proposing that Ub-receptors can 'acquire' three structural states: 'apo', which is the unbound form, 'trans' which is bound to another ubiquitylated-protein, and 'cis' which is self-ubiquitylated. Determining a 'cis' structure has been crucial for understanding how molecules interact among themselves to regulate protein function (auto-inhibition). So the project developed a novel bacterial system for protein ubiquitylation that will help determine high-resolution structures of Ub-receptors in 'cis' form and give better insights into how auto-regulation takes place.

Project partners expect that their work will make it possible to pharmacologically manipulate the Ub system. Results in this area could serve as templates for the future design of new drugs for diseases such as AIDS and cancer.

(1) 'Structural insight into auto-ubiquitylation as a regulatory mechanism for protein trafficking'.

Funded under the FP7 specific programme People (Marie-Curie actions).

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Endocrine disruptors and the male reproductive system

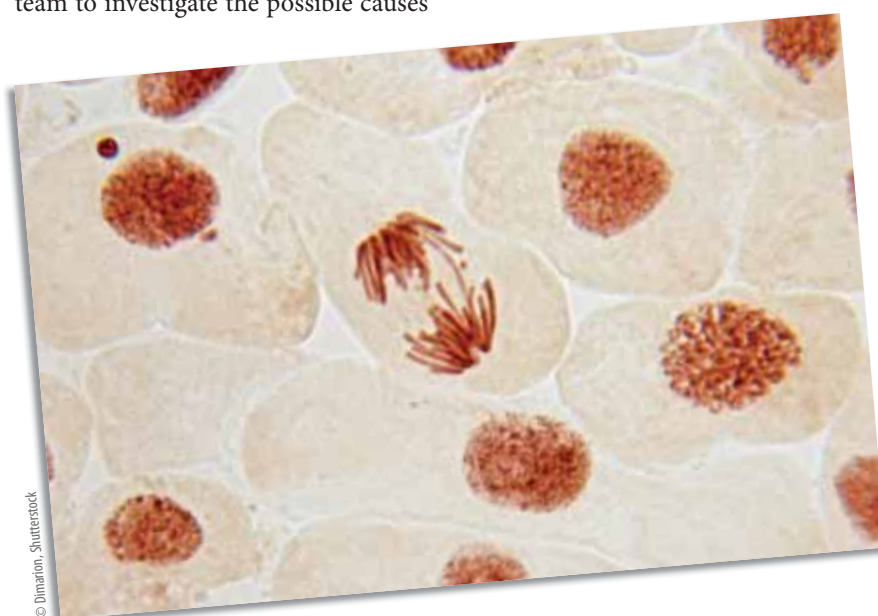
Some disorders with the reproductive system that arise during puberty may have their roots in exposure to harmful chemicals during the foetal stage. Some of Europe's best researchers are going back in time to find the answers.

Hormones secreted by the body's endocrine system govern a number of important functions, including development. Genetics as well as contact with manmade chemicals from our environment, known as endocrine disruptors, have been blamed for malfunction of the endocrine system.

The EU funded a multinational research team to investigate the possible causes

of problems with the male reproductive system. The project was entitled 'Developmental effects of environment on reproductive health' (DEER).

Participants in previous studies targeting the foetal and early childhood stages who had now reached puberty were selected. New hormone and other samples were collected and analysed.



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Information about exposure to endocrine disruptors was derived from questionnaires as well as bioinformatic tools. Since food is one of the major pathways of exposure, the breast milk of the subjects' mothers was also examined.

The DEER team discovered that Leydig cells, which are responsible for producing male hormones, play a critical role in the normal development of the male sex organs. *In vitro* and *in vivo* tests clearly demonstrated that exposure to endocrine disruptors caused dysfunction in Leydig cells. Furthermore, the effect was magnified in cases where two or more endocrine disruptors were present.

Evidence of geographical variation in exposure to endocrine disruptors was uncovered. In addition, changes in the level of exposure to such substances over time may be responsible for the earlier onset of puberty observed in young adults today in comparison to their counterparts last decade.

Interestingly, the DEER results may also have relevance to the current epidemic of child obesity since the endocrine system also regulates metabolism.

Funded under the FP7 specific programme Cooperation under the theme Environment.

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Understanding disease resistance in plant cross-breeding

The ability to cross-breed genetically different plants is a significant advance in modern agriculture. Resolving incompatibility issues, however, is key to taking advantage of hybrid vigour.

Although hybrid vigour has much to offer agriculture, there is still great untapped potential as long as incompatibility is not better understood. The failure of many plant crosses limits the applications it can be used for.

The EU-funded *Arabidopsis* hybrids⁽¹⁾ project set out to make it possible to introduce the widest possible range of valuable features into crops. The project consisted of two sub-projects and

worked to understand the molecular and biochemical basis of hybrid incompatibility within as well as between species.

The first step was to characterise an incompatibility that was identified, where offspring develop ectopic outgrowths on leaf petioles.



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The model used was a cross between two *Arabidopsis thaliana* strains from Spain and Tajikistan. Initial results suggested that this example of severe negative epistasis is due to an interaction between two alleles of a disease resistance protein.

The project sought to characterise the interaction at the protein level by domain-swapping and mutagenesis, unravelling the mechanisms behind the adverse interaction.

The second sub-project focused on the effects of intra- and inter-specific hybrid formation on genomic regulation through RNA silencing. Hybrids in the *Arabidopsis* genus were to be used.

The assumption is that changes in small RNA populations in hybrids contribute to a misregulation of genes, which results in hybrid incompatibility. However, bioinformatic analysis of the data has proven to be challenging as the study involves genomes that have not

been fully sequenced. Data has been shared with other relevant research groups in order to offer maximum benefit from this project's achievements.

(1) 'Structural insight into auto-ubiquitylation as a regulatory mechanism for protein trafficking.'

Funded under the FP7 specific programme People (Marie-Curie actions).

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Structural strength from nature

A new process for incorporating natural fibres to create strong composite materials will benefit many structural applications, from shipbuilding to agriculture.

A new, more eco-friendly class of natural materials and textiles is in the making. These are called biocomposites, which means they contain natural materials such as fibres, as well as polymers derived from natural sources. However, these promising materials are not readily available for use in structural applications.

The EU-funded NATEX ⁽¹⁾ project aims at exploiting these materials for use in numerous applications. It is developing high-strength reinforcing fabrics made from natural fibres to produce biocomposites that can be

ideal for all kinds of structures.

NATEX wants to use woven natural fibres in bioderived thermoplastics (heat-shaped plastics derived from natural sources) to manufacture high-tech products with high added value, made entirely from renewable resources.

The project team is working on new chemical or enzyme treatments to modify the chemistry of the fibres so they could be combined more easily with the polymers required to make composites. New yarns with improved mechanical properties will

be developed using novel weaving techniques, creating innovative 3D textiles. A new spinning process will also reduce yarn twisting during manufacturing. Other innovations will improve the permeability of the composite and help obtain well-mingled yarns.

Another issue to address is the viscosity of the resin itself in composites and its compatibility with natural fibres. New resin processing methods will be adopted and combined with natural fibres with improved properties. This will increase the mechanical properties of these natural composites and increase their suitability for structural applications in transport, energy, agricultural machinery and shipbuilding sectors.

The novel composites with natural fibres are set to yield numerous advantages, significantly contributing to the expected growth in textile production. They could offer great versatility and replace many old-generation materials to yield more competitive industries and products. Lastly, it is worth noting that the project website (www.natex.eu) has been developed to inform industry stakeholders, academia, EU and national officials, as well as all those interested in the new technology.

(1) 'Aligned natural fibres and textiles for use in structural composite applications.'

Funded under the FP7 specific programme Cooperation under the theme 'Nanoscience, nanotechnologies, materials and new production technologies.'

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ENERGY AND TRANSPORT

EU researchers develop wearable solar panels

Scientists in Spain are looking at how photovoltaic panels can be integrated into common objects or textiles.

Solar energy is a rapidly growing market. However, a lack of flexibility means that it remains difficult to integrate photovoltaic panels into common objects or clothes. Researchers believe this problem needs to be solved since many sun-exposed surface areas are textile based and could be significant providers of solar energy.

Scientists in the EU-funded Dephotex ⁽¹⁾ project will therefore identify the specific needs of these textiles, namely their geometrical dimensions, durability, electrical properties

(voltage and power), and cost sustainability for various industrial sectors, such as home textiles, sports, leisure, clothing and the automotive industry. Secondly, the research team will investigate various conductive textiles, in particular, carbon nano-tubes and conductive polymers, as potential substrates for the photovoltaic cells.

In parallel to this activity, researchers will study photovoltaic active materials, barrier materials and deposition techniques, leading ultimately to the fabrication of new devices for two

distinct markets. First, the project will develop the technology necessary for applications where pieces of fabric can be processed with industrial tools. A second technique will enable the production of photovoltaic patches that can be pasted on to large surface area textiles, such as sizeable stadium awnings, that cannot be processed in a factory.



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(1) 'Development of photovoltaic textiles based on novel fibres'.

Funded under the FP7 specific programme Cooperation under the theme 'Nanoscience, nanotechnologies, materials and new production technologies.'
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Thermoacoustic energy to become affordable

Researchers in the Netherlands are investigating how advances in science and technology can make thermoacoustic energy economically attractive.

Thermoacoustics is concerned with the thermodynamic conversion between heat and intense sound in the presence of a solid boundary. While its working principles are complex, the technology offers huge advantages over other systems as it has few moving parts, uses

environmentally-friendly working media and only ordinary materials.

Researchers believe therefore that the development of thermoacoustic systems will lead



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to energy and cost savings and economically attractive renewable energy options.

The EU-funded 'Thermoacoustic technology for energy applications' (Thatea) project is exploring different conversion processes involved in thermoacoustic systems and the potential they have for energy applications. It is, for example, assessing the feasibility of

thermoacoustic applications to achieve various conversion efficiencies.

The scientists are also investigating the integrated systems that couple the separate components, resulting in high overall system efficiency. Research is being carried out on thermoacoustic engines, on heat pumps, on resonators, on thermoacoustic heat exchangers, on regenerator material, and on non-linear

phenomena occurring in these systems. In addition to making the technology more efficient and subsequently more affordable, the research team hopes the project, once complete, will place the EU in a stronger competitive position in this field vis-à-vis the China, Japan and US.

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Active solar technology to facilitate cheap solar panels

Active solar panels based on a novel parallactic tracking technology concept will reduce the costs of solar power by up to three times compared to conventional photovoltaic modules.

The EU hopes that by 2015 it will be possible to produce solar power at the same cost as grid electricity for the

consumer. Researchers in the 'Active solar panel initiative' (ASPIS) project believe that this target can be achieved with the production of revolutionary active solar panels that will cost up to three times less than traditional photovoltaic solar modules.

The project partners use a novel parallactic tracking technology concept that reduces the amount of polycrystalline silicon used by

10-fold, slashing production costs significantly. Moreover, the scientists claim that this can be effected without compromising the installation area efficiency.

In addition to replacing conventional photovoltaic panels, researchers hope the work carried out in this project will lay the groundwork for the next generation of active solar technology that will enable a drastic additional increase in residential solar generation efficiency. They hope to achieve this through the use of highly efficient multi-junction cells in flat, fixed rooftop-mounted panels.

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Improved sandwich panels to boost building energy efficiency

Sandwich panels, modern lightweight insulating components, are increasingly being used to boost energy efficiency. Scientists in Europe hope to iron out the remaining problems associated with the components.

The use of sandwich panels, building components made of two thin metal sheets with an insulating core between the faces, is popular in industrial, residential and office buildings as a means to boost energy efficiency. However, they are currently not subject to any standard rules and remain dogged by a variety of problems. EU-funded researchers hope to put an end to these problems and optimise their use via the 'Ensuring advancement in sandwich construction through innovation and exploitation' (EASIE) project.

The research team will aim to develop solutions and technical guidelines to

aid the implementation of the revised European standard for sandwich panels. At the moment, the standard lacks rules or requirements for many important areas: axially loaded panels as well as the panels' fastenings, openings, and stabilising frame structures.

The EASIE project is also aimed at ensuring that any new information is widely disseminated through seminars and practical guidelines

as well as e-learning modules demonstrating the correct and safe use of sandwich panels in Europe.

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Pre-combustion research to slash power plant emissions

Researchers are carrying out much-needed research and development in advanced pre-combustion capture techniques to substantially reduce emissions of greenhouse gases from fossil fuel power plants.

Much has been made of the potential for carbon capture and storage (CCS) technology to help the EU slash its greenhouse gas emissions. However, there remains an urgent need for further R&D into advanced

pre-combustion capture techniques to substantially reduce emissions from fossil fuel power plants.

The EU-backed project 'Enabling advanced pre-combustion capture techniques and plants' (Decarbit) is looking to improve or develop new pre-combustion technologies, with the overall objective of enabling zero-emission pre-combustion power plants by 2020 with a capture cost of less than 15 EUR/tonne and the highest feasible capture rate.



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The project team is also keen to encourage further industrial uptake of CCS through its industrial contact group. Likewise, they believe Decarbit will strengthen the competitiveness of European industry and the economy by maintaining and reinforcing its position as the world leader in CCS technologies.

The researchers have chosen to structure the R&D activities around five sub-projects, namely system integration and optimisation, advanced pre-combustion carbon dioxide (CO₂) separation, advanced oxygen separation technologies, enabling technologies for pre-combustion, and pre-combustion pilots.

All of these projects include theoretical and experimental investigations, leading to extended pilot testing.

Funded under the FP7 specific programme Cooperation under the theme Energy.

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Energy end-users to get better service

European Member States are working to improve end-user services for their citizens by analysing energy use and developing tailored measures that take into account national cultures and institutions and socio-technical change.

To support the shift in European energy policy towards end-user services, researchers have analysed consumer behaviour in conjunction with national idiosyncrasies and the need to reduce energy demand in the EU.

The EU-funded Changing Behaviour⁽¹⁾ project's objectives were four-fold. First, to develop a 'sophisticated but practical' model of end-user behaviour and stakeholder interaction. Second, to integrate knowledge about

national cultures and institutions into demand management practice. Third, to pilot the transfer of context-tailored demand-side measures, and fourth, to create a toolkit to manage the socio-technical change involved in reducing energy demand.

This work took place with the aid of intensive cooperation between researchers and organisations affected by these changes, including governmental or semi-governmental energy agencies, non-governmental organisations (NGOs), consultancies and energy service companies.

Researchers intend for the final results to help EU policy-makers draw up a more sustainable energy economy for the future by providing knowledge tools for energy efficiency policies and by enhancing the competencies of practitioners operating in the field through the exchange of best practices.

⁽¹⁾ 'Contextualising behavioural changes in energy programmes involving intermediaries and policy-making organisations working towards changing behaviour'.

Funded under the FP7 specific programme Cooperation under the theme Energy.

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Curtailing energy use in the personal care industry

New technology aims to reduce energy use in the personal care products industry and promote residuals as resources rather than liabilities.

Industries such as the personal care products sector use vast amounts of energy to deal with residuals. Apart from not being in line with the EU's commitment to slash energy use by 2020, this is not cost-effective for them, and will become less so as energy becomes ever-more expensive.

The 'Energy-use minimisation in residuals management in the personal care product industry' (Enermin) project combined the skills and experiences of academia and industry, with the latter being represented by French personal product care leader L'Oréal.

The aims were to reduce energy use in residuals management, make their treatment more efficient, and demonstrate that residuals could be seen as resources rather than liabilities if handled appropriately.

The industry traditionally uses high levels of air to stimulate biological activity to ensure the degradation of residuals. However, aeration uses vast amounts of electricity, making this technology very energy intensive. Furthermore, aerobic biological processes for residuals treatment generate large amounts of biosolids (sludge), which creates a handling problem that is also energy intensive.

The project has therefore concentrated on assessing the suitability of anaerobic, non-air-consuming technologies in residual management and on modifying older aerobic technologies to require less air.



Funded under the FP7 specific programme People (Marie-Curie actions).

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Carbon export is making waves

In an effort to improve our understanding of carbon uptake by the oceans, a research team travelled to the Gulf of California to study a special group of micro-organisms.

While it is well known that the oceans are a major sink for carbon from the atmosphere, the exact mechanisms through which this export takes place are not well understood. It has been suggested that nitrogen-fixing

organisms, known as diazotrophs, have an important role to play here.

EU funding was set aside to examine this aspect in detail through the 'New approaches for understanding oceanic

carbon uptake' (Carbon Export) project. In this context, a well-equipped research vessel was deployed to the Gulf of California to perform extensive sampling of its biologically rich waters.

Measurements of nitrogen fixation at several depths have indicated a strong dependence both on the type of organisms present in the plankton mix and on sea-surface temperature. Evidence of a substantial contribution to carbon



fixation made by unicellular Group A diazotrophs was found in colder waters just outside the Gulf.

In addition, two naturally occurring radioisotopes, ^{234}Th and ^{210}Po , have been used to measure the carbon flux from the sea surface downwards. As

expected, carbon export was very high in regions where the plankton population was enriched with diatoms. However, large fluxes were also recorded in areas with unicellular Group A diazotrophs. In fact, analysis revealed that they were much more efficient than diatoms at exporting carbon.

These findings will allow for more accurate carbon cycling in global models and consequently help improve their predictions of future climate change.

Funded under the FP7 specific programme People
(Marie-Curie actions).

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Energy framework to tackle security of supply problems

EU-funded researchers have worked on a framework to address security of supply issues in the energy sector inside and outside the EU.

The framework takes into consideration all issues related to security of supply, including geopolitics, price formation and the economic and technical design of energy markets inside and outside the EU.

The scientists set out to develop energy security indicators for all the major energy sources, namely oil, natural gas, coal, nuclear and renewables, in order to identify risk factors and quantify the EU's exposure to volume and price

risks in the short and long terms. This includes the potential impacts of severe accidents and terrorist threats.

This meant evaluating the costs and benefits (both measurable and perceived) of energy security for different energy supply and demand scenarios to help policy-makers introduce the most appropriate institutional, political and industrial solutions. This includes aiding the European institutions and national governments to achieve the right energy mix taking into consideration energy security and sustainability requirements.

The researchers also looked at the need for the EU to develop stable relations with energy exporting countries and external partners, and to build efficient regulatory frameworks that address incentives and obligations for energy companies and consumers.

They also looked into optimising the synergies among Member States to improve security of supply, and defining sound public service missions to compensate for potential market failures.

Funded under the FP7 specific programme Cooperation
under the theme Energy.

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Eye in the sky measures biomass potential

Biomass is the amount of biological material in a given area and is an important source of renewable energy. A method for gathering data on the potential availability of biomass has been developed by a European research project using earth observation (EO) techniques.

Analysis of remote sensing data is the most practical way of measuring land cover, providing an efficient, cost-effective and reliable way of monitoring the global, regional and local environment.

It also enables isolated and inaccessible areas to be accurately assessed.

The framework developed by the EU-funded project 'Classification of European biomass potential for bioenergy

using terrestrial and earth observations' (Ceubiom) has provided a harmonised approach for conducting bioenergy assessments. It includes existing data from European, national and regional records together with information collected in the field.

Project partners have also created a platform for raising awareness among the scientific community by disseminating information and best practices on the use and applicability of the



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methodology developed. In addition, the platform can train EO, agricultural and forestry professionals to use the new, harmonised approach and achieve a better understanding of each others activities and requirements.

The Ceubiom initiative has developed an accurate and efficient

way of determining the biomass potential thereby boosting the European bio-energy sector.

The project also supports the EU's drive towards sustainable development and use of renewable forms of energy.

Funded under the FP7 specific programme Cooperation under the theme Energy.

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New laser process to improve glass structure

New, laser-enhanced crystallisation processes on glass will offer better solar cell efficiency with low silicon consumption.

The EU-funded HIGH-EF ⁽¹⁾ project set out to provide the silicon thin-film photovoltaic (PV) industry with a unique process allowing for high solar cell efficiencies.

Based on the combination of crystallisation and thickening by a solid phase crystallisation (SPC) process, laser SPC is a major breakthrough in silicon

thin-film PV on glass since it greatly increases the grain size and reduces the density of defects and stress levels. Standard SPC processes on glass provide smaller grains with a high density of internal extended defects that hinder good solar cell efficiencies.

It was deemed important, however, that the cost of industrial laser SPC implementation should not be more than the pure SPC process. The HIGH-EF project worked on developing low-cost laser processing using highly efficient laser diodes. The goal was to combine these to form a line focus allowing for the crystallisation of an entire module within a single scan.

Attention was focused on identifying each competence needed for the project's success and to select partners to form a multidisciplinary consortium bringing together seven organisations from four Member States and one associated country. All efforts aimed to advance the technology of multicrystalline thin-film silicon solar-cells through the new laser SPC process.

(1) 'Large grained, low stress multi-crystalline silicon thin film solar cells on glass by a novel combined diode laser and solid phase crystallization process'.

Funded under the FP7 specific programme Cooperation under the theme Energy.

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The path to better rail in the Balkans

By enhancing the capabilities of the railway vehicles centre at a notable Serbian university, the EU wants to upgrade the railway sector in the whole region.

Serbia is at the crossroads of the Balkans and links many countries together by rail. It also has a well-known railway vehicles centre (RVC), which falls under the Faculty of Mechanical Engineering Kraljevo at the University of Kragujevac. Europe wants to strengthen the capabilities of the centre and enhance its activity through an EU-sponsored project entitled Service ⁽¹⁾.

The project has been working to strengthen research in railway vehicles according to contemporary industry needs. It set out to achieve this by improving knowledge and skills of research staff, acquiring new research

equipment and developing strategic partnerships with prominent EU research centres.

Traditionally, the centre has been a leading Serbian institution in the field of railway vehicle investigation and testing. It provides research and development services to Serbian wagon factories and to the national railway operator, Serbian Railways. Key among its mandates is the investigation of railway vehicle dynamics and the fatigue of vehicle structures and components.

The Service project helps to boost existing cooperation in the field with other

Balkan countries while also improving research competence and increasing their involvement in the European Research Area (ERA).

The project successfully accomplished the aims set out for the first two years. It exchanged experts with the Department of Mechanical, Nuclear, Aviation and Metallurgical Engineering (DIEM) at the University of Bologna (Italy), and KTH University Railway Group in Sweden. RVC is strengthening its partnership with these two institutions on many levels, over and above staff exchange.

On another front, study visits to companies in France and to the railway test centre at Szolnok in Hungary were also conducted. Furthermore, with the project's support, RVC brought two more experienced researchers and four young researchers into its fold.

In addition, the project is overseeing the procurement of a software package for design and analysis of mechanical structures, all being performed during the Serbian centre. It is also helping RVC acquire research equipment to measure forces related to wheel-rail contact and for calibration. The construction of a specialised test track is foreseen to carry out extensive rail and wagon tests.

Dissemination of knowledge and experiences through workshops is also part of the project's remit, as well as the dissemination of results and other communications efforts.

By the end of the project, rail research in the Balkan area and eventual harmonisation of Serbia's network will facilitate transport in the whole region and solidify the new rail standard that is taking place across the continent.

(1) 'Strengthening railway vehicles centre of faculty of mechanical engineering Kraljevo'.

Funded under the FP7 specific programme Capacities under the theme 'Research potential of convergence regions'.

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Saturn and the swirling, massive storm

Astronomers have been keeping an eye on a massive storm encircling Saturn since December 2010. The planet is 10 times larger than earth. Experts say it has an atmosphere that is relatively calm.

But every 30 years or so, giant storms form on the planet. Researchers at the European Southern Observatory (ESO) and NASA have measured the storm's effects that stretch 600 km into the stratosphere. The findings are published in the journal *Science*.

Observing this storm at the same time gives us a great chance to put the Cassini observations into context. Previous studies of these storms have only been able to use reflected sunlight, but now, by observing thermal infrared light for the first time, we can reveal hidden regions of the atmosphere and measure the really substantial changes in temperatures and winds associated with this event.'



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The astronomers initially used NASA's Cassini spacecraft to detect the storm. They then used the ESO's Very Large Telescope (VLT) array in Chile, together with the 'Composite infrared spectrometer' (CIRS) instrument on Cassini. The instruments revealed in detail the fast-moving northern-hemisphere storm.

Thunderstorms on earth do not encircle our planet and usually don't surpass 20 km in height. This is the sixth massive storm on Saturn to be spotted since 1876. It is the first ever to be probed in the thermal infrared in order to see the variations of temperature within a Saturnian storm, the astronomers say. It is also the first storm of the planet ever to be observed by an orbiting spacecraft.

'This disturbance in the northern hemisphere of Saturn has created a gigantic, violent and complex eruption of bright cloud material, which has spread to encircle the entire planet,' says lead author Leigh Fletcher of the University of Oxford in the United Kingdom. 'Having both the VLT and Cassini inves-

The team speculates that the storm originated deep down in the water clouds, where a phenomenon similar to a thunderstorm helped a huge convective plume emerge. That is, the mass of gas rose up and punched through Saturn's usually placid upper atmosphere. According to the astronomers, these disturbances mix with the circulating winds moving east and west, triggering significant changes in the atmosphere's temperature.

'Our new observations show that the storm had a major effect on the atmosphere, transporting energy and material over great distances, modifying the atmospheric winds – creating meandering jet streams and

forming giant vortices – and disrupting Saturn's slow seasonal evolution,' says Glenn Orton of Jet Propulsion Laboratory in the United States, a co-author of the study.

'We were lucky to have an observing run scheduled for early in 2011, which ESO allowed us to bring forward so that we could observe the storm as soon as possible. It was another stroke of luck that Cassini's CIRS instrument could also observe the storm at the same time, so we had imaging from VLT and spectroscopy of Cassi.

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[http://ec.europa.eu/research/info/centre > search > 21533](http://ec.europa.eu/research/info/centre%20search%2021533)



Brown dwarfs? A cool cup of tea

Researchers from Canada, France and the US have discovered that the dimmest and coldest star in space is as hot as a cup of freshly brewed tea. Presented in the upcoming Astrophysical Journal, the findings show that the brown star in a double system is about as large as Jupiter.

But the surface temperature of the smaller, farther star is 100 °C. While the temperature is hot for people, it is very cold for a star's surface.

Brown dwarfs are failed stars. Astronomers say the dwarfs do not have enough mass for gravity to generate the nuclear reactions that give stars their shine. Using the European Southern Observatory's Very Large Telescope (VLT) and two other telescopes — the Laser Guide Star (LGS) Adaptive Optics on the Keck II Telescope in the US state of Hawaii, and the Canada-France-Hawaii

Telescope — the team identified the brown dwarf as CFBDSIR 1458+10B, the dimmer member of a binary brown dwarf system about 75 light years from earth.

They used the x-shooter spectrograph on the VLT to reveal that the composite object was very cool by brown dwarf standards. Until now, the coolest brown dwarf binary on record is CFBDSIR 1458+10.

'We were very excited to see that this object had such a low temperature, but

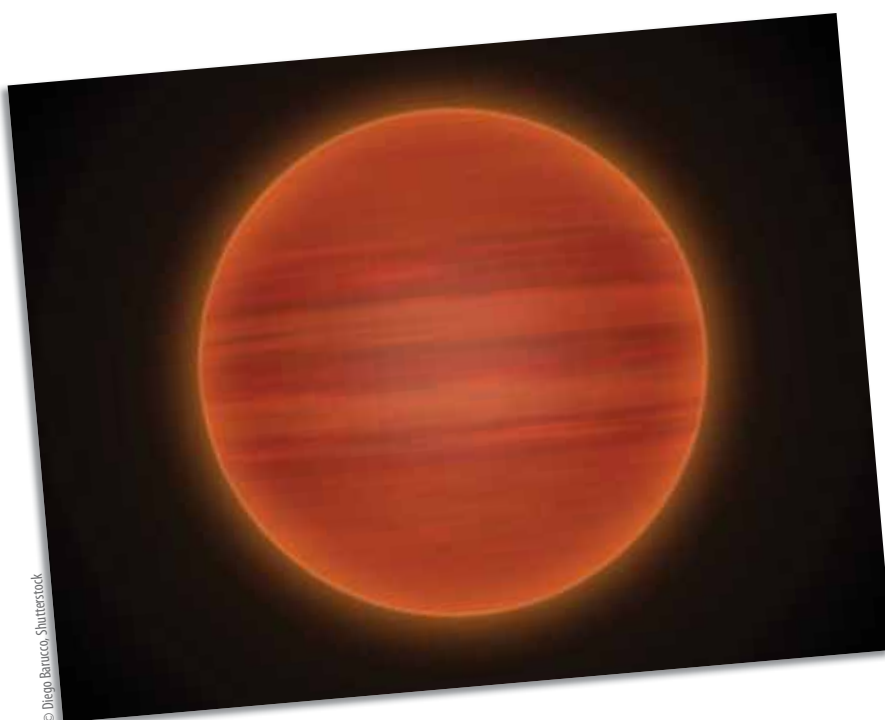
we couldn't have guessed that it would turn out to be a double system and have an even more interesting, even colder component,' explains Philippe Delorme of the Institut de Planétologie et d'Astrophysique de Grenoble (CNRS/ Université Joseph Fourier), one of the authors of the paper.

'At such temperatures we expect the brown dwarf to have properties that are different from previously known brown dwarfs and much closer to those of giant exoplanets — it could even have water clouds in its atmosphere,' says lead author Michael Liu of the University of Hawaii's Institute for Astronomy, who is lead author of the paper describing this new work. 'In fact, once we start taking images of gas giant planets around sun-like stars in the near future, I expect that many of them will look like CFBDSIR 1458+10B.'

Astronomers continue to search for cool objects. Scientists recently used the Spitzer Space Telescope to identify two other very faint objects as potential contenders for the coolest known brown dwarfs. However, they could not precisely measure their temperatures.

The team believes future observations will help researchers compare these objects to CFBDSIR 1458+10B. The scientists are looking to reassess CFBDSIR 1458+10B to better determine its properties and to begin mapping the binary's orbit. Astronomers should be able to determine the binary's mass.

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SOHO spacecraft becomes greatest comet finder ever

The Solar and Heliospheric Observatory (SOHO) has become the single greatest comet finder of all time discovering its 200 th comet as 2010 drew to a close.

Drawing on help from amateur scientists around the world the ESA/NASA (European Space Agency/National Aeronautics and Space Administration) spacecraft quietly reached the milestone on 26 December, 2010 — 15 years after it was launched.

The accolade is even more impressive as SOHO was specifically designed to monitor the Sun rather than find comets. 'Since it launched on 2 December, 1995 to observe the Sun, SOHO has more than doubled the number of comets for which orbits have been

determined over the last 300 years,' stated Joe Gurman, the US project scientist for SOHO at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

The project team acknowledged that while SOHO may take the credit, most of the hard work is done by the dozens of amateur astronomer volunteers who daily pour over the fuzzy lights dancing across the pictures produced by SOHO's large angle and spectrometric coronagraph (LASCO) cameras.



© Courtesy of SOHO/EIT consortium. SOHO is a project of international cooperation between ESA and NASA.

images looks to be the correct size and brightness to be a comet and is headed for the Sun. He then confirms the finding, gives each comet an unofficial number, and then sends the information off to the US-based Minor Planet Center. The centre categorises small astronomical bodies and their orbits.

It took SOHO 10 years to spot its first 1 000 comets, but only five more

LASCO was not designed primarily to spot comets. Its camera blocks out the brightest part of the Sun in order to better watch emissions in the Sun's much fainter outer atmosphere, or corona. Its comet-finding skills are a natural side effect as with the Sun blocked, it is also much easier to see dimmer objects such as comets.

'There is definitely a lot of science that comes with these comets. First, now we know there are far more comets in the inner solar system than we were previously aware of, and that can tell us a lot about where such things come from and how they're formed originally and break up,' Dr Battams explained, adding that 'we can tell that a lot of these comets all have a common origin.'

According to the astronomer, 85 % of the comets discovered with LASCO are thought to come from a single group known as the Kreutz family, believed to be the remnants of a single large comet that broke up several hundred years ago.

According to the scientists, over 70 people from 18 different countries have helped spot comets over the last 15 years by searching through the publicly available online SOHO images.

Karl Battams, who has been in charge of running the SOHO comet-sighting website since 2003 for the Naval Research Lab in Washington, receives reports from people who think that one of the spots in SOHO's LASCO

years to find the next 1 000. The project team explained that this boost was due partly to increased participation from comet hunters and work done to optimise the images for comet-sighting, but also due to an unexplained systematic increase in the number of comets around the Sun. Indeed, in December alone an unprecedented 37 new comets were spotted, a number high enough to qualify as a 'comet storm', according to the scientists.

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How hot matter is not always doomed

The Integral gamma-ray observatory of the European Space Agency (ESA) recently spotted super hot matter just a millisecond before it got lost in a black hole. But is the matter done for?

Astronomers believe some of the matter may be making a great escape. Experts say being close to a black hole would play with anyone's nerves. Particles and radiation are in great supply in space, and vast storms of particles are doomed at close to the speed of light. The result is a boost in temperature, as high as millions of degrees.

Under normal circumstances, particles cross the final distance within just a millisecond. But a tiny fraction of them may actually be able to be 'saved'. The new Integral observations have allowed the scientists to determine that this chaotic region is threaded by magnetic fields.

It is the first time ever that astronomers have succeeded in identifying

magnetic fields in the vicinity of a black hole. Integral shows that they are highly structured magnetic fields that are creating an escape tunnel for some particles that were done for.

Philippe Laurent of the Centre d'Etudes Nucléaires de Saclay (CEA Saclay) in France and colleagues made the discovery by investigating the nearby black hole, Cygnus X-1, which is tearing a companion star to pieces and feeding on its gas.

Their work shows that the magnetic field is so strong that it can tear away particles

from the black hole's gravitational hold and funnel them outwards. Jets of matter then end up being spewed into space. The researchers say the particles in these jets are being drawn into spiral trajectories as they climb the magnetic field to freedom. This is impacting a property of their gamma-ray light.



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A gamma ray is identified as a wave whose orientation is known as its polarisation. Fast particles spiralling in a magnetic field generate a kind of light, what astronomers call 'synchrotron emission', which displays a characteristic pattern of polarisation. It is this polarisation that the researchers discovered in the gamma rays. This was no easy feat.

'We had to use almost every observation Integral has ever made of Cygnus X-1 to make this detection,' Dr Laurent says. Repeated observations of the black hole, over a seven year period, amounted to more than five million

seconds of observing time. This is like snapping one image with an exposure time of over two months. The team compiled everything together to generate such an exposure.

'We still do not know exactly how the infalling matter is turned into the jets. There is a big debate among theoreticians, these observations will help them decide,' explains Dr Laurent.

In the past, researchers identified jets around black holes by using radio telescopes. But they were unable to see the black hole in sufficient detail to determine how close to the black hole

the jets originate. And this is where this study differs.

'This discovery of polarised emission from a black hole jet is a unique result demonstrating that Integral, which is covering the high-energy band in ESA's wide spectrum of scientific missions, continues to produce key results more than eight years after its launch,' comments Christoph Winkler, ESA Integral project scientist.

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Accurate picture of the global carbon cycle

Some of Europe's finest researchers are making an important contribution to the science of earth observation (EO) with the intention of producing a more accurate picture of the global carbon cycle.

Fossil fuel emissions from anthropogenic activities have significantly modified the global carbon cycle. No one knows for sure what the outcome will be since there is still a great deal of uncertainty regarding the exchange of carbon between the biosphere, atmosphere and oceans.

Harmonising EO research efforts is certainly a step in the right direction. This was the aim of the EU-funded COCOS⁽¹⁾ project, which received financial support from the EU.

The first goal was to standardise the way in which different scientists collect

EO data. This was achieved by defining a core list of variables. To further promote data sharing, a policy document has been created that addresses copyright issues.

Since a number of different approaches to modelling the global carbon cycle exist, a comparison exercise has been arranged to identify the most accurate method.

Consensus was reached concerning gaps in our knowledge of the relative strength of carbon sources and sinks over land and oceans. Efforts are being made to improve estimates for wetlands, wildfires and other elements of the global carbon cycle. Furthermore, the geographical coverage of a dataset of carbon dissolved in the ocean has been greatly extended.

The team of scientists involved in COCOS has also been active in the global earth observation (GEO) partnership on behalf of Europe. Work such as defining a common strategy for carbon observation will help focus the efforts of all EO experts.

(1) 'Coordination action carbon observation system'.

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Human rights and minorities in South Asia

The EU-funded Eurasia-net ⁽¹⁾ project has explored cooperation between Europe and South Asia in the field of human and minority rights.

The aim is to exchange knowledge and best practice between the two regions and raise the profile of the South Asian Association for Regional Cooperation (SAARC) on minority issues.

A conference was organised under the auspices of the Eurasia-net initiative, which highlighted the need for fresh approaches to protect the rights of

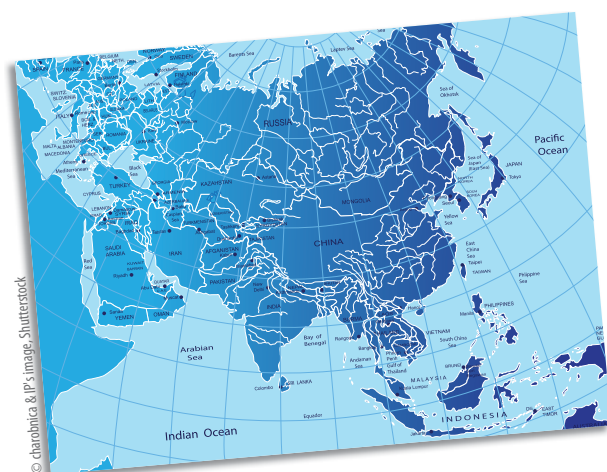
minorities. Special measures for protecting vulnerable members of society were also discussed.

Study visits for improving cooperation between European and South Asian academics have been organised to enable a common agenda for future research. Furthermore, two summer schools have been run in Italy and Nepal. Participating students have provided very positive feedback and expressed an interest in contributing further to the success of Eurasia-net.

A trans-regional platform has been established, which has acted as a forum for the exchange of information and experience between researchers, universities, media,

NGOs and decision-makers. The platform has also been used for dissemination of results and to help prepare the way for joint research activities and the Joint Research Agenda (JRA).

The Eurasia-net initiative has successfully enhanced the knowledge-base needed for new policies and methodologies to reduce ethnic and religious conflict. The activities conducted by the project therefore help promote stability and security in South Asia.



(1) 'Europe-South Asia exchange on supranational (regional) policies and instruments for the promotion of human rights and management of minority issues.'

Funded under the FP7 specific programme Cooperation under the theme Environment.
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Currents of the second Somali migration wave

As a significant portion of the Dutch Somali population has undergone a second wave of migration to the UK, the EU-funded Secondary movements ⁽¹⁾ project asked the fundamental question: why?

Over a decade of war in Somalia has left a toll on its people. Today, Somalis are the third largest registered refugee population in the world with hundreds of thousands fleeing to save their lives.

One of the many countries to which Somalis fled for asylum is the Netherlands — many are now Dutch citizens. As EU citizens this means they can move more freely between Member States. And many have taken this opportunity to relocate to the UK — a so-called 'secondary movement' allowing them to reach what many claim was their destination of choice.

It is estimated that a third of the Dutch Somali community (around 10 000 people) has moved to the UK. Yet very little is known about the specific characteristics of these movements. Reports also suggest that both legal and illegal asylum seekers

are taking part in this secondary migration movement. This makes migration a more complex phenomenon than it appears on paper, which is a challenge for policy-makers and authorities to manage.

The project tackled this challenge. Based on 33 in-depth interviews with Dutch Somalis in London and Leicester the project answered the key question about the motivation for relocating.

Their findings suggest, for example, that the second-move Somalis find the UK easier to call home. This is due to opportunities for employment and education as well as to Somalis' ability to more easily maintain their ethnic and religious identity. If and how refugees will integrate within a national context is something that interests policy-makers and politicians.

The results of this research project should help shed some light on the bigger picture of migration by taking into account patterns of intra-European mobility and the factors that influence them.

(1) 'Secondary movements of Somalis within Europe'.

Funded under the FP7 specific programme People (Marie-Curie actions).
<http://cordis.europa.eu/marketplace> > search > offers > 6267



Food for all

There is an urgent need to develop tools that crosslink agriculture with nutritional needs in Africa, where hunger and malnutrition is still common. The EU-funded Agrinuts ⁽¹⁾ project is coming up with a solution.

While significant steps have been taken in the last couple of decades to reduce hunger in the world and increase agricultural productivity, over one billion people are still chronically underfed. In addition, over three billion people have some kind of nutritional deficiency that must be addressed.

To understand the causes of hunger and tackle it, researchers must examine the many causes of malnutrition at the home, community, and regional levels. They must develop solutions and implement policies specifically targeted at vulnerable populations.

The Millennium Villages Project (MVP) and the Consortium of Improving Agriculture-based Livelihoods in Central Africa (CIALCA) are two unique projects supporting rural development in sub-Saharan Africa. Building

on these initiatives, the Agrinuts project is developing tools to study and strengthen linkages between the agriculture and human nutrition sector.

It is gathering and cross-referencing biophysical and socio-economic data, based on field and literature research, to build conclusions and recommendations. Agrinuts will then examine how feasible and synergistic these initiatives and interventions are in supporting undernourished and malnourished populations.

The project is also exploring ecological tools and knowledge to address the nutritional diversity of the agricultural system. Data on agro-biodiversity were collected for farming in three MVP sites in sub-Saharan Africa alongside food and nutrition indicators. This helps assess the cropping system for

its diversity of nutrients essential for human life.

The developed tool is able to identify low and high redundancy of nutrient groups in the system as well as crop species that could increase or decrease nutritional diversity of the system. The tool helps to assess agricultural systems beyond conventional indicators such as yield and the economic cost/benefit ratio.

In addition, a global food systems conference on assessing global agriculture was hosted at the Earth Institute in 2009. Over 100 experts described means to evaluate practices to grow and distribute enough food for a population of nine billion people, as projected in 2050. The workshop resulted in consensus among the participants on the need for a major paradigm shift in the way we assess agriculture, considering all social, economic and environmental impacts.

The project partners are currently contributing to this endeavour and ideas are being further elaborated. If the emerging ideas and recommendations are exploited, this modest project could change the way we feed the world, and for the better.



⁽¹⁾ 'The development of a timely and robust tool to analyse relations that link crop and livestock diversity and income to nutrition in poor rural areas in sub-Saharan Africa'.

Funded under the FP7 specific programme People (Marie-Curie actions).

<http://cordis.europa.eu/marketplace> > search > offers > 6285

Putting a price on soil biodiversity

Scientists in Europe have managed to put a price on soil biodiversity by combining basic soil science with an economic model. Understanding its true value will provide greater impetus for protecting this important resource.

Healthy soil provides a number of important ecosystem services. Growing food is perhaps the most tangible benefit, but soil also plays a significant role in the cycling of carbon, nitrogen

and other species. It is therefore imperative that soil biodiversity be preserved.

The EU-funded Soilservice ⁽¹⁾ project sought not only to assess soil

biodiversity in Europe, but to also assign an economic value to it.

Soil samples have been collected from several sites in four Member States and analysed for a number of biological and chemical parameters. Not surprisingly, there are considerably fewer microorganisms in the soil at industrial farms than at more natural sites.



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In addition, experiments indicated that reducing the amount of precipitation lowered the soil's capacity to hold nitrogen, an important nutrient. This has relevance since precipitation patterns may be modified by global climate change.

In order to determine a price for soil biodiversity, the SoilService team has connected a food web to an economic model.

In this way it was possible to determine threshold values for maintaining the health of the soil. Finally, more accurate scenarios at the European and global levels have been created by incorporating soil- and land-use parameters related to soil biodiversity.

The project results will be useful for decision-makers as they shape future strategies and policies addressing not only soil but also agriculture, biofuels and other topics.

(1) 'Conflicting demands of land use, soil biodiversity and the sustainable delivery of ecosystem goods and services in Europe'.

Funded under the FP7 specific programme Cooperation under the theme Environment.

<http://cordis.europa.eu/marketplace> > search > offers > 6210

Protecting shipwrecks from boring worms

Wooden ships that have been resting peacefully at the bottom of the Baltic Sea for centuries are now literally being devoured. Fortunately, a multidisciplinary research team has come to their rescue with recommendations about how to battle the culprit.

The brackish waters of the Baltic Sea have long been home to a number of wooden shipwrecks. However, these archaeological treasures have recently come under threat by *Teredo navalis*, more commonly known as the

shipworm. It is thought that changes in water salinity, possibly due to climate change, have allowed the shipworm to encroach upon this previously inhospitable environment.

enhanced with data concerning the location and degree of degradation of shipwrecks. This model was then used to recreate conditions stretching back over the past three decades.

Specialists in the conservation of wooden objects were called in to propose methods to prevent shipworm infestation. Given the difficult environment in which the ships exist, the most effective approaches include physical barriers and modifying water parameters to inhibit growth. In some cases the cheapest solution may actually be to excavate the shipwreck.

The Wreckprotect team is compiling its findings into guidelines for the use of the GIS tool and mitigation methods. This knowledge is also being shared with the public and a range of stakeholders through workshops, training sessions and the project website.



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The EU-funded Wreckprotect⁽¹⁾ project is performing a risk assessment of the threat posed by the shipworm. Marine biologists involved in Wreckprotect investigated the response of shipworms to changes in water temperature, salinity, dissolved oxygen content and currents.

This information was used to determine which areas of the Baltic Sea may be at risk. Geographical information system (GIS) experts helped put this information on maps of the region.

The maps were further

(1) 'Strategies for the protection of shipwrecks in the Baltic Sea against forthcoming attack by wood degrading marine borers, based on the effects of climate changes'.

Funded under the FP7 specific programme Cooperation under the theme Environment.

<http://cordis.europa.eu/marketplace> > search > offers > 6240

Innovation — the key to recovery

Governments that fail to stimulate innovation and recognise the dangers of short-term policy-making do so at their own peril, suggest the authors of a recent FINNOV ⁽¹⁾ study on Europe's finance, innovation and growth.

The findings, part of an EU-backed study, underline the reforms needed to ensure Europe's economies pull out of the current malaise and maintain long-term competitiveness. European economic systems need to reward rather than penalise businesses which invest in innovation, the authors suggest.

The study puts forward a five-point plan to help European governments revise and reformulate policies that focus on rewarding rather than hindering innovation. The plan includes some general recommendations as well as some country and innovation-specific guidance.



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The economic system encourages business and industry to focus on 'achievable' short-term goals at the expense of innovative, but often higher risk, longer-term goals and markets. Such 'short-termism', stress the authors, leads to financial bubbles where the price of products exceed their value.

'The [current] financial crisis gives added weight to the argument that industrial policy needs to return after decades of taking a back seat and it also signals the economic and political imperative for understanding financial bubbles,' says Mariana Mazzucato, Professor of the Economics of Innovation at The Open University and coordinator of the FINNOV project.

If innovation continues to be neglected these bubbles are likely to increase in frequency and could have powerful economic repercussions, she cautions. But there is a way of out of this situation.

The five-point plan

First, the amount of time private equity investment must be held before the gains from sale can be exempt from capital gains tax in the UK, for example, should be raised from its current two years to five (it has been as high as 10 years in the past). This would help prevent the 'take the money and run' approach especially in green technology and biotechnology — many companies in these innovation-rich areas struggle to deliver tangible 'products' in this business environment.

Second, state investments in emerging technology — again especially in computing, biotech and green tech — should be better compensated or supported for this risk-taking activity.

Third, the EU could find ways to discourage European business from emulating the US practice of issuing stock buybacks that push up stock prices for short-term gains, in favour of long-run investment in innovation.

Fourth, credit ratings should better reflect the industrial performance of companies, such as their productivity and investment in innovation, rather than focusing on financial performance measures.

Fifth, economic and financial 'short-termism' threatens to stifle technological development. Uncertainty in new green tech, for example, has tended to scare venture capital off. 'Given the lack of private investments, the UK government should step up and increase its "green" budget,' the study's authors offer as an example.

Brief but bold steps

The findings appear in the second of a series of policy briefs, called 'Innovation, uncertainty and bubbles', published by FINNOV — a three-year study to understand the sources, implications and management of positive and negative changes in financial markets. FINNOV brings together innovation economists, applied industrial economists, political economists and business historians to investigate the interconnections and implications between recent changes in the patterns of financing, innovation and industrial evolution, and the ensuing dynamics in corporate growth, employment and income distribution. The project partners are delivering insight into European innovation policy, identifying the technological and market conditions which best foster innovation and growth.

'We need policies to reward innovation, along with targeted state investment that will encourage companies to take bold steps to focus on longer term goals. Ploughing more cash into innovation is the key to recovery,' concludes Ms Mazzucato.

⁽¹⁾ 'Finance, innovation and growth: Changing patterns and policy implications'.

Funded under the FP7 specific programme Cooperation under the theme Socio-economic sciences and the humanities. Promoted through the FINNOV project.

www.finnov-fp7.eu

Hedge funds, social networks and risk

Hedge funds handle assets worth billions of euros but remain private in nature and are poorly documented. The EU-funded SNIR ⁽¹⁾ project has analysed the link between social networks, risk taking and performance in a unique environment.

The research consortium has assessed idiosyncratic risk in the hedge fund industry by studying the individual attributes, social networks and perceptions of the leading actors involved. Researchers have also carried out literature reviews and conducted interviews with leading figures in the industry to increase their understanding of the sector.

Interviews included major investment banks and other institutions, involving brokers, hedge fund managers, investment analysts and regulators. Following a detailed literature review researchers now have a better appreciation of the relationship between networks, risk taking and performance.

Benefits include greater access to resources and data but drawbacks can involve information overload that can affect the performance of those at the centre of the networks. Being at the centre of a network may make an actor more powerful and able to take risks. However, powerful actors may be reluctant to take risks because they have more to lose.

Findings by the project will provide valuable insights for EU and national regulators who may wish to further regulate the activities of hedge funds.



(1) 'Social networks and idiosyncratic risk in the hedge funds industry'.

Funded under the FP7 specific programme People (Marie-Curie actions).

<http://cordis.europa.eu/marketplace> > search > offers > 6200

Alliance to enhance alcohol policy and related research

The way alcohol is used needs to be understood across Europe's multicultural economic and social communities.

New research into alcohol use and abuse will be used to design and implement effective alcohol policy measures. The EU-funded Amphora ⁽¹⁾ project offers scientific support for the development of alcohol policy through the European Alcohol Policy Research Alliance. This group is made up of 33 partners from research centres and public administration institutions from 14 countries.

Partners take into account the social, economical and cultural diversity across Europe and aim to enrich the European research base on the effects of alcohol-related public health measures. The focus will be mainly on scarcely or non-explored areas.

Research is investigating socio-cultural determinants of how alcohol consumption has evolved, early identification

and intervention in alcohol use disorders, and legislation on alcohol trade and consumption. Other studies under the project include the effectiveness and cost-effectiveness of policy measures, public perceptions of harmful alcohol use and related policy measures, the impact of alcohol marketing on youth, and the availability of alcohol.

The team plans to make the results available through an open-access database on cost-effective public health measures and through project-related meetings.

The European Alcohol Policy Research Alliance held three workshop meetings in 2009. A thorough review has identified studies exploring relationships between nightlife environmental factors and the levels of alcohol use and harm as a result of it.

Interviews with key agencies concerned are also being conducted.

(1) 'Alcohol measures for public health alliance'.

Funded under the FP7 specific programme People (Marie-Curie actions).

<http://cordis.europa.eu/marketplace> > search > offers > 6184



Polar plankton reveals secrets of the carbon cycle

Marine microorganisms studied in the polar regions have provided valuable information about the role of the carbon dioxide (CO₂) in aquatic ecosystems.

Carbon fixation enables CO₂ gas from the Earth's atmosphere to be converted into a solid compound by organisms known as autotrophs, which are able to produce their own food. The process is driven by photosynthesis, whereby CO₂ is turned into sugars.

However, chemoautotrophic microorganisms can fix CO₂ without the use of light. Although this process is widespread in natural systems and plays an important role in the carbon cycle, the fixation of CO₂ in the dark has not been widely studied.

The EU-funded Chemoarch⁽¹⁾ project has investigated the process of dark CO₂ fixation in aquatic systems by identifying chemoautotrophic microorganisms and studying their abundance and metabolic activity. Researchers have also examined the main factors that determine the distribution of the microorganisms in the environment.

Chemoarch scientists studying microorganisms known as *Crenarchaeota*, which belong to a group called *Archaea*, visited Antarctica and the Arctic. Although *Crenarchaeota* are abundant in the polar regions their diversity and ecology is not really known.

Researchers have discovered that although most of the *Crenarchaeota* in Antarctic and Arctic waters are chemoautotrophs they fix less CO₂ than expected. Scientists have found a wide range of archaeans in different Antarctic water masses, indicating that environmental conditions influence their diversity.

Project partners have also identified Arctic marine bacteria that are active in dark CO₂ assimilation. Results have indicated that this could be an important process for the metabolism and survival of polar bacteria.

The success of the Chemoarch project could help improve understanding of the biogeochemical role of *Archaea* in polar systems. Due to the great sensitivity of these environments to global climatic change, understanding mechanisms underlying the regions' biochemistry is a priority for scientists and policy-makers alike.



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(1) 'Identity and biogeochemical role of chemoautotrophic prokaryotes in aquatic ecosystems'.

Funded under the FP7 specific programme People (Marie-Curie actions).

<http://cordis.europa.eu/marketplace> > search > offers > 6264

New ways to work, learn and collaborate

Lifelong learning has emerged as an essential ingredient for success in our knowledge-intensive society. For many people, this is synonymous with short or post-graduate courses.

But a new approach by European researchers proves that learning can and should be an integral part of working life.

Not surprisingly, where 'e-learning' was the latest trend in corporate training in the early 2000s, and 'blended learning' was the craze in 2003 and 2004, today, thanks to the widespread availability of online wikis and portals, work-integrated learning is the next big thing.

In reality, work-integrated learning is not new and also takes a number of different forms. A case in point is go-getter knowledge workers who check Google or other resources on the web to see who's got books or case studies or blogs on their topic.

After they've got a sketchy framework of what's to be learned mapped out, it's time to dive in, try new things, and build on the knowledge of others. Knowledge workers don't usually take off for a week-long workshop; more likely, they pick up bits and pieces over time.

But how can all these fragments of information be harnessed into a valuable resource, a concrete learning experience?

Work-integrated learning can provide the appropriate context to the users — both suitable for the topics they are currently working on and their level of experience in these topics. This 'information context' can then be used to tailor the resources recommended according to the learner's needs. So a convenient place is needed to store all these so-called 'informal learning assets', including documents, slides, podcasts, videos, spreadsheets and many more. Some organisations use Microsoft Sharepoint®. Others build repositories of sorts with inexpensive wiki and social networking software.

The Aposdle (1) project, backed by European Commission's Sixth Framework Programme, proposed its own solution. It developed a software platform that offers a variety of learning support services — like practical guidance, content and expert advice — for the user to choose from.

As far as possible, this support is provided within the work environment, and not in a separate learning environment. It is also based on knowledge sources available within an organisation which may not have been originally intended for learning.



‘Our approach is based on trying to identify work tasks and competences based on the user’s interaction with the [computer] desktop.

The goal is to unburden the user from having to explicitly search and maintain a user profile,’ explains Stefanie Lindstaedt, scientific coordinator for the Aposdle project.

The system proactively identifies information needs and recommends relevant resources — parts of documents, people, parts of models, learning paths, and so on. So an expert and a novice both working on the same task will be offered very different resources, she adds.

The space where coworkers interact

The key difference with e-learning systems is that Aposdle provides support for all three roles a knowledge worker fills at the workplace: the role of the worker, the role of the learner, and the role of the expert. These roles are represented by the three rings of the Aposdle logo: work, learn and collaborate.

Specifically, the system supports knowledge workers by automatically recognising their everyday duties, by searching available documents and displaying the most relevant, by recommending suitable partners, and by automatically adding new resources to an organisation’s knowledge network.

For this purpose, the project partners develop concepts as well as entirely new tools for modelling working processes, competence portfolios and learning preferences, or how to access different resources stored in different data repositories. The learners’ peers and teachers are also represented in order to allow them access to expert help.

‘The models can be constructed in a rather coarse manner, and provide the basis for reasoning within the system. The learning content is then automatically created by reutilising existing documents (text as well as multimedia) from the organisation’s knowledge space,’ says Dr Lindstaedt. In short, the interrelated pieces of a roughly designed network are orchestrated to deliver a meaningful learning experience to the user. In contrast, e-learning content is expensive to create, requires lots of standardisation efforts, and a lot of organisational structure.

Dr Lindstaedt adds that ‘Aposdle is a design environment for creating domain-specific [learning] support environments. We could show that we could significantly reduce the efforts needed for instantiation to about 120 hours.

This is especially notable if you consider the amount of time needed to instantiate a learning system for a specialised work domain.’

Coming together was the beginning

To make sure that the needs of workers who want to learn at work are fulfilled, Aposdle was designed in close cooperation with potential users from three different companies: the European Aeronautic Defence and Space Company (EADS) in France, the Innovation Service Network (ISN) in Austria and the Chamber of Commerce and Industry (CCI) in Germany.

For about three months the system was available to 25 engineers examining the effects of lightning on airplanes and for consultants providing customised solutions for collaborative innovation or guidance for business start-ups. This ensured that the findings were not biased towards one particular field of work.

Aposdle proved particularly useful for learners in highly specialised fields of work such as electromagnetic simulations conducted at EADS, where relatively inexperienced workers were able to broaden their knowledge by using the learning guidance provided. On the contrary, in customer-driven fields, where knowledge is shared to a large extent, it was less effective.

On 15 January 2010 most of the source code for Aposdle’s platform was made available through the project website (www.aposdle.tugraz.at/home) as open source software. The Aposdle partners are keen that ‘this will make cooperation with other researchers and projects easier’, according to Dr Lindstaedt.

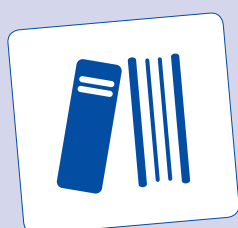
‘For example, we intend to integrate results from the Aposdle project with insights gained from the “Continuous social learning in knowledge networks” (Mature) project. Also, we are currently exploring application possibilities in a number of corporations and examining funding opportunities which would enable us to turn Aposdle into a product.’

The Aposdle project received funding from the Information Society Technologies (IST) initiative of the Sixth Framework Programme.

(1) ‘Advanced process-oriented self-directed learning environment’.

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<http://cordis.europa.eu/marketplace> > search > offers > 6217



Watch this space!

Coming up in issue 6 of *research*eu results magazine* a special dossier on ‘Health and ageing: new therapies and technologies to improve well-being’.

Crisis management at its best

Better, more dependable communication between crisis response teams and concerned parties is set to save lives and enhance security.

In recent years, Europe has been focusing strongly on security and response to crisis situations. As the world becomes 'smaller' and more globalised, security risks and emergency situations are creeping into our immediate environments more frequently.

In 2006, the European Security Research Advisory Board (ESRAB) outlined the European security research agenda and the requirements for new communication infrastructures. These requirements include security, dependability, enhanced connectivity and advanced search

functions. Much headway was made since then in this area, culminating in the EU-funded 'Seamless communication for crisis management' (Secricom) project.

It involves 13 partners from 8 different EU countries who are producing a dependable solution for advanced, secure communication and collaboration of emergency responders.

In line with the above-mentioned requirements of ESRAB, the Secricom project ensures end-to-end secure transmission of data and services

across heterogeneous infrastructures with real-time detection and recovery capabilities against intrusions, malfunctions and failures.

One main objective of the project is to improve crisis communication infrastructures through seamless, and secure interoperability between the hundreds of thousands mobile devices deployed. Secricom is thus aiming for a smooth, simple, converging interface between systems currently deployed. It is creating a pervasive and trusted communication infrastructure, bringing interconnectivity between different networks, as well as providing true collaboration among emergency responders. Such a system would seamlessly support different user traffic over multiple communication channels and platforms.

The project wants to employ new smart functions using distributed IT systems based on secure software-defined radio (SDR) technology and infrastructure. This is a platform that could allow for easier, instant information gathering and processing, focusing on emergency responders' main task of saving lives.

Once such a system goes into full operation, emergency crisis response could be streamlined and possibly better coordinated.

Funded under the FP7 specific programme Cooperation under the theme Security.

<http://cordis.europa.eu/marketplace>search>offers>6251>



Novel antennas boost communication

With ever-increasing demand for their services, satellite and mobile applications would benefit greatly from improved antennas that work more efficiently, even in indoor settings.

As communication brings different parts of the world closer, global navigation satellite systems (GNSS) are playing an increasingly important role in our daily lives. However, the need for more immediate accessibility and much

larger exchange of data streams call for better antennas that enable this evolving technology.

'GNSS reconfigurable antenna-based enhanced localisation' (Grabel), an

EU-funded SME research initiative, is planning to develop better and more efficient antennas by improving how they beam signals between each other.

Development of new technology is particularly important as users demand accurate, reliable indoor-outdoor localisation and more location-aware services. If the project succeeds, this will improve the localisation properties of GNSS receivers, including systems such as GPS



mobile services and the well-known Galileo navigation system.



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Generally, these systems work well under the right conditions outdoors and with a clear line of sight. Under such conditions, most current GNSS receivers are able to deliver reliable navigation to within a few metres. But in reality signals often have to travel long distances, get round obstacles indoors and out, and deal with interferences.

In technical terms, Grabel is developing improved GNSS receiver techniques that make better use of the weak GNSS signals while mitigating the adverse effects of multi-path signals, fading, shadowing and interference. It is using jointly optimised reconfigurable antenna arrays and a new 'beam-forming' approach.

Beam-forming is a signal processing technique that focuses and improves directional signal transmission and reception. The approach employs complex algorithms to upgrade the signal, offering robust, high-performance

localisation in dynamically changing indoor and outdoor environments. Consequently, Grabel is opening the door to a new generation of outdoor/indoor location-aware services that meet market demands.

Preliminary market studies have allowed the project to identify potential applications for the new technology and select the most promising ones based on the characteristics of the final receiver.

Grabel has succeeded in designing a reconfigurable antenna and antenna arrays based on GNSS requirements with beam-forming functionality, holding strong promise for mass market GPS receivers. After considerable testing, a roadmap for developing viable applications and demonstrations has been defined.

Funded under the FP7 specific programme Capacities under the theme 'Research for the benefit of SMEs'.

<http://cordis.europa.eu/marketplace> > search > offers > 6345

New techniques developed to improve wireless systems

EU funds are being used to develop novel techniques to improve the next generation of wireless broadband access systems.

Researchers, led by a team from the UK wireless company Rinicom, have succeeded in improving advanced signal processing and coding techniques to boost the performance of wireless systems, as exemplified by the current worldwide interoperability for microwave access (WIMAX) system. WIMAX is an international standard for wireless broadband access network with a cellular structure consisting of base-stations and fixed or mobile user terminals.

One of the main goals of the EU-funded 'Next generation wireless broadband access systems and advanced coding techniques' (Wi-coding) project was to develop new coding techniques. The research team used an entirely new coding method called 'polar coding', a class of codes with low-complexity encoding and decoding algorithms, to achieve this. They investigated how to

take polar coding from a theoretical idea and turn it into practice. Their initial work in this area included a critical assessment of polar codes as a potential competitor to the existing coding schemes used in the WIMAX system. With 'encouraging' results, the researchers will continue to work on designing coding, modulation, and space-time coding schemes based on the polar coding paradigm.

Another project target was the development of a pre-distortion algorithm to correct amplifier non-linearities. Orthogonal frequency division multiplexing (OFDM) is a means of allowing



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multiple users to share a common communication electromagnetic spectrum. It has become the air-interface of choice for modern wireless systems, but it suffers from a 'peak to average power ratio' (PAPR) problem which makes OFDM systems costly to implement. In OFDM

systems, the PAPR of transmitted signals tends to be high which prevents the OFDM transmitter's high-power amplifier from operating efficiently.

The Wi-coding research team developed a novel hybrid pre-distortion algorithm for OFDM systems and prepared

a prototype of the pre-distorter, which will compensate for the non-linear behaviour of the power amplifier when it is saturated by a strong input signal.

To balance the academic and practical aspects of the project, the novel ideas were all developed and tested in the

context of emerging next-generation wireless standards, such as WIMAX.

(1) 'Funded under the FP7 specific programme People under the theme 'Implementing the Seventh Framework Programme'.

<http://cordis.europa.eu/marketplace> > search > offers > 6223

Making better sense of agriculture

A new centre in the Western Balkans is exploring wireless sensor technologies to help monitor and advance agriculture and related sectors in the region.

Advanced technologies such as wireless sensor networks (WSN) and remote sensing are changing the face of agriculture. They ensure timely access to data from the field and enable prompt responses. Measures can be administered with more precision and effectiveness, providing higher food quality, environmental protection and considerable savings.

The Western Balkans (Albania and the former Yugoslav republics except Slovenia) can benefit greatly from this technology as agriculture is the main backbone of the economy. This particularly applies to the Autonomous

Province of Vojvodina in Serbia where agriculture represents 40 % of GDP. To support the region's agricultural advancement, the EU-funded Agrosense⁽¹⁾ project is teaming up with the Centre for Measurement Technologies in Precision Agriculture (Metep@) at the University of Novi Sad. The focus is on developing and applying these new technologies so that the research community and the Western Balkans can benefit.

Agrosense has already helped the centre to purchase a thermal camera and recruit new researchers to further the project's aims. It has conducted numerous training sessions revolving around advancements in the field and new technologies. Important exchanges in staff and knowledge were also undertaken.

Meetings were held within the project partners and with potential partners outside the Agrosense consortium. As a result, several proposals for joint research projects were submitted under different programmes and a solid base was formed for future cooperation and joint research work related to the Agrosense activities.

In October 2009, the project organised the Biosense09 workshop on sensing technology in agriculture, forestry

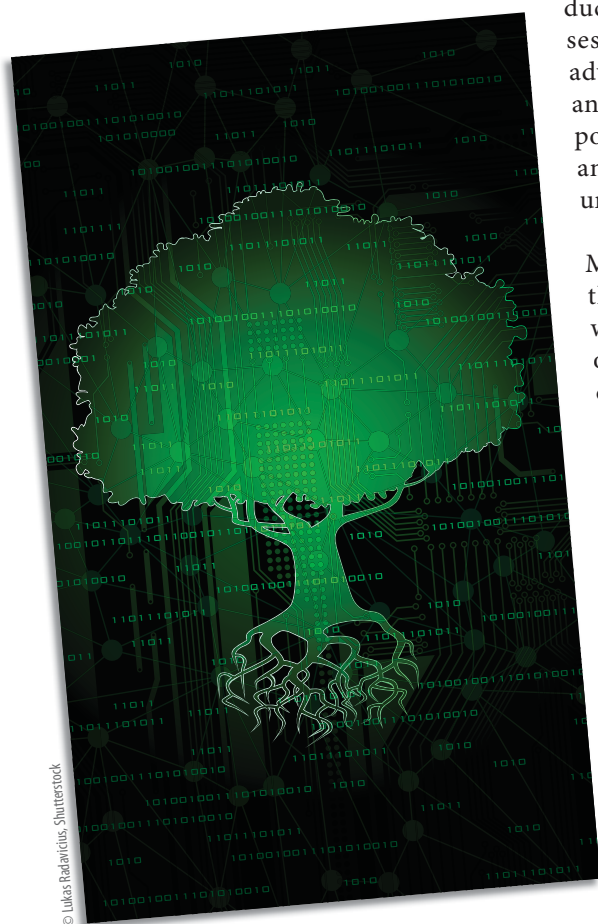
and the environment in Novi Sad with commendable participation from all project partners. The partners contributed significantly to the successful organisation of the workshop, where a total of 23 papers and seminars were presented. In addition, the workshop hosted 15 experts from Canada, the EU and the US, as well as 26 experts from the Western Balkan region.

Project partners have also participated in many international conferences, gaining access to research and promoting project results to a wider scientific community. This has garnered considerable interest from academics in related fields, such as ecology and water management, as well as from people within the industry.

Many delegates were especially interested in furthering the development of systems based on technologies like WSN and remote sensing. As a consequence, the Metep@ centre was renamed the BioSense Centre to take advantage of the success of the evolving Agrosense project and Biosense09 workshop. This marks the project's success and opens the door for considerable exchange of knowledge, and advances sensor technology in the field of agriculture.

(1) 'Wireless sensor networks and remote sensing — foundation of a modern agricultural infrastructure in the region'.

Funded under the FP7 specific programme Capacities under the theme 'Research Potential of Convergence Regions'.
<http://cordis.europa.eu/marketplace> > search > offers > 6284



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Robots show the evolution of altruism

Scientists in Switzerland have pieced together the puzzle on the evolution of unselfish behaviour. They simulated genetic evolution over hundreds of generations by using simple robots, providing evidence of kin selection.

Presented in the journal *PLoS Biology*, the study was backed in part by the EU projects Ecagents⁽¹⁾ and Swarmanoids⁽²⁾ with a combined funding of EUR 6.8 million.

Altruistic gene expression is not foreign to nature; one generation gets it from the one that came before. A case in point is worker ants. These ants are sterile and make the altruistic sacrifice by not transmitting their genes in order to guarantee the survival of the queen's genetic makeup. Kin selection is when an individual makes a sacrifice so as to ensure the survival of a relative's genetic code.

The biologist W.D. Hamilton proposed in the mid-1960s a set of conditions under which altruistic behaviour could evolve. Today's researchers call this rule kin selection.

In a nutshell, when an individual shares food with family, they decrease their chances of survival but increase the likelihood that their family members will pass on their genes. Under this rule, the genetic proximity of organisms influences whether one individual shares food with another.

To date, the challenge for researchers to test the evolution of altruism has been great, mainly due to the lack of experiments and the fact that too many variables were involved.

Dario Floreano, a professor of robotics at the École Polytechnique Fédérale de Lausanne (EPFL) in Switzerland, and one of the authors of the study, used simulated gene and genome functions on robots that evolve quickly, giving researchers the support they need to calculate the costs and benefits associated with the trait.

'This study mirrors Hamilton's rule remarkably well to explain when an altruistic gene is passed on from one generation to the next, and when it is not,' explains Laurent Keller from the

Department of Ecology and Evolution, Biophore, University of Lausanne.

In past tests, Prof. Floreano and Prof. Keller demonstrated that foraging robots able to do complex-free tasks evolve over multiple generations. In this latest study, they used a foraging robot that could handle more complex tasks including deciding whether it wants to share an object or not.

The team says the results are already proving useful in swarm robotics. 'We have been able to take this experiment and extract an algorithm that we can use to evolve cooperation in any type of robot,' Prof. Floreano says. 'We are using this altruism algorithm to improve the control system of our flying robots and we see that it allows them to effectively collaborate and fly in swarm formation more successfully.'

Ecagents received EUR 4.3 million under the 'Information society technologies' (IST) thematic area of the EU's Sixth Framework Programme (FP6). Pooling together the expertise of researchers in Belgium, France, Germany, Hungary, Japan, Spain, Sweden and Switzerland, Ecagents investigated how communication emerges, what types of communication systems exist or can exist, and how communication network topology influences such systems.

Swarmanoids clinched EUR 2.5 million under the 'Future and emerging technologies' (FET-OPEN) programme of FP6. Belgian, Italian and Swiss researchers targeted construction robots with the capacity to live in human-made environments.

(1) 'Embodied and communicating agents.'

(2) 'Towards humanoid robotic swarms.'

Promoted through the Research Information Centre.
<http://ec.europa.eu/research/infocentre> > search > 21393



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Eyeshots project delivers tactile solution

EU-funded researchers have made giant strides in their quest to control the interaction between movement and vision, replicating human behaviour in robots. How? They have developed a sophisticated three-dimensional visual system synchronised with robotic arms.

The outcome is part of the 'Heterogeneous 3D perception across visual fragments' (Eyeshots) project, which received EUR 2.4 million under the 'Information and communication technologies' (ICT) theme of the EU's Seventh Framework Programme (FP7).

This latest development could enable robots to see and be aware of their surroundings. It could also give these machines the edge in remembering the contents of those images so that they could act accordingly, the researchers say.

Led by the Department of Biophysical and Electronic Engineering at the University of Genoa in Italy, the Eyeshots partners say they had to refine the basic mechanisms of a humanoid robot to ensure the successful interaction of

its environment with the autonomous tasks it must fulfil. Ángel Pasqual del Pobil is the head of the Spain-based Robotic Intelligence Laboratory of the Universitat Jaume I de Castellón, which is an Eyeshots partner. His team validated the consortium's findings with a system developed at the university. This system comprises a torso with articulated arms and a robot head with moving eyes.

The partners kicked off the development process by examining human and animal biology. Experts in robotics, neuroscience, engineering and psychology, the team members built the computer models by recording monkey's neurons engaged in visual-motor coordination. Humans and primates, say the partners, show the way in how the world is perceived.

The first artificially replicated feature of the human visual system was our saccadic eye movement which is related to the dynamic change of attention, they say. 'We constantly change the point of view through very fast eye movements, so fast that we are hardly aware of it,' Dr Pobil says. 'When the eyes are moving, the image is blurred and we can't see clearly. Therefore, the brain must integrate the fragments as if it were a puzzle to give the impression of a continuous and perfect image of our surroundings.'

Using the neural data, the team built computer models of the section of the brain that combines images with movements of both eyes and arms. According to them, this model is unique. The integration of images with movements confirms that when humans move to grasp an object, it is not necessary for the brain to calculate the coordinates.

'The truth is that the sequence is much more straightforward: our eyes look at a point and tell our arm where to go,' Dr Pobil explains. 'Babies learn this progressively by connecting neurons.'

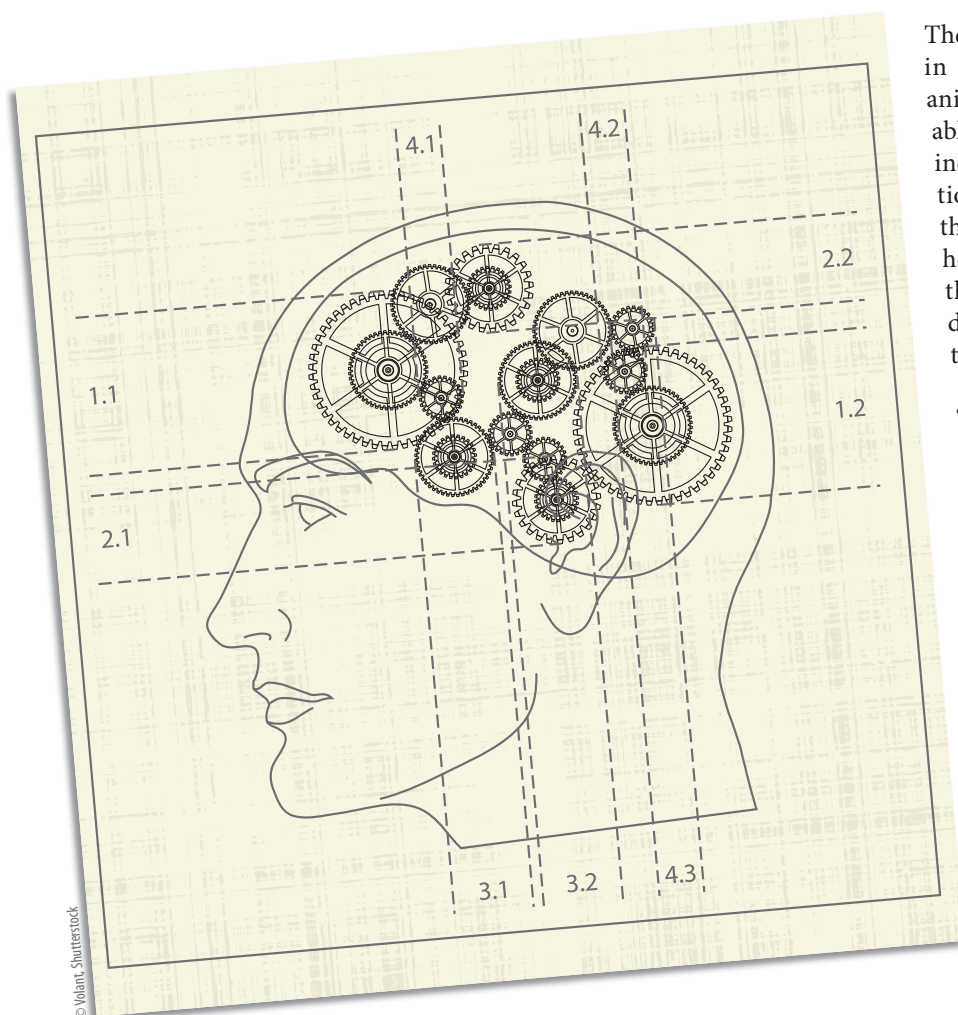
The Eyeshots partners have succeeded in simulating these learning mechanisms through a neural network, enabling robots to perform various tasks including constructing a representation of the environment, preserving the appropriate images and learning how to look. These robots also use their memory to reach for objects despite not being able to actually see them.

'Our findings can be applied to any future humanoid robot capable of moving its eyes and focusing on one point,' the Spanish researcher says. 'These are priority issues for the other mechanisms to work correctly.'

The other partners of Eyeshots are the University of Münster in Germany, the University of Bologna in Italy and Katholieke Universiteit Leuven in Belgium.

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<http://ec.europa.eu/research/infocentre> > search >

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The road to smart safety

Advanced software systems are revising current behaviours of drivers and their interaction with technology to improve emergency response systems in cars.

In recent years, several driver support and information management systems have been designed and implemented to improve the safety and performance of vehicles. However, there still remains a need to examine these systems' effects on driver behaviour and strategies, and their impact on the operation and safety of the traffic system.

Such a unified model of driver behaviour helps the design of more innovative technologies as it assesses and fine-tunes the systems in a safe and controllable environment. The model can assist designers in identifying potential challenges at the prototype stage and build scenarios to be used in system evaluation.

They have also evaluated the current systems available for the three modes of land transport to identify commonalities and see how they can be used for the experimental work.

The project consortium comprises seven partners from Europe and Israel. Iterate's progress and results are available on the project website. In the near future, systems using this new model and software will be designed for better driving, even before they hit the market.



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The EU-funded 'IT for error remediation and trapping emergencies' (Iterate) project is developing a unified model of driver behaviour and interaction with innovative technologies in emergency situations related to all surface transport modes.

Driver age, gender, education, experience and culture, as well as workload and fatigue, are being considered along with influences from the environment and the vehicle. All this information will help design the ultimate software for analysing driver behaviour and response in emergencies.

It can be used to improve driver interaction with innovative technologies in emergency situations and ultimately create better emergency systems.

In addition, the model could guide authorities in assessing and approving innovative technologies without having to perform extensive simulator experiments or large-scale field trials.

Project partners have already amassed a critical review of the literature regarding available models and the theories behind them to help build this latest one.

They will provide better support to the driver in emergency situations, a very important accomplishment in vehicle safety.

Funded under the FP7 specific programme Cooperation under the theme 'Transport'.

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Nanotechnology gives birth to super materials

A new project is exploiting nanotechnology to make super composite materials and polymers that can be used in myriad applications.

Advanced, strong and lightweight materials based on nanotechnology have been around for years, but there is much more potential lying dormant when it comes to their exploitation and application. These materials are made of extremely tiny elements called carbon nano-tubes (CNTs), each approximately 1/50 000 th of a human hair.

The EU-funded POCO ⁽¹⁾ project wants to create very strong and light materials, known as polymer composites, using CNTs, not least because of their exceptional mechanical and electrical properties. In more technical terms, POCO plans to fill innovative polymer composites with CNTs in order to obtain nano-structured materials that possess tailor-made properties.

The process considers three elements: the polymer itself, the CNTs, and the CNT/polymer interface. This requires a rethinking of the chemical properties of CNT surfaces so they disperse correctly and bind the nanotubes into the polymer mix (or matrix) during processing.

The approach involves the development of different CNT confinement strategies to develop novel polymer matrix nanocomposites. Several polymers with the desired thermosetting properties can be moulded by heat into any desired shape which makes them useful in numerous industrial applications. This includes automotive, aeronautics, building, aerospace, wind power generation (blades), ship building and biomedicine.

The project team is working on producing materials with specific properties that can be used in these fields. The materials must possess high strength for structural and mechanical components, boast tuneable electrical properties and be highly resistant, particularly to water and liquids. The final goal is to develop CNT/polymer nanocomposites with superior mechanical, electrical, thermal and other properties.

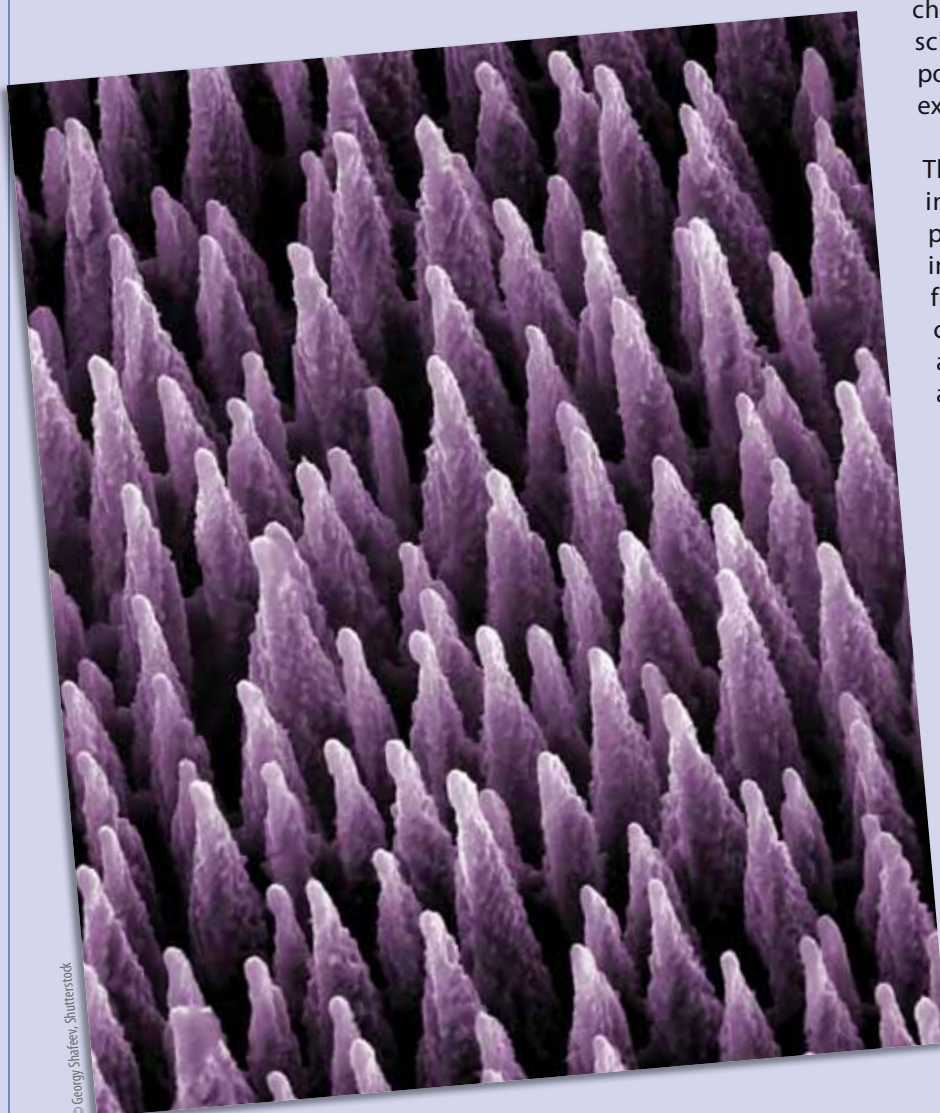
To ensure project success, POCO is adopting a multidisciplinary approach by skilled scientists from different disciplines. This includes organic chemistry, carbon nanotube chemistry, polymer physics, surface science, nanocomposite modelling, polymer processing and toxicological expertise among others.

The team is currently experimenting on CNTs to achieve the ideal positioning of the nano-structures, including correct alignment, confinement and adhesion. Ease of processing is also being investigated, and studies for processing have already started.

If all goes as planned, these new materials could revolutionise industry, reduce costs and usher Europe confidently towards a brighter industrial future.

(1) 'Carbon nanotube confinement strategies to develop novel polymer matrix composites'.

Funded under the FP7 specific programme Cooperation under the theme 'Nanoscience, nanotechnologies, materials and new production technologies.'
<http://cordis.europa.eu/marketplace> >
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Nano-crystal research to revolutionise electronics

EU-funded researchers are exploring the potential for nanocrystal molecules to be employed in European industries such as health care, printable electronics and security.

Recent developments in the design and synthesis of nano-scale building blocks as active elements in opto- or bio-electronic devices with tailored electronic functionality have huge potential.

Indeed, scientists believe they could revolutionise multi-billion-euro

markets across many technology sectors, including health care, printable electronics and security.

Ligand-stabilised inorganic nanocrystals and functional organic molecules are attractive building blocks because of their size-dependent optoelectronic properties, the availability of low-cost

synthesis processes, and the potential to form ordered structures via biomolecular recognition and self-assembly.

Scientists are therefore working to harness the complementary properties of nano-crystals and functional molecules.

They claim this is a unique opportunity to generate new knowledge and develop new classes of high-knowledge-content materials that have been tailored specifically for key applications, such as printable electronics, bio-sensing or energy conversion.

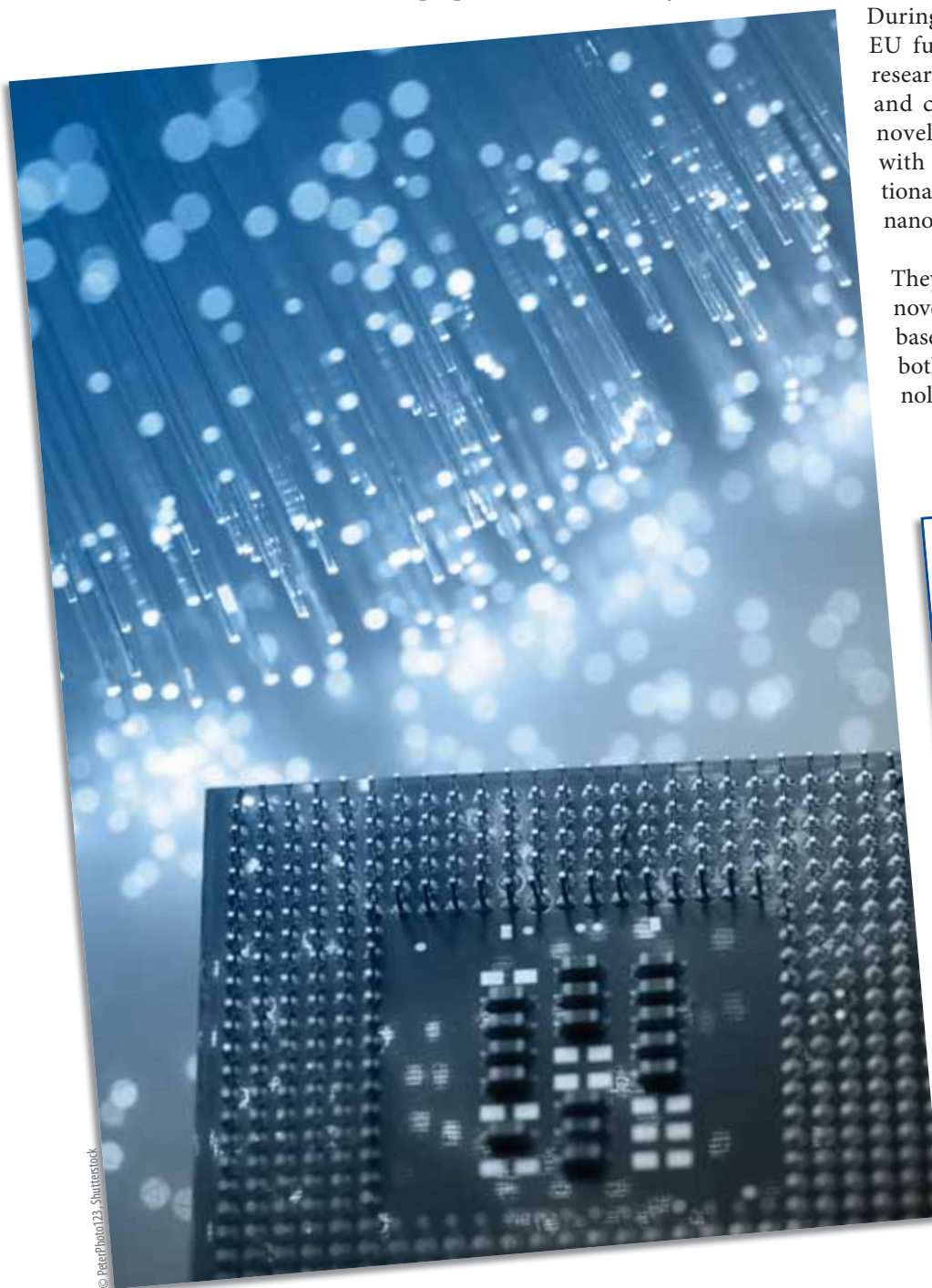
During the first 18 months of the EU funded Funmol ⁽¹⁾ project, researchers designed, synthesised and characterised a number of novel linker molecular systems with novel optoelectrical functionalities in isolation and within nano-crystal-based assemblies.

They also developed a variety of novel biomolecular and protein based materials and tested them both in solution and with technologically relevant substrates.

Scientists believe they could revolutionise multi-billion-euro markets across many technology sectors.

⁽¹⁾ 'Multi-scale formation of functional nano-crystal molecule assemblies and architectures'.

Funded under the FP7 specific programme Cooperation under the theme 'Nanoscience, nanotechnologies, materials and new production technologies.'
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Interview

A flare for solar research

Our closest star, the Sun, remains shrouded in mystery. Its impact on our lives and on our very existence is still to be fully understood. And yet throughout the existence of mankind, we have marvelled at the wondrous Northern Lights in the upper atmosphere and their swirling glow of coloured lights. We now understand why this happens and how particles emitted by the Sun get trapped in the Earth's magnetic field.

We also understand how massive solar flares can disrupt satellite communication and how solar radiation can threaten the lives of astronauts. But we don't understand why sunspots cycle every eleven years. Nor can we predict with any accuracy the solar storms that disrupt electronics here on earth.

For obvious technical and physical reasons, we have to study the Sun at a distance. This is why the EU-funded 'European Solar Telescope' (EST) project is preparing the designs for the world's most sophisticated and largest solar thermal telescope. We speak to Manuel Collados, a research scientist at the Instituto de Astrofísica de Canarias and the University of La Laguna.

Dr Collados is project coordinator at EST. He is an expert in solar spectropolarimetry and magnetic field measurements and has led the development of instrumentation for solar telescopes. He has worked on the Tenerife Infrared Polarimeter (TIP), the German VTT of the Observatorio del Teide (Tenerife), and the spectrograph for the 1.5 metre Gregor solar telescope.

He provides us with some compelling insights into ground-based space exploration and how this new solar telescope can help solve many of the remaining mysteries of our most vital star.

• Your project, EST, is in the process of developing the conceptual design study behind a large aperture European solar telescope. Explain in simple language what this means and where you come in.

Thanks to an EC grant, obtained through an FP7 collaborative project, we were able to start some three years ago the conceptual design of the

telescope. This means the identification of suitable alternatives for all the subsystems that form part of it. For instance, there is a choice of either having a dome to protect the telescope from wind or having an open telescope where wind is allowed to blow across the telescope to sweep turbulent cells with it. Or there is the possibility of either having an evacuated telescope, like in the past, or designing an environment with strict thermal control to avoid internal turbulence along the light path.

Other factors include the number and type of instruments, alternatives for the image rotation to ensure stable images, the height of the building so that near-ground turbulence produced by the heat from solar radiation does not reach the telescope, etc. A conceptual design implies studying all these alternatives to decide the most suitable one for each subsystem, taking into account a global vision of the telescope.

As a result of the analyses, EST aims to combine the best of present ground-based European facilities for high-resolution solar research. Examples include the open designs like the Dutch Open Telescope, the superb imaging capabilities of the Swedish Solar Tower, the robust adaptive optics system at the German Vacuum Tower Telescope and the excellent spectropolarimetric performance of the French Thémis. This combined European expertise has made the design of the telescope feasible, minimising risks and exploiting the strengths of each country.

EST is intended to measure the physical properties of phenomena happening in the solar atmosphere. This implies accurately measuring the temperature, the velocity, and especially



Dr Manuel Collados

the magnetic field. Magnetic fields play an important role in the Sun since they are able to interact with the solar plasma — the ionised gas that forms the Sun and the stars — extract energy from it, and help to transfer it to the outer layers of the solar atmosphere where it can finally be released back to the solar plasma. All this leads to matter being heated up to much higher temperatures than if the magnetic field didn't exist.

The two main technical objectives of EST are to observe the Sun with a spatial resolution much better than has ever been achieved with a solar telescope and to measure the magnetic field — how it emerges to the surface of the Sun, how it interacts with matter and how it delivers back the energy that has been stored in it — with unprecedented accuracy. Questions like, why the number of sunspots on the solar surface varies periodically with a cycle of 11 years or why sunspots are still a puzzle for solar physicists.

In the project, 30 institutions from 9 EU countries have participated in the technical studies. Half of the partners are research institutes and the other half are private companies, whose expertise in particular technological fields has been crucial for the development of the design. The project is promoted by the European Association for Solar Telescopes. This is a consortium of research institutions of 15 European countries. Even if some of these institutions have not been directly involved in the technical design of the telescope, their contribution has been centred on the definition of the scientific requirements of EST from the very beginning.





Scientific requirements are an essential part of the project since they define what the telescope is intended to do and its technical goals. The conceptual design of EST has been coordinated by the Instituto de Astrofísica de Canarias and, at this moment, the project is ready to proceed with the subsequent phase of the project, the detailed design of all components of the telescope, prior to construction. Support from the funding agencies of all countries that are participating will be crucial for the final success of EST.

• ***Your proposed telescope aims to provide deeper insight into solar mysteries. Can you elaborate on those mysteries and how this may affect the Earth?***

The energy released in the solar atmosphere happens sometimes as giant explosions that we call flares. During these flares, large amounts of energy are emitted by the Sun in a very short time. The energy is accompanied by electrons and ionised material moving with speeds reaching kilometres per second. If these particles happen to be ejected in the direction of the Earth, they can produce a number of phenomena when they reach us. They are the reason for the amazing aurorae that are observed at high latitudes. The particles emitted by the Sun can be trapped by the Earth's magnetic field and guided to the poles where they enter the Earth's atmosphere. Due to the high energy of these particles, they can ionise the atmospheric molecules, which some time later may recombine again with electrons and emit the fascinating light we see in the aurorae.

Other phenomena are not so innocuous and may have an important impact. For example, the high-energy particles released by the Sun can burn the satellites orbiting the Earth by creating enormous currents in their electronics. Sometimes, solar storms are very powerful and can penetrate the magnetic shield of the Earth and overload and burn electric plants on the ground. Also, astronauts in space need to keep an eye on these storms.

They represent a severe menace for their lives. All these phenomena, related to the release of large amounts of energy by the Sun, its propagation through the interplanetary medium and its interaction with the Earth or other planets is known as 'space weather'. This topic is receiving more and more attention by funding agencies all over the world.

EST will study these phenomena at their roots, in the Sun itself, to help us understand under which conditions the magnetic energy is stored and released to produce solar storms. With EST, we will be able to observe the interaction of the plasma and the magnetic field with much better resolution than with the present telescopes and we hope that we will be able to answer questions like how sunspots are formed, or how energy is transferred to heat up the upper layers of the solar atmosphere, or how giant prominences can remain stable above the solar surface for months.

• ***The European Commission announced recently its commitment towards identifying and supporting European space exploration. Discussions are even underway to possibly propose a European space programme some time this year. What are, in your views, some of the more pressing issues concerning space exploration? And how would you like see such a European space programme developed?***

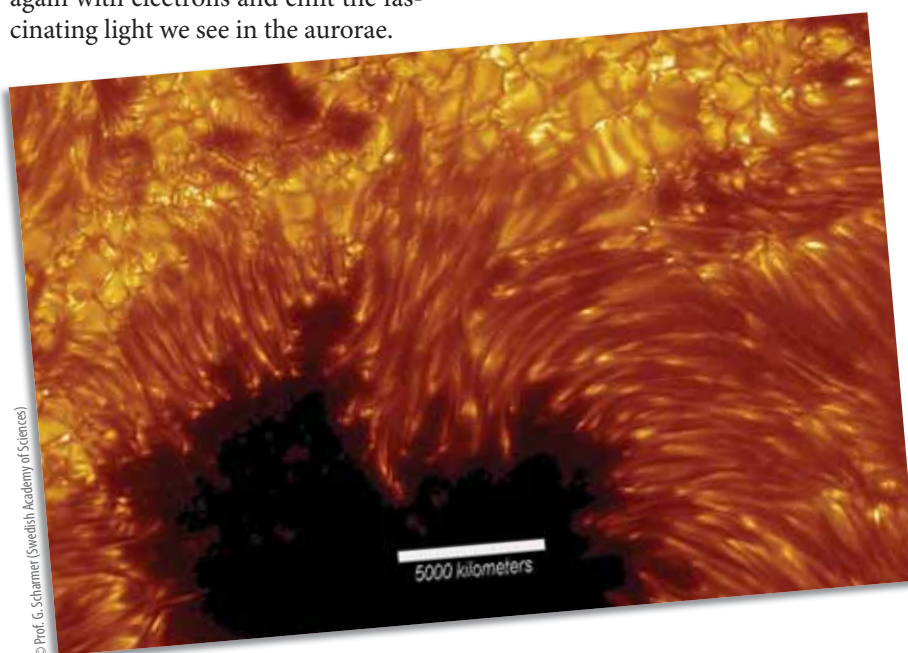
Studying the Sun from space is fundamental. The advantages come from the very fact of being in space, and thus free from the effects of the Earth's atmosphere. Our atmosphere behaves as a filter and is only transparent to a small part of the radiation. From the ground, the Sun can only be studied in visible, and part of infrared, wavelengths, as well as in radio frequencies.

The hottest part of the solar atmosphere — the corona which has a temperature of a few million degrees — is only accessible to telescopes on the ground during eclipses. However, from space it can be continuously studied in ultraviolet and shorter wavelengths. This is of primary importance to understand how the magnetic phenomena propagate through the different layers of the solar atmosphere, understanding the varying interactions between the magnetic field and the plasma, and how this is accelerated.

European space missions like the Solar and Heliospheric Observatory have had an enormous impact on our knowledge of the Sun, leading to a global vision of it as a single system that must be studied as a whole. Phenomena that take place in the deep layers of the solar atmosphere propagate outwards and only a joint observation of their properties at all layers makes it possible to understand.

• ***Many people think of rockets and satellites when they hear about space exploration. But ground-based installations are a key feature of space programmes. Can you elaborate?***

Space and ground-based observations are complementary. Clearly, there are advantages of observing the Sun from space. However, this comes at a price. Space missions are very expensive and space can be a very uncomfortable environment.



© Prof. G. Schamer (Swedish Academy of Sciences)

For instance, it is not easy to repair a broken component. Every little detail is crucial for the success of the mission. Most of the time you can't just take a step backward if the performance of some system deviates.

From a technological point of view, this implies that very well-tested and secure components have to be used when designing an instrument for space. Thus, in many cases, state-of-the-art technologies are not the first choice. The most advanced technical developments are usually found in ground telescopes.

In addition, putting a large telescope in space is also very expensive. For this reason, the largest day-time and night-time telescopes are located on the ground. Their larger size allows us to collect more light and see fainter objects at night. They also allow us to study rapidly evolving phenomena with a larger cadence. And finally they have a greater resolution and so phenomena can be studied with much more detail. So, in practice, both approaches are necessary and complementary.

• Space and its exploration has always been driven by large ideas and innovation. These ideas and technologies have spun off numerous other innovations. What potential new innovations do you envisage as a result from your own work at EST?

EST, with its diameter of four metres, is a solar telescope much larger than any existing solar telescope and will be located in the Canary Islands. The islands host two of the best sites in the world for astronomical observations; the Observatorio del Teide on Tenerife and the Observatorio del Roque de los Muchachos on La Palma. However, despite the excellent location the turbulence of the Earth's atmosphere degrades the image quality to some extent, and live correcting systems are needed to exploit the maximum optical performance of the telescope.

A powerful system, known as multi-conjugate adaptive optics, has been designed for EST to allow us to observe details as small as 30 kilometres on the surface of the Sun. To be able to take the telescope to the limit

of its performance, a number of technological challenges have been identified and analysed during the conceptual design phase. Mirrors whose shape can be modified in real time, in a millisecond, are needed for the powerful adaptive optics required to compensate for the disturbing effects of the Earth's atmosphere on image quality. These mirrors already exist today, but they are not large enough for the required actuator size for this large telescope.

The basic ingredient of adaptive optics is an image stabilisation system. These systems are nowadays used in common video cameras and were already developed and used in solar telescopes much before they were incorporated into these devices. Now, astronomy is a step further and it will not be strange if the complex adaptive systems we are designing today for our telescopes will be routinely used in daily life.

Thermal control is also a critical issue for a solar telescope. Solar light is collected and concentrated by the telescope and, in some parts of it, the amount of heat is as high as that produced by a nuclear plant.

In the past, with small telescopes, this issue was solved by extracting air from the telescope's tube, operating it in an evacuated environment in the parts where heat was more concentrated. EST's four-metre mirrors make this solution unfeasible. So a complex thermal control system of the whole telescope environment is needed to avoid local heating that can also produce turbulence in the telescope surroundings which can seriously affect the image quality.

Instruments also represent an important aspect of the project. On the one hand, novel proposals are being analysed which will require the development of special mechanical components just tens of microns in size which can't be manufactured using today's technology. Industrial efforts will be required to make these instruments a reality.



© Gabriel Pérez Díaz, IAC (SMM)

EST, however, will have a large number of instruments to optimise its performance. Some will be devoted to obtain high-resolution images in different wavelengths. Others will be used for polarimetric measurements in particular spectral lines to help determine the thermal, dynamical and magnetic properties of the solar plasma. They will all be used simultaneously and the development of the adequate computing and numerical tools to handle the enormous amount of data will be of primary importance to extract all the information from it.

• What drew you to this field? As a schoolboy, did you ever imagine you would be doing this?

That takes me back. I remember reading a book about the Universe when I was in secondary school. I borrowed it from my physics teacher at that time. I was fascinated by the processes that lead to the formation of stars, by how gravitation can keep stars together to form galaxies or by black holes. This convinced me to study astrophysics at university.

And the Sun is our closest star and the one that influences our lives the most. I feel lucky that life took me to the Canary Islands, where a number of solar telescopes already existed, and others were installed later, and this made possible the growth of a solar physics group at the Instituto de Astrofísica de Canarias.

I am happy that I could join the group and discover more and more about this fascinating star. But, by no means could I imagine that many years later I would be contributing to the development of the best solar telescope together with colleagues from so many European countries. I am thankful for it.

Researching the pull of magneto-plasmonic nano-materials

Transport and mobility go hand in hand. But while transport literally drives economic development it sometimes comes at a heavy price. Congestion alone costs the EU 1 % of its GDP per year while the number of vehicles on the road is set to increase.

Spanish-based scientists are investigating how to prepare active magneto-plasmonic (MP) materials with tailored properties at the nano-scale. They are trying to understand the interactions between magnetic properties and plasmonic and optical ones, linked to electric charge oscillations.

The research is being pursued with a view to develop application prototypes that can benefit from this coupling.

Researchers in the EU-funded Nanomagma ⁽¹⁾ project expect that the optical properties of these materials can be driven by using a magnetic field. If proven, this will allow them to design, fabricate and test a prototype of a new kind of surface plasmon resonance (SPR) biosensor with magneto-optical elements, namely a surface magneto-plasmon resonance biosensor, and to compare its performance with standard biosensors.

They have established the theoretical and experimental tools needed for the design, fabrication and analysis of the structures, and taken the first steps towards

the applications that will use these materials.

Moreover, they have investigated two potential uses of MP materials in opto-electronic applications: data storage and optical isolators for integrated photonic circuits at telecom wavelength.

According to the research team, the field of integrated optical isolators seems the most promising application because these components are essential in photonic circuits and they are today commercially available only in expensive bulk versions.

They will now investigate two kinds of MP non-reciprocal wave guides, envisaging that compact tunable optical isolators could become possible in the future by modulating the external magnetic field.

⁽¹⁾ 'Nano-structured active magneto-plasmonic materials'.

Funded under the FP7 specific programme Cooperation under the theme 'Nanoscience, nanotechnologies, materials and new production technologies'.

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EU to enhance efficiency of mineral production chain

The European Commission's concern about the EU's trade deficit in metal and mineral imports has provoked an investigation into how efficiency can be improved in this area.

Scientists are investigating how the EU can enhance the efficiency of its metal and mineral imports production chain by putting higher quality and added-value products on the mark.

The EU-funded Promine ⁽¹⁾ project will help address this issue through initiatives aimed at extractive and end-user industries.

Upstream, it will endeavour to set up the first ever pan-EU geographic information system (GIS)-based mineral resource. It also plans to create an advanced modelling system for the extractive industry that will show known and predicted, metallic and non-metallic mineral occurrences across the EU.

Moreover, detailed 4D computer models will be produced for four metal-liferous regions. Work will also include demonstrating the reliability of new biotechnologies for an eco-efficient production of strategic metals.

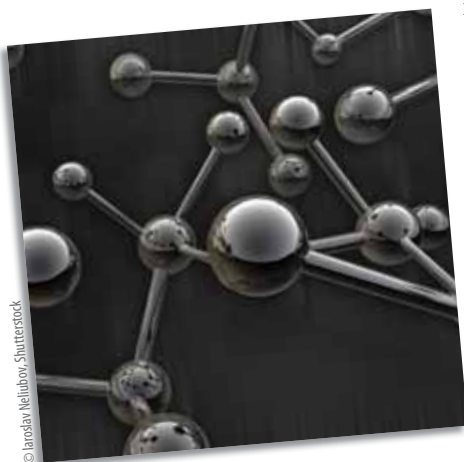
A new strategy will be developed for the European extractive industry looking not only at increasing production, but also at delivering high-value, tailored nano-products which will form new raw materials for the manufacturing industry.

The project focuses on five nano-products, namely conductive metal fibres, rhenium and rhenium alloy powders, nano-silica, iron oxyhydroxysulphate and new nano-particle-based coatings for printing paper, which will have a major impact on the economic viability of the extractive industry. These will be tested at bench scale, and a number selected for development to pilot scale where larger samples will be provided for characterisation and testing by end-user industries.

⁽¹⁾ 'Nano-particle products from new mineral resources in Europe'.

Funded under the FP7 specific programme Cooperation under the theme 'Nanoscience, nanotechnologies, materials and new production technologies'.

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New uses developed for glycerol from biorefineries

As biodiesel production increases so does the production of the by-product glycerol. Researchers hope to develop a novel technology to convert glycerol into liquid biofuels, bioenergy and biochemicals.

The EU target to increase the use of renewable energy in the transportation sector has boosted the production of biodiesel from rapeseed and other vegetable oils. Indeed, over 5.7 million

tonnes of biodiesel were produced in the EU in 2007, an increase of around 17 % compared to the previous year. This has led to an immense increase in the production of glycerol, an unavoidable by-product from the transesterification process, with current volumes already exceeding market demand.

In a typical biodiesel process, approximately 10 % of the reaction volume ends up as crude glycerol, and glycerol production levels are increasing in line with biodiesel production — with around 570 000 tonnes produced in 2007. The product is already used in over 2 000 pharmaceutical, food and other practices, but an increasingly large fraction of it is incinerated or stored as excess in an already saturated market.

The EU-funded Glyfinery⁽¹⁾ project is developing a novel technology based on the biological conversion of glycerol by micro-organisms, into known and new advanced liquid biofuels, bioenergy and biochemical. The scientists plan to design, test and improve products using metabolic engineering strategies. Bio-processes are being designed and optimised for each of the products at lab scale, and the most promising process scheme tested at pilot scale as an integrated concept.

Efficient recovery processes are also being developed for the products of interest. The project's ultimate goal is to demonstrate the suitability and sustainability of the Glyfinery concept for implementation into large-scale biorefineries.

(1) 'Sustainable and integrated production of liquid biofuels, bioenergy and green chemicals from glycerol in biorefineries'.

Funded under the FP7 specific programme Cooperation under the theme Energy.

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Piezoelectric multilayer actuators must perform

Growing demand from end-users has led researchers to investigate how the performance and reliability of piezoelectric-multilayer actuators can be improved.

Piezo actuators have so far failed to reach their full potential given the high production costs and problems related to obtaining reliable components.

Researchers led by the Danish piezo technology group Noliac are proposing a radical innovation in the

piezoelectricity field, based on an enhanced understanding of materials degradation.

They claim this will greatly improve the properties of long actuators, and thereby allow end-users to use them for new industrial applications.

commercially viable solution through lower production costs, thereby increasing the potential business and exploitation of the project.

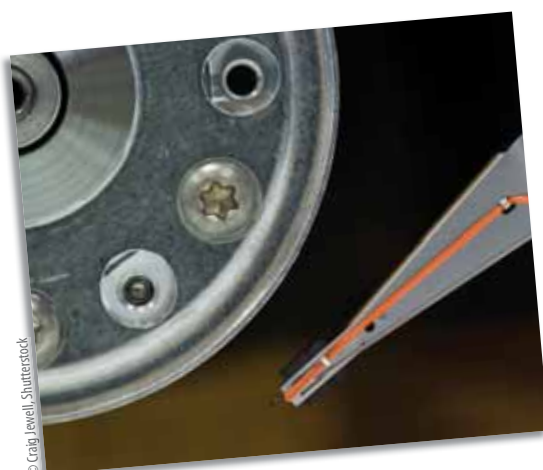
Significant technical progress has yielded some important results, such as proposals to improve the performance of piezoelectric transducers (PZT), work on narrow electrodes, including initial benchmarking between existing screen printing paste and preliminary new paste formulation, and research into wire technology.

The identification of new piezoelectric actuators is expected to provide a radical innovation in terms of new possible applications in major industrial markets worldwide, according to the project team.

(1) 'Novel technology for high-performance piezoelectric actuators'.

Funded under the FP7 specific programme Cooperation under the theme Energy.

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According to the EU-funded Hiper-Act⁽¹⁾ project research team, the new actuators will be able to sustain extreme conditions, including humid environments and high stress, and will provide extreme long-term reliability.

They say they would include integrated device electronics (IDE) technology in their designs to develop a more

High-precision manufacturing technologies save on time and waste

An EU-funded project aims to create new multitasking machines able to generate complex shapes in 3D.

To ensure EU manufacturing techniques remain at the cutting edge, scientists in Italy are creating new high-precision manufacturing technologies. They will be more cost-effective

and eco-friendly than current models used for the production of complex-shape micro parts, embedded systems and miniaturised products at a micro/meso-scale.



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The main objective of the EU-funded Integ-micro⁽¹⁾ project is the research and development of new hybrid and reconfigurable multitasking machines for the generation of 3D complex-shape micro-components made from different kinds of materials. Multitasking micro-machines are able to perform multiple operations using a single machine. This guarantees greater accuracy,

reduced handling and plant area, faster throughput and increased productivity.

The availability of several machining technologies on a single machine also enables important synergies between the different machining methods.

They say the project will achieve its goals by exploiting methods of sustainable production. This will include the downscaling of machine sizes by at least five times, new process chain approaches to dramatically reduce processing times, and eco-friendly processes such as dry ultra-high speed cutting (UHSC) at the micro-meso level, which eliminates the use of cutting fluid to achieve the zero waste emission target.

⁽¹⁾ 'New production technologies of complex 3D micro-devices through multiprocess integration of ultra precision engineering techniques.'

Funded under the FP7 specific programme Cooperation under the theme Energy.

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Diffraction optics light up with potential

A faster manufacturing process with more efficient components that reflect and refract light advance eco-friendly light emitting diodes (LED) technology.



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LEDs are all the rage in the lighting industry — they are much more energy efficient and cost-effective compared to traditional lighting. LEDs are now used not only to illuminate rooms, but also in TVs, monitors and a wide variety of electronics and appliances.

While LED technology is catching on everywhere, there are still some challenges to overcome, such as dispersing the light effectively

over large areas. This requires advances in the area of diffractive optics (DO), i.e. the development of highly complex micro-structured surfaces that distribute light evenly and efficiently. DO technology reflects, combines, and refracts light to harness its intensity.

However, DO elements are expensive to produce and can limit lighting performance. The EU-funded Flexpaet⁽¹⁾ project is working on improving the production of micro-structure surfaces used in DO elements and on decreasing their cost.

The project is working to bridge the gap between conventional micro-manufacturing technologies, generating industrial-scale, cost-effective production of a new generation of innovative, high value-added products.

To achieve this, Flexpaet is working to enable the transfer of lab-scale manufacturing processes to an industrial-scale production of high-quality, large-area DO elements for a variety of advanced lighting solutions.

Flexpaet has yielded strong results that are likely to advance the LED lighting sector. To illustrate, micro-embossing is an important part of DO technology, requiring complex studies and tests. Not only has the concept for micro-embossing been validated but also the entire process chain. The process begins with micro-machining of tools for new optical designs, ending with the mass production of micro-structured samples. So far, micro-embossing and

replication of the desired components have been realised for relatively small surfaces. The second half of the project is focusing on processing surfaces up to 2 m², opening up the industry to a variety of applications.

Combined with this new process for making DO components, LED lighting is set to take off exponentially, and Europe will be at the core of this innovative technology. Indeed this work

stands to strengthen European industry against Asian competition in the lucrative high-end consumer products market.

(1) 'Flexible patterning of complex micro-structures using adaptive embossing technology.'

Funded under the FP7 specific programme Cooperation under the theme Energy.

<http://cordis.europa.eu/marketplace> > search > offers > 6195



Crete upgrades satellite altimetry technology

The Greek island of Crete is using EU funds to ensure it remains at the cutting edge of geodesy and geomatics.

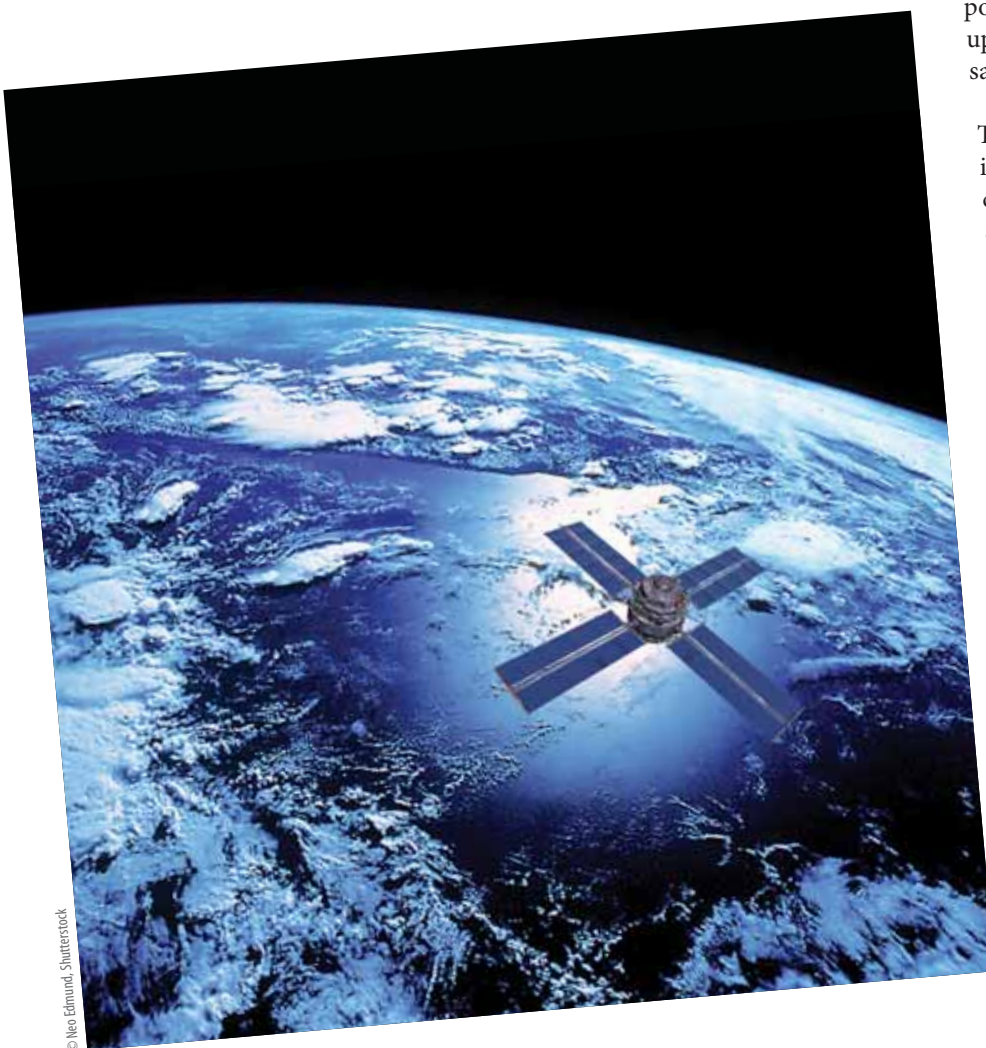
The EU-funded Sofia ⁽¹⁾ project is helping the Laboratory of Geodesy and Geomatics Engineering at the Technical University of Crete (Geomatlab) update its equipment and remain a key player in its field through the recruitment of researchers.

Geomatlab's work is focused on global navigation satellite systems, satellite geodesy and deformation monitoring, quality control algorithms and software for geodetic data, and on satellite altimetry calibration.

The Sofia project is using the additional financing to upgrade its facility for satellite altimeter calibration on Gavdos, the southernmost Greek island that lies south of Crete. Thanks to the EU funds it has been able to ensure this facility is fully up to date technologically.

The funds have also helped the university develop strategic partnerships with well-established European institutes and thereby ensure the continued operation of this infrastructure. Moreover, Geomatlab has been able to recruit post-doctoral researchers and set up an extensive software suite for satellite altimetry calibration.

The institution now hopes to improve the satellite altimetry calibration for other satellites and techniques, test the new prototype transponder and develop abrupt change detection algorithms.



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(1) 'Enhancement of Crete's potential for a dedicated calibration facility for satellite radar altimeters and for tectonic deformation monitoring using continuously operating geodetic arrays.'

Funded under the FP7 specific programme Capacities under the theme 'Research potential of convergence regions'.

<http://cordis.europa.eu/marketplace> > search > offers > 6310

The following upcoming events were selected from the event diary of the Directorate-General for Research and from the CORDIS event calendar.

For further information on past and upcoming events, please visit:

<http://ec.europa.eu/research/events>

<http://cordis.europa.eu/events>

Eighteenth working conference on reverse engineering

The eighteenth working conference on reverse engineering will take place from 17 to 20 October 2011 in Lero, Ireland.

Reverse engineering is defined as the process of discovering the technological principles of a device, object or system through analysis of its structure, function and operation.

The conference will look at innovative methods of extracting the many kinds of information that can be recovered from software, software engineering documents, and systems artefacts.

Topics set to be covered during the event include:

- programme comprehension;
- mining software repositories;
- software architecture recovery;
- empirical studies in reverse engineering;
- concept and feature location;
- object and aspect identification;
- redocumenting legacy systems;
- reengineering patterns;
- user interface reengineering;
- dynamic analysis;
- reverse engineering for security assessment;
- reverse engineering tool support;
- education in reverse engineering;
- reverse engineering of service-oriented systems;
- performance re-engineering.

For further information, please visit:
<http://www.cs.wm.edu/semeru/wcre2011>

Third international conference on computational aspects of social networks

The third international conference on computational aspects of social networks will take place from 19 to 21 October 2011 in Salamanca, Spain.

Social networks provide a powerful abstraction of the structure and dynamics of diverse kinds of people or people-to-technology interaction. These network systems are usually characterised by the complex structures and rich accompanying contextual information. Recent trends also indicate the usage of complex networks as a key feature for next-generation internet usage.

The conference will focus on the foundations of social networks as well as case studies, empirical, and other methodological works related to the computational tools for the automatic discovery of internet-based social networks. It will also be an opportunity to compare and contrast the ethological approach to social behaviour in animals (including the study of animal tracks and learning by members of the same species) with web-based evidence of social interaction, perceptual learning, information granulation, the behaviour of humans and affinities between web-based social networks.

For further information, please visit:
<http://www.mirlabs.org/cason11>

The sixth international workshop on ontology matching

The sixth international workshop on ontology matching will take place on 23 and 24 October 2011 in Bonn, Germany.

Ontology matching is a key interoperability enabler for the semantic web, as well as a useful tactic in some classical data integration tasks dealing with the semantic heterogeneity problem.

An ontology typically provides a vocabulary that describes a domain of interest and a specification of the meaning of terms used in the vocabulary. Depending on the precision of this specification, the notion of ontology encompasses several data/conceptual models, such as classifications, database schemas or fully axiomatised theories.

This type of matching takes ontologies as input and determines as output an alignment, that is, a set of correspondences between the semantically related entities of those ontologies.

These correspondences can be used for various tasks, such as ontology merging, data translation, query answering or navigation on the web of data.

The workshop will bring together leaders from academia, industry and user institutions to assess how academic advances are addressing real-world requirements. It will examine ontology matching approaches through the Ontology Alignment Evaluation Initiative (OAEI) 2011 campaign and look at similarities and differences in database schema matching.

For further information, please visit:
<http://www.om2011.ontologymatching.org>

Third international workshop on cloud data management

The third international workshop on cloud data management will take place on 28 October 2011 in Glasgow, UK.

Technology advances in communications, computation, and storage are leading to large collections of data, capturing information of value to business, science, government, and society. The size of collected data is imposing big challenges on infrastructure for data storage.

Meanwhile, the rise of large data centres and computing clusters has created a new business model, cloud-based computing, where businesses and individuals can rent storage and computing capacity. This reduction in cost and investment, though, is matched by challenges in ensuring that cloud-based computing can function consistently and reliably.

The workshop will bring together researchers and practitioners in cloud computing and data-intensive system design, programming, parallel algorithms, data management, scientific applications, and information-based applications.

For further information, please visit:
<http://www.clouddb.org/CloudDB11>

The second international workshop on web science and information exchange in the medical web

The second international workshop on web science and information exchange in the medical web will take place on 28 October 2011 in Glasgow, UK.

The amount of social media data dealing with medical and health issues has increased significantly over the past few years. Facts, experiences, opinions or information on behaviour can all be found on the internet and could be used to support a broad range of applications. For example, health organisations monitor online news repositories and web pages for relevant data on epidemiological events. Physicians learn about the experiences of their colleagues provided through social media platforms. At the same time, patients can search for information or experiences of others.

The event will cover the latest discussion and findings in the analysis of medical social media data and multimedia data, including event detection and information extraction.

The event is being organised by the 'Medical ecosystem personalised event-based surveillance' (M-ECO) project. Funded by the Seventh Framework Programme. The project covers technologies related to the development of the medicine 2.0, which are rapidly changing the possibilities to assess and provide health information.

For further information, please visit:
<http://www.meco-project.eu/medex2011>

Third international workshop on model-driven service engineering

The third international workshop on model-driven service engineering will take place from 31 October to 3 November 2011 in Brussels, Belgium.

Model-driven engineering (MDE) concerns the provision of models, transformations between them and code generators to address software development. One of the main advantages of a model-driven approach is the provision of a conceptual structure where the models used by business managers

and analysts can be traced towards more detailed models used by software developers. This kind of alignment between high-level business specifications and the lower level service-oriented architectures (SOA) is a crucial aspect in the field of service-oriented development (SOD).

SOD has become one of the major research topics in the field of software engineering, leading to the appearance of a novel and emerging discipline called service engineering (SE). This area focuses on the identification of services as first-class elements in software development.

The workshop will be a forum to discuss different issues related to SE in conjunction with MDE, ranging from research problems to practical experiences.

For further information, please visit:
<http://kybele.escet.urjc.es/mose2011>

Thirtieth international conference on conceptual modelling

The thirtieth international conference on conceptual modelling will take place from 31 October to 3 November 2011 in Brussels, Belgium.

A conceptual model represents concepts and relationships between ideas in a problem domain, or the area of expertise or application that needs to be examined to solve a problem. A conceptual model in the field of computer science is also known as a domain model.

The aim of a conceptual model is to express the meaning of terms and concepts used by domain experts to discuss the problem, and to find the correct relationships between different concepts. It also attempts to clarify the meaning of various, usually ambiguous terms, and ensure that problems with different interpretations of the terms and concepts cannot occur.

Once the domain concepts have been modelled, the model becomes a stable basis for subsequent development of applications in the domain. The concepts of the conceptual model can be mapped into physical design or implementation constructs using either

manual or automated code generation approaches.

The event will be a forum for presenting and discussing current research and applications in which the major emphasis is on conceptual modelling. Topics of interest span the entire spectrum of conceptual modelling including research and practice in areas such as theories of concepts and ontologies underlying conceptual modelling, methods and tools for developing and communicating conceptual models, and techniques for transforming conceptual models into effective implementations.

For further information, please visit:
<http://cs.ulb.ac.be/conferences/er2011>

Fourth international conference on motion in games

The fourth international conference on motion in games will take place from 13 to 15 November 2011 in Edinburgh, UK.

Games have become a very important medium for both education and entertainment. Motion plays a crucial role in computer games. Characters move around, objects are manipulated or move due to physical constraints, entities are animated, and the camera moves through the scene.

Motion is currently studied in many different areas of research, including graphics and animation, game technology, robotics, simulation, computer vision, and also physics, psychology, and urban studies. Cross-fertilisation between these communities can considerably advance the field.

The goal of the conference will be to bring together researchers from different fields to present the most recent results and to initiate collaboration. The event programme will consist of a regular paper session, as well as presentations by a selection of internationally renowned speakers in the field of games and simulations.

For further information, please visit:
http://www.motioningames.org/MIG_2011/MIG_2011.html

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