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EDITORIAL

European science and International Women's Day



Apart from heralding the end of winter, March is also known for International Women's Day (IWD), which is marked on 8 March by thousands of events aiming to inspire women and celebrate gender equality.

Every day, thousands of women scientists are contributing to the advance of European research and development, in fields as varied as environment, medicine or information and communication technologies. But women are still under-represented in science — especially at the most senior levels.

In this issue of *research*eu magazine* we interview Sheena Laursen, Director of International Affairs at Denmark's Experimentarium. In an article opening the new 'social sciences and humanities' section, she explains how the EU-funded TWIST project is helping to break down gender stereotypes in science — encouraging more young women to choose scientific careers.

The 'biology and medicine' section also features the celebrated work of Professor Molly Stevens of Imperial College who is carrying out research into areas where nanomaterials and biological systems converge. One of the fields in which she is making a significant impact is tissue engineering, where artificial scaffold structures are being used to grow new cells. Prof. Stevens' research has focused on growing replacement bones by using smart polymer systems.

Then Professor Clara Menéendez of the Barcelona Institute for Global Health introduces us to Pregvax, an ambitious project aiming to improve our understanding of how malaria infections affect pregnancy. As she points out, increased participation of women in leadership roles can lead to more research into problems mainly affecting women. The 'biology and medicine' section includes two more such examples: the BASIS project on the 'Genetic basis of breast cancer', on page 11 and the Bonequal project on 'The importance of bone quality in osteoporosis', on page 12.

This issue also sees the launch of two new sections in *research*eu results* magazine, aiming to give an even more complete view of the range of research topics supported by Europe: the first, on 'social sciences and humanities', starts on page 13, while a second, on 'space', covers everything from astronomy to satellite communications and begins on page 42.

The other usual sections are all in place. The 'energy and transport' section opens on page 16 with an article entitled 'Innovative bomb-proof luggage container to improve aviation safety', while the feature article in the 'environment' section focuses on 'Clean water for a safer future', on page 24.

The 'IT and telecommunications' section begins with 'TV and the internet: a marriage made in entertainment heaven', on page 29, and the 'industrial technologies' section starts with 'Planning for a sustainable plastic future', on page 37.

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

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

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The editorial team

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Watch this space!

Coming up in issue 21 of *research*eu results magazine* — a special dossier called 'Water of life: desertification and access to clean water'.

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BIOLOGY AND MEDICINE



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Better understanding of malaria infection during pregnancy

Plasmodium vivax — also known as P. vivax — is the most frequent cause of malaria. But little is known about how it affects pregnancy. In an unprecedented effort, the Pregvax consortium has travelled to Latin America and the Asia-Pacific region to close this knowledge gap about an infection which affects over 25 million women every year.

What happens if a pregnant woman is infected by *P. vivax* during her pregnancy? According to recent studies in Latin America, India and Thailand, the consequences can be dramatic. They can range from low birth weight and maternal anaemia to miscarriage. Yet these studies were based on small samples of population and sometimes provide inconsistent information.

Historically, Europe has been a major actor in the fight against malaria. In 2008, this notably resulted in funding of the Pregvax[1] Consortium, whose objective is to address the knowledge gaps concerning *P. vivax* infection during pregnancy. Some of the best multi-disciplinary scientists and experts on *P. vivax* malaria worked in three Latin American countries, India and Papua New Guinea to follow the pregnancy of almost 10 000 indigenous women. Professor Clara Menéendez, from the Barcelona Institute for Global Health, is the project coordinator of Pregvax. She spoke to the *research*eu magazine* to discuss this very ambitious project, its findings and her commitment to improving other women's lives.

What are the main objectives of the Pregvax project?

Our objective is to describe the epidemiological and clinical features of *P. vivax* malaria in pregnancy by following standardised methods for data collection. In addition, we have worked to determine whether there are pregnancy-specific *P. vivax* immune

responses, as well as to characterise the parasites in the placenta, both genotypically and phenotypically.

How is this project different from other research addressing *P. vivax* infection?

The main innovative aspect of Pregvax would certainly be the representativeness of our sample. In an unprecedented effort, we have been able to enrol almost 10 000 women from five *P. vivax* endemic countries (Brazil, Colombia, Guatemala, India and Papua New Guinea), representing most of the world's pregnancies at risk of *P. vivax* malaria infection. More than 50 % of these women were followed until they gave birth. Almost 98 000 study visits have taken place and almost 77 000 biological samples collected. All this is resulting in priceless data.

What first drew you to research in this area?

Having worked for nearly 20 years on maternal health and *P. falciparum* malaria in pregnant women, I was struck by the lack of information on the impact of *P. vivax* in pregnant women. I wanted to find answers that would help to control the disease.

You happen to be a woman scientist helping to improve the lives of other women. Was that a deliberate choice?

Yes, indeed. Increasing gender diversity can bring clear benefits. For example, the increased participation of women in leading positions in governments has increased attention on solving problems that are specific to or mainly affect women. The lack of diversity at decision-making level may lead to a 'group-think'.

On the other hand, do you think being a woman helped you in coordinating this particular project?

Not necessarily. Science — and this includes maternal health — must be approached in the most objective way possible.

Actually, it is rather the opposite: science, like other fields, is mainly run by men and it seems that we women must prove our expertise at every step.

What are some of the difficulties you encountered with Pregvax and how did you solve them?

Some of the recruitment sites — mostly rural areas — are difficult to access and sometimes even dangerous. This was a challenge from the beginning of the study which was addressed by recruiting large teams of local field workers, nurses and midwives. We notably trained local nurses to make a microscopic examination of parasites, to use standardised procedures, and to collect and store samples.

Of course, we have also had unforeseen delays in the progress of the project, with country and institution-specific rules constraining us to work with five different timelines. Communications within the consortium, making sure that data from across countries were comparable, setting standardised operating procedures (SOP) and handling personnel turnover were amongst our main challenges, but we have been able to cope with them.

What are the concrete results from the research so far?

After five years of intensive work, the Pregvax project has reached its final stages and definitive results from the project will be soon available. What we already know is that the prevalence of infections, measured by molecular analysis, is much larger than previously thought.

This is just one of many knowledge gaps closed by Pregvax: we also reported the first congenital malaria case in Latin America with complete characterisation; we showed that *P. vivax* can be found in the placenta, but does not lead to inflammation in this tissue,, and might be able to sequester there; and we found that 'rosetting' and cytoadhesion to CSA in *P. vivax* infections may negatively impact the health of the infected women.

How do you expect your research to help pregnant women in those regions of the world most affected by *P. vivax*?

This project provides accurate data on the burden and impact of *P. vivax* malaria during gestation. This is essential to improve its clinical management and to guide control policies for malaria in pregnancy in low-transmission settings. Besides, elucidating the mechanisms involved in the pathology of *P. vivax* in pregnancy, such as for instance, the histopathological and molecular features of placental *P. vivax* infection, and the cytoadhesion phenotypes with a clinical impact in *P. vivax*, investigated as part of this project, may help to develop specific control tools like more effective drugs and vaccines.

Aligned with the current goal of the World Health Organization to develop an evidence-driven Global Strategic Plan for *P. vivax* control and elimination, the Pregvax project will also genuinely contribute to identifying the best approaches to clinical management, epidemiological surveillance, and preventive strategies for malaria control during pregnancy in areas where *P. vivax* malaria transmission occurs.



© Paola de Grenet

Prof. Clara Menéendez

What are the next steps in the project, or next topics for your research?

We hope that the results from this study will contribute to the development of policies to control malaria in pregnant women in *P. vivax* endemic areas, as well as provide useful information for the current initiatives on malaria eradication. This could lead to the evaluation of different strategies, mainly drug-based, to prevent *P. vivax* malaria in pregnancy. On the other hand, the links built over the years with the partners in this project will lead to work on other projects related to maternal health, such as the interaction of other prevalent, vector-borne infections in pregnancy with *P. vivax* malaria.

1 'Plasmodium vivax Malaria in Pregnancy'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
For further information see:
http://www.cresib.cat/en/page.asp?id=134

BIOLOGY AND MEDICINE

Nanotechnology to help rebuild bodies and detect disease

Nanotechnology — making and manipulating structures with nanometre-scale dimensions — has the potential to transform many areas of science and engineering. Professor Molly Stevens of Imperial College is carrying out research into the areas where nanomaterials and biological systems converge.

One of the fields in which she is making a big impact is tissue engineering, where artificial scaffold structures are used to grow new cells. By mimicking the nanostructure of tissues in the body, it is possible that human organs and body parts could be made or grown in the laboratory. In particular, Prof. Stevens' research has focused on growing replacement bones by using smart polymer systems.

Prof. Stevens has assembled a multi-disciplinary team — encompassing engineering, biology, chemistry and physics — with research interests ranging from high-resolution studies of the cell-materials interface to the novel design and engineering of biomaterials for regenerative medicine and bio-sensing. In the Naturale[1] project, supported by an ERC Starting Grant, this expertise has been directed towards two goals.

First, the aim was to design biologically responsive peptides, which are component parts of proteins, to control the assembly and disassembly of nanostructures. These new bio-responsive materials could have important applications in bio-sensing and diagnostics. By improving bio-sensing technologies for the real-time monitoring of enzymes and other bio-chemicals, this research could impact on many diseases ranging from cancer to early HIV detection.

Prof Stevens and team member Dr Roberto de la Rica have, for instance, successfully tested a pioneering, ultra-sensitive protein-detection technique based on a plasmonic ELISA that is many orders of magnitude more sensitive than the conventional widely used ELISA technique. The new methodology, which has been tested using human samples from HIV positive patients, offers a much simpler naked-eye-based-read-out and could be commercialised in the near future. It would also potentially allow much earlier diagnosis of a range of diseases. This result was published in October 2012 in *Nature Nanotechnology*.

Secondly, the Naturale team sought to understand the natural biological nanostructures found in the support structures of biological tissues — the 'scaffolding' that supports the cells. By developing synthetic versions of these nanostructures, the research is making significant inroads into improved cell growth for tissue regeneration.

These new approaches could lead to clinical applications by, for example, helping large bone defects to heal. Greater understanding of cell differentiation and the interactions between cells and their surrounding support matrix is also of fundamental importance in understanding tissue development itself.



© Prof. Molly Stevens

Prof. Molly Stevens

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

1 'Bio-inspired materials for sensing and regenerative medicine'.

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

Early intervention for chronic kidney disease

Chronic kidney disease (CKD) affects up to 10% of the population. Progress is under way to develop a toolkit for individual risk/progression assessment as well as to provide a better understanding of disease mechanisms. Both components serve as basis for developing drugs that will help to slow down disease progression.



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To date, early diagnosis of CKD and tailored treatment are still inadequate. Some patients not at risk for progression receive unnecessary treatment with associated costs and side effects. Others receive treatment that is not adjusted to the individual pathophysiology and progress to 'End-stage renal disease' (ESRD). Furthermore, serious comorbidities need to be taken into account, including cardiovascular complications and bone metabolism disorders, which modify treatment selection and response.

With diabetes and hypertension being two of the most relevant risk factors in CKD, the EU-funded

Syskid[1] project initiated development of a clinically tested toolkit to identify patients most at risk. The programme also includes research on both prescribed and novel drugs and their use to hinder disease progression.

Syskid has completed first marker validation for assay development and testing. Genetic, proteomic and metabolomic data collected so far, along with trials on the Syskid clinical cohorts, have already provided additional information for kit development.

To develop risk scores, Syskid scientists are analysing major clinical databases and validating results among patient groups. The significance of allocating risk scores to risk progression factors will be assessed at a later stage.

The discovery of drug-based mechanisms to slow down progress of CKD development rests partly on research into known biochemical pathways involved, as well as exploring novel molecular foundations of the disease. Syskid is developing and testing a novel, molecular-unit-based patient stratification concept based on 'systems biology'. This approach promises to build on tailored use or application of existing drugs, closely aligned with companion diagnostics. The large volume of Syskid data under analysis and study stands to validate this approach.

CKD has a significant detrimental impact on the quality of life of millions of people suffering from diabetes and hypertension. Project deliverables have so far provided the basis for improved diagnosis, and continue to build on tailored therapy for CKD.

The project is coordinated by Emergentec Biodevelopment in Austria.

1 'Systems biology towards novel chronic kidney disease diagnosis and treatment'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
http://cordis.europa.eu/marketplace > search > offers > 9666

Diet affects mental performance

Key issues in the mental health of European children and the role of diet are being addressed by the Nutrimenthe[1] initiative. Results will shed light on the influence of early nutrition over long-term cognitive and mental disorders.

Current evidence on the effect of diet on mental performance is largely based on animal, retrospective and short-term nutritional intervention studies in humans. However, to obtain more results robust experimental studies in humans are required, backed by modern prospective observational studies and molecular techniques.

The aim of the EU-funded Nutrimenthe project is to provide insight into the role, mechanisms, risks and benefits of specific nutrients and food components in the mental performance of children.



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The project integrates key epidemiological studies with large cohorts in the EU (Generation R, ALSPAC, CHOP, NUHEAL, EARNEST). Data on dietary intake and nutritional status of infants and children are being linked to mental performance.

The research will include quantification of the nutrient effects of early programming on later cognitive and mental disorders. In addition, the effects of food on mental state and performance, such as mood, activation, attention, motivation, effort, perception, memory and intelligence, as well as mental illness, will be studied.

Results have already shown that maternal folic acid supplement use in early pregnancy reduces the risk of child behavioural problems at 18 months. Also, higher dietary fish intake by women during pregnancy is associated with improved behaviour in children at the age of 6-7 years. These findings are being linked to potential genetic influences from FADS1 and FADS2 gene polymorphisms, which lower 'Long-chain polyunsaturated fatty acids' (LC-PUFA) in plasma contents and may also have behavioural effects.

Other maternal nutrient factors including proteins, vitamins, iron and zinc are being assessed for their effect on the mental status of 'normal' children. In children suffering from phenylketonuria (PKU), scientists are quantifying the dose of LC-PUFA required for a beneficial effect.

Through the development of a standardised battery of tests, the Nutrimenthe project aims to apply the same neuropsychological methods throughout Europe for evaluating the effects of nutrient intake on mental performance. Results will raise public awareness across Europe of the important role of nutrition on children's mental performance.

The project is coordinated by the University of Granada in Spain.

1 'Effect of diet on the mental performance of children'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology' (KBBE).
http://cordis.europa.eu/marketplace > search > offers > 10028

BIOLOGY AND MEDICINE

DNA-related biomarker predicts cancer

In a concerted effort to diagnose and tackle cancer, the Telomarker[1] project discovered and evaluated biomarkers for identifying telomere dysfunction. The preclinical evaluation of project findings raises hope for a more sensitive approach to malignancy prognosis.



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Improved molecular understanding of the structure of chromosome ends — also known as telomeres — is pointing towards a central role of the telomere-maintenance enzyme telomerase in genomic instability and clonal evolution of cancer. Deregulation of telomerase has therefore become an attractive biomarker for diagnosing cancer and a novel target for anti-cancer treatment.

Building on this finding, the EU-funded Telomarker project aimed to bring together all leading expertise in the field of mammalian telomere research within the European Union. The plan was to test new and existing biomarkers of telomere function and dysfunction that might have clinical value.

Using *in vitro* and *in vivo* model systems, the consortium members obtained detailed insight into factors influencing telomere maintenance and the effects of telomere-associated proteins on telomere dysfunction. New biomarkers associated with the recruitment and transcriptional regulation of telomerase in normal and cancer cells were identified.

A thorough analysis of human tissue biobank samples has seen the length of telomeres emerge as a promising cancer biomarker. Incorporation of these biomarkers into clinical assays demonstrates their potential to be further developed into anticancer drug-screening systems.

The Telomarker study succeeded in translating into clinical practice the long-considered notion that DNA telomere integrity is involved in cancer development. Implementation of the project findings into improved cancer diagnosis and treatment is expected to benefit the health and well-being of European Union citizens.

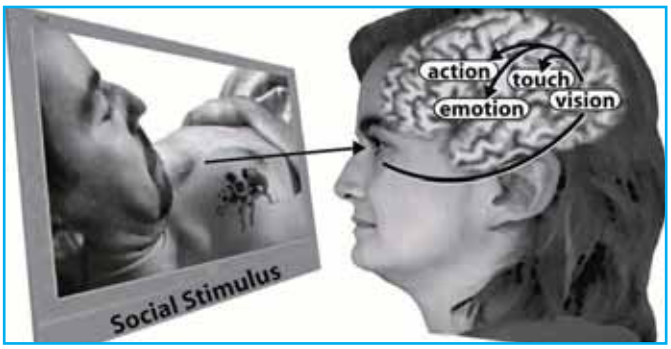
The project was coordinated by the Chancellor, Masters and Scholars of the University of Cambridge in the United Kingdom.

1 'Identification and characterisation of novel human telomere-related biomarkers that aid cancer management by improving patient diagnosis, treatment selection, response monitoring, and drug development'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
http://cordis.europa.eu/marketplace > search > offers > 9698

Vicarious brain: in search of how your brain feels

Do you remember Dr No, *the first James Bond film? When the tarantula crawled on to the hero's chest, what did you see? The flickering of frames or pixels on the screen? No, you probably saw a scared secret agent with an itching chest who tries to kill a spider. Somehow your brain transformed the pixels into hidden states that are not visible to the eye, namely intentions and emotions.*



© Valeria Gazzola

Your body tensed in anticipation of his actions and your heart beat faster, as if scared in his stead. Intense experiences of sharing other people's actions and emotions help make cinema captivating. But films only capitalise on the human capacity that lies at the core of this project; the capacity to slip into the skin of other people, to vicariously experience their actions and share their emotions.

Professor Christian Keysers is leading the Vicariousbrain[1] research project, funded by a EUR 1.8 million European Research Council (ERC) Starting Grant, which aims to better understand the processes of empathy within our neurons.

Christian Keysers' research project consists of two complementary analyses. Together with his team, he will examine how the network of regions in the brain involved in action observation — the so-called vicarious motor network — integrates information. They will focus on the direction of information flow between the different vicarious motor nodes to challenge traditional models of action observation.

While the first analysis tackles how we share others' actions, the second explores emotions. Prof. Keysers and his team will examine how neurons in brain regions associated with empathy respond during the experience and witnessing of emotions.

His laboratory has already shown that while viewing the disgust of others, we activate a region of our brain (the insula) that is normally activated when we experience disgust ourselves. These vicarious emotional activations are similar to vicarious motor activations, except that they occur in regions associated with emotions rather than action execution.

Given the tremendous interest in emotional empathy across many fields, understanding its neural causes will open exciting

new horizons in several areas. This research project will notably impact life sciences, contributing to progress in genetics but also to better therapies of psychiatric disorders of empathy (autism, schizophrenia and psychopathy).

In robotics, it will concretise a biological example of how brains can process and predict the actions of others and read their feelings. In the long-run, these interactions through robotics will feed back into neuroscience, by testing whether their models indeed enable the prediction and perception of the actions of other organisms.

Prof. Christian Keysers is the 3000th grantee to be funded by the ERC. During an event in Amsterdam in January 2013, he commented: 'To get an ERC grant is a dream come true and being the 3000th grantee is very inspiring. I can now devote five years to solving what I think to be the most worthy research question in my field. It allows me to handpick an outstanding multidisciplinary team and gives me the freedom to conduct the best fundamental research. In a climate where the immediate applicability of science is often valued most, the ERC has become the patron for the brightest scientists pursuing curiosity-driven research and the backbone for a Europe of Ideas. It epitomises a Europe of intellectual innovation and excellence that makes me proud to be European.'

The project was is coordinated by the Royal Netherlands Academy of Arts and Sciences (KNAW) in the Netherlands.

1 'Cracking the code and flow of empathy'.

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

Genetic basis of breast cancer

Understanding the critical events underlying the development of cancer is paramount for advancing prevention, early detection and effective treatment of the disease. To this end, the BASIS consortium will perform a large mutational, epigenomic and gene expression analysis for breast cancer.

With more than 1 million cases diagnosed annually, breast cancer represents the most prevalent form of cancer in women. Although the precise disease aetiology remains elusive, certain endocrine factors, genetic susceptibility and mutagenic exposures such as X-irradiation are known to influence breast cancer risk.

The EU-funded BASIS[1] project will perform a thorough analysis of 500 breast cancer cases to identify the molecular determinants of this particular disease. Part of the International Cancer Genome Consortium (ICGC) Breast Cancer Working Group established in 2008, the BASIS consortium concentrates on the study of the sub-type of breast cancer that is positive for the 'oestrogen receptor' (ER) and negative for the 'human epidermal growth factor receptor 2' (HER2). This ER+/HER2- subclass represents about 40 % of breast cancer cases and is characterised by a rather slow, non-metastatic progression.

By performing an extensive mutational analysis, the BASIS project aims to identify cancer genes mutated at a frequency greater than 3 %. Additional analysis of epigenomic modifications will be performed alongside gene expression and microRNA (miRNA).

Collectively, information generated by BASIS is expected to reveal the biological pathways and specific molecular targets that malfunction in the common class of ER+/HER2- breast carcinoma. This would improve our understanding of the causes and biology of breast cancer, providing a foundation for the development of new therapeutics.

Furthermore, discovering the number and types of 'passenger' mutations in ER+/HER2- breast cancers should help unveil the mutational processes that generated them. These include defects in specific DNA repair pathways and exogenous environmental exposures that contribute to this disease.

The BASIS project's results will be integrated and compared to data generated from other subclasses of breast cancer by the ICGC Breast Cancer Working Group to provide a complete picture of the genomics of this disease. Partners are hopeful that their findings will be translated into clinical practice for the detection of minimal residual disease, early prognosis and design of treatment regimens.

The project is coordinated by Genome Research Limited in the United Kingdom.



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1 'Breast-cancer somatic genetics study'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
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BIOLOGY AND MEDICINE

The importance of bone quality in osteoporosis

Osteoporosis affects 30% of post-menopausal women in the EU. New diagnostic methods have been developed to improve the treatment of this debilitating disease.

Osteoporosis is currently diagnosed by measuring 'bone mineral density' (BMD) and treated with biphosphonates. Long-term treatment with biphosphonates can lead to deterioration of bone structural integrity and increased fracture risk, despite high BMD.

There are many factors related to bone quality including bone architecture, geometry and accumulation of microfractures. The development of new methods to evaluate bone quality is expected to improve diagnosis and to keep track of treatment effectiveness.

The Bonequal[1] project aimed to assess the effects of ageing and osteoporosis on the structure, composition and mechanical properties of spongy or trabecular bone. To achieve this, Bonequal researchers took bone biopsies from cadavers of clinical patients who had suffered from metabolic bone diseases.

Bonequal scientists developed a new method to estimate the three-dimensional (3D) shape of the femur. The latter is based on a two-dimensional (2D) BMD image combined with a template from a computerised tomography (CT) scan. Further development of this technology should provide a more sensitive assessment of fracture risk in osteoporosis.

From new methods developed to determine the viscoelastic properties of bone, Bonequal found that viscoelasticity decreases with age, thereby explaining the increase in bone fragility amongst the elderly. Project scientists also investigated infrared spectroscopic methods to pinpoint changes in bone composition in patients and have recommended this as a potentially valuable diagnostic tool.

Towards the future research path in quantitative imaging tools, Bonequal investigated the quality of image needed to separate structural parameters in spongy bone comparing normal with osteoporotic bone. The project found that 'volumetric pixels' (voxels) — a type of volumetric picture element — of up to 100 micrometres (µm) must be used for the required resolution.

Not only has Bonequal developed new imaging systems to diagnose the onset of osteoporosis at its earlier stages, but the novel technology better predicts fracture risk.



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The project was coordinated by Itä-Suomen Yliopisto in Finland.

1 'Assessment of bone quality in metabolic bone diseases'.

Funded under the FP7 specific programme 'People' (Marie-Curie actions).
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Working together on rare disease research

Up to 30 million Europeans suffer from a long list of various rare diseases. Because the patients of each of the 6000–8000 disorders are sparsely scattered across the EU, the region must combine research resources in order to boost the search for new therapies.

Research efforts need to be coordinated and funds pooled to find out how rare diseases arise and affect humans. Scientists can build patient registries, find out how prevalent each disease is and find biological molecules, or 'markers', that confirm the presence of the disease. This will allow for better diagnostics and treatments to be tested in clinical studies.

The EU-funded E-RARE-2[1] project is building on the work of its predecessor E-RARE-1 to strengthen rare disease research and funding networks. In particular, this second phase will focus on including newer Member States, non-European countries and other important stakeholders and initiatives.



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In 2011, the first call for joint, transnational research proposals resulted in funding of EUR 8.78 million for over 60 research groups from 13 consortia. The successful research bids covered a range of diseases and potential therapies, including gene therapy and customised animal models.

The 2012 call is still open and is aimed at young, independent scientists. E-RARE-2 has identified research areas that need special attention, and this call addresses those topics specifically.

These research calls have demonstrated that scientists are keen to work together on rare conditions. To further strengthen these networks and to create awareness, E-RARE-2 uses various communication tools and it is also developing an online research portal. This portal will eventually become a forum for information exchange and a search engine to find collaborators.

With these successes to drive it forward, E-RARE-2 will continue to diversify its activities and increase funding commitment from new and existing funders.

The project was coordinated by the Institut National de la Santé et de la Recherche Medicale (INSERM) in France.

1 'ERA-NET on rare diseases'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
http://cordis.europa.eu/marketplace > search > offers > 10423



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Breaking down stereotypes around women in science

While role models like Marie Skłodowska-Curie have had a huge impact on the world of science and the way it perceives gender, women still account for only 12% of top science positions in Europe. Launched in 2010, the TWIST[1] project set out to help reverse this trend with programmes and activities in science centres and museums.

'Science exhibits often seem to appeal more to boys than girls, and boys often stay longer.' This reality is one of many that pushed Sheena Laursen, Director of International Affairs at Denmark's Experimentarium, to launch the TWIST project with partners from seven EU Member States and Israel. Their common objective? Using marketing tools, role models and more targeted teaching methods to ensure that everyone, from primary school boys and girls to young men and women studying at university, can enjoy science to the point of considering it as a possible career path.

The project — which targeted students, teachers and parents — looked at the stereotypes and biases regarding societal roles of male and female scientists and aimed to foster gender and science debates. To achieve this, it employed progressive exercises such as interactive drama, teacher training, scientist speed-dating, female scientist role models and a 'virtual puppet' to challenge biases. Interviewed by *research*eu results magazine*, Sheena Laursen explains the project and how she expects it to help break down gender stereotypes in science.

What are the main objectives of the project?

The TWIST project aims to raise awareness about the role and representation of women in science. We have been running various programmes and activities in science centres and museums, such as exhibitions targeting students, their teachers and parents. The objective is to stimulate debates and ignite ongoing discussions on issues of gender and science.

There are not many women in top science positions. Why?

That is a big question — and probably one with many different possible answers. For us — and this is the issue we address with this project — it notably comes from widespread stereotyped perceptions and unconscious biases on gender, in particular on gender in science.

Then, the lack of female scientist role models — especially in leading positions — is definitely another reason for the lack >



© Experimentarium

Sheena Laursen

of women in top positions. And finally, many men and women are not interested in taking top positions in science, as these positions are not very family friendly, involve long hours of work and include many tasks other than the research and development that scientists are good at.

What is new or innovative about the project and the way it addresses gender equality?

I think the new and innovative approach lies in the target groups we try to reach. I really believe that if we want to change the stereotyped ideas of women in science we must target men and women, girls and boys. This we have tried to do through the TWIST activities and we quickly realised that there is no simple solution to this issue. Targeting the broader public and specific groups in different ways and at different stages of their career is definitely part of the solution. With TWIST we have targeted primary schools (pupils, teachers and parents), high schools and secondary schools as well as university students and adults in general.

The courses that have been developed by TWIST have proven invaluable in targeting numerous teachers, and giving them a chance to reflect on the way they teach and approach girls and boys. Teachers have a huge impact on students and their choice of career, but far too little emphasis is put on providing them with the means to inspire their students in their career choices.

What difficulties have you encountered and how have you solved them?

The main difficulty for us was to identify and target the many and diverse issues linked to gender in a way that could inspire people to change their practice for the better. Often people do have preconceived ideas of what the gender issue is, and they expect it to focus only on women. Often, only women would show up to our meetings or participate in TWIST activities, so targeting men as well has been a real challenge.

To overcome this obstacle, we opted for direct marketing towards each gender and focused on making our activities appealing to both girls and boys. But it was not always an easy task: for example, we had a workshop on robots which almost only attracted boys and their fathers, in spite of us trying to target girls as well with female role models and a specific marketing approach. Next time we will try to solve this issue by directly targeting the parents.

What are the concrete results from the project so far?

The TWIST project came up with a new way of focusing on the gender issue in each partner country. This is called the 'Gender Day', coinciding with International Women's Day. The focus here is on celebrating the role of women in science and bringing female scientists into science centres and museums to meet and communicate with visitors. The main emphasis of these activities is on helping girls to see themselves as the scientists of tomorrow.

Then we have managed to develop activities that challenge people's stereotyped ideas of scientists. Although much remains to be done in this field, the partners of the TWIST project have learned and gained inspiration. They found new ways to attract visitors in science institutions and make them participate in science activities.

Finally and most importantly, we raised staff awareness on the importance of mainstreaming exhibits and activities so they appeal to both girls and boys. This may have a significant strategic importance — meaning that we will have a larger and more diverse audience visiting our museums and science centres. These changes, along with the gender-mainstreaming policy we helped implement in partner institutions, would not have occurred without the TWIST project.

What are the next steps in the project, or for your research?

The project is ending now, but the TWIST exhibition — with a database of 42 female scientist role models as well as a 'virtual puppet' that challenges the visitor's gender biases — will be continuing in each of the science centres that were partners in the project. Furthermore, many of the activities and ideas that have been implemented will continue in various museums and science centres. And finally, many new networks and collaborations have been established together with female scientists, Danish ministries and industry, thanks to the TWIST project and these will bring new possibilities in the future.

1 'Towards women in science and technology'.

Funded under the FP7 specific programme 'Capacities' under the theme 'Science in society'.
For further information, see: http://www.the-twist-project.eu

Recruiting scientists of the future

There is a widely recognised need to attract young people, and women in particular, to study and work in the fields of science, technology, engineering and mathematics. Understanding recruitment, retention and gender equity patterns in higher education — and improving them — would be an important step in this direction.

The EU-funded IRIS[1] project identified specific questions around these topics: How are educational choices made? What are women's perceptions of 'science, technology, engineering and mathematics' (STEM)? Have efforts to recruit more women STEM students been fruitful? How do countries, institutions and genders differ in terms of opt-out rates from these subjects? To answer these and related questions, data were collected from questionnaires completed by first-year students. The data were complemented by literature reviews and smaller qualitative and quantitative studies.

Drawing on different theoretical frameworks to explore how young people process educational choices, and their relationship to STEM, almost 7000 STEM students from eight STEM disciplines in five European countries completed the IRIS questionnaire. The instrument sought to gather information on related subjects: science experiences from school, inspiration for choice of education, future job expectations, first-year experiences, and attitudes to gender equity in each field.

Project activities were successful in generating insights into the topics under investigation. These have been published in a summary, with results spread across six categories. They reveal, among other findings, that choice is connected to intrinsic value, and that school experiences have a great impact on choice. Also, recruitment initiatives need to be developed and improved over time to attract student interest and respond to expectations of success.

The IRIS team has enhanced efforts aimed at realising a larger and more diverse STEM workforce that will contribute to growth in important areas like medicine, renewable energy, agricultural technology and transport.

The project was coordinated by the University of Oslo in Norway.

1 'Interests and recruitment in science. Factors influencing recruitment, retention and gender equity in science, technology and mathematics higher education'.

Funded under the FP7 specific programme 'Capacities' under the theme 'Science in society'.
http://cordis.europa.eu/marketplace > search > offers > 10448



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The solution to social exclusion

Rising unemployment and immigration have resulted in social exclusion, a phenomenon that the EU is addressing through innovative socio-economic strategies.

In these economically challenging times, which are giving rise to an increase in global migration, problems such as social exclusion and high unemployment are growing significantly in European communities. The EU-funded WILCO[1] project is investigating novel solutions to overcome these issues in Europe's cities, while taking into consideration cultural and political differences.

The project is mapping social inequality and exclusion, focusing on statistically under-represented groups such as migrants and women, as well as examining policies related to childcare, unemployment and housing. WILCO is working on identifying innovative and citizen-led initiatives that challenge local welfare policies, adapting them to different socio-economic models and local welfare traditions. Studies are being conducted in 20 cities, focusing on two in each of 10 European countries, namely Croatia, France, Germany, Italy, the Netherlands, Poland, Spain, Sweden, Switzerland and the United Kingdom.



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Once this has been completed, the project team will issue recommendations based on these insights to help address social inequality and improve social cohesion, building bridges between academic research and professional practice. Already, through expert interviews and literature reviews, WILCO has identified local welfare mechanisms and policies to produce city reports for each of the 20 cities. It has also analysed data from over 200 European cities, incorporating data from single mothers, migrants and the unemployed, too.

Specific aspects that have been investigated by the project team include characteristics of the labour market, demographics, family structure, old-age dependency, multi-ethnicity of cities, and city comparisons. Current work is focusing on articulating useful innovations to improve the social issues concerned in a long-lasting, sustainable manner. A better understanding of socio-economic problems and the adoption of novel solutions could improve the livelihoods of millions across the EU.

The project was coordinated by the Nijmegen School of Management in the Netherlands.

1 'Welfare innovations at the local level in favour of cohesion'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Socio-economic sciences and humanities'.
http://cordis.europa.eu/marketplace > search > offers > 10109

ENERGY AND TRANSPORT



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Innovative bomb-proof luggage container to improve aviation safety

Engineers are continually working on new ways to improve aviation safety, and the EU-funded research project Fly-Bag[1] may have taken a big step towards preventing terrorist attacks.

Led by project coordinator Donato Zangani of Italian engineering company D'Appolonia, the Fly-Bag consortium has developed a bomb-proof luggage container that can withstand an explosion on a commercial airliner. In other words, the Fly-Bag technology can prevent a small to medium-sized bomb hidden in a suitcase or a cargo hold from damaging the structure or tearing a hole in the fuselage and bringing down the plane.

EU co-funding helped bring together an international team of manufacturing, material and aviation engineers. The diversity of industries and partners makes the Fly-Bag project an example of cross-fertilisation among large research centres, universities and small and medium-sized companies with specialist expertise in areas like textiles and aeronautics.

'High-tech textiles have advanced a lot in the last few years. Even bulletproof vests now use composite textiles,' says Zangani. 'For this application of the technology, we needed blast protection, first of all, and it needed to be lightweight — every kilogramme you put in a plane increases fuel consumption. And then of course there is the cost.'

Zangani and his team addressed these constraints by combining high-density, ballistic fibres with hybrid textiles from lightweight fibres, including aramid (a kind of strong, heat-resistant synthetic fibre) and carbon.

The primary challenge was to make these state-of-the-art materials contain the rapid gas expansion that occurs in an explosion strong enough to rip open the aluminium fuselage of a plane. This is accompanied by a concentrated shockwave effect called 'shock-holing' that occurs at the first moments after the detonation.

'We used a multi-layered structure of textiles that provided enough resistance to fully contain the gas expansion and the pressure generated by the blast,' says Zangani, describing the fine balance needed to contain the various effects of an explosion. 'We wanted to have flexibility, but also a delayed gas release of a few seconds to relieve the pressure. Some of the layers were also designed to trap fragments from the explosion.'

Although Zangani cannot disclose exactly what sized bomb the Fly-Bag system can withstand, he says it has been designed to contain the kind of explosive used in the Lockerbie bombing of 1988, the terrorist

attack in which a commercial airliner was brought down over Scotland by a bomb hidden in the baggage.

D'Appolonia began development in 2008, with a team of five working to complete the final patented prototype in February 2011. As well as speaking to various airlines, Zangani and his team are currently finalising the certification process that will allow the deployment of the Fly-Bag in the aviation sector. The project is in a pioneering position to dominate the market for blast-resistant containers.

The engineers are also working with their partners to devise new applications for the Fly-Bag technology. One of the major potential uses is on cargo planes — not to confine terrorist bombs, but to transport dangerous materials.

'For instance, there is the problem of lithium batteries, which can catch fire easily if they are not transported properly,' explains Zangani. 'Our system is already blast-proof, and in a blast you have high temperatures and you can also have fire,' he adds. 'The Fly-Bag has been designed to seal in a fire, starving it of oxygen.'

From 2008 to 2011, Fly-Bag's total EUR 3.1-million budget was supported by a EUR 2.2-million contribution from the EU. Joining D'Appolonia in the project were nine other companies from Denmark, Germany, Italy, the Netherlands, Sweden and the UK. According to Zangani, the first Fly-Bags are expected to be installed in commercial passenger planes in 2013.

The project was coordinated by D'Appolonia Spa in Italy.

1 'Blast-worthy textile-based luggage containers for aviation safety'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Transport (including aeronautics)'. http://ec.europa.eu/research > Information Centre > search > 28513

Assessing radiation exposure in large-scale emergencies

European scientists are thinking of the unthinkable — a mass radiation casualty scenario — and developing tools for sensitive and fast testing of those exposed.

A large-scale radiological emergency requires tools to quickly assess exposure of human tissues to ionising radiation — known as 'biodosimetric tools'. This is vital for victims to be triaged or sorted according to degree and nature of exposure.

While a number of tools are available, they are mainly geared to small-scale examinations that might be required for routine checks of personnel working with hazardous materials. In the event of a large-scale emergency, these tools would be limited in their specificity and sensitivity to radiation, signal stability and performance speed.

Thanks to EU funding of the Multibiodose[1] project, European scientists with extensive experience in biological dosimetry are adapting available technology to cope with a mass casualty scenario. The team has chosen six different tools to adapt and are training partner laboratories in their usage. Future training programmes will be carried out at external laboratories.

Two blood tests are under investigation. Scientists have taken blood from healthy donors, irradiated it to simulate various types of exposure and evaluated it according to the two protocols. They have tested sensitivity — important in a triage scenario in which time and thus sample counts must be minimised — and identified limits of detection. Multibiodose researchers have also investigated modes of automation and provided recommendations on full or semi-automation depending on dose range.

In addition, they are evaluating two new tests, a non-invasive and fast 'Skin-speckle assay' (SSA) and a semi-invasive and fast 'Serum-protein assay' (SPA). When available, these tests will complement other assays not sensitive to exposures of small parts of the body.

Two other tests of radiation exposure are being validated by assessing the ability of various mobile phones to determine doses attained by people carrying them. The scientists are also developing the necessary data-analysis methods to support the assays themselves.

While most people would not like to consider the possibility of a mass radiation scenario, Multibiodose has produced measures to deal with such a situation.

The project was coordinated by the University of Stockholm in Sweden.



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1 'Multi-disciplinary biodosimetric tools to manage high scale radiological casualties'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Security'. http://cordis.europa.eu/marketplace > search > offers > 9909

ENERGY AND TRANSPORT

New materials for fusion reactors

A European consortium has joined forces to develop new materials suitable for building reactors based on nuclear fusion — a safer, cheaper and greener version of nuclear power.

Nuclear power generation relies on harnessing the energy within the nuclei of atoms that holds nuclear particles together. Fission reactors exploit atomic fission, the breaking apart of heavy atomic nuclei, such as certain forms of uranium. Fission is the process behind electrical power production in conventional nuclear reactors today.

Fusion reactors, on the other hand, rely on the fusing of light atomic nuclei in a process similar to that powering the Sun, where hydrogen atoms fuse to form helium. Fusion has some important potential advantages over fission — among them is the creation of less radioactive materials than fission and no carbon emissions or air pollution. In addition, its fuel is abundant and safe with no need for underground storage.

Fusion reactors are seen by many as a cheap, pollution-free form of energy that would solve the world's energy problem. Stephen Hawking has identified electricity production from nuclear fusion to be the most pressing scientific challenge facing man.

One of the major stumbling blocks to widespread commercialisation of fusion reactors is the lack of materials capable of withstanding the tremendously high temperatures involved in nuclear fusion.

European scientists from 27 institutions initiated the EU-funded FEMAS-CA[1] project to expedite the development of new materials for use in fusion reactors.



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Their goal was to strengthen materials characterisation methods along with networking and collaboration in close cooperation with the European Fusion Development Agreement (EFDA). Materials with improved irradiation resistance and heat-removing capacity were targeted for testing with application of the most advanced structural characterisation methods. The project's first workshop defined a total of 65 new collaborative activities.

FEMAS-A's second phase aimed to elucidate promising new materials potentially leading to the long-awaited and highly anticipated commercialisation of fusion reactors.

The project was coordinated by Max Planck Gesellschaft zur Foerderung der Wissenschaften E.v. in Germany.

1 'Fusion energy materials science coordination action'.

Funded under the FP7 specific programme 'Euratom' under the research theme 'Fusion energy research'.
http://cordis.europa.eu/marketplace > search > offers > 9846

The future of solar energy is looking bright

Harnessing the Sun's energy to produce electricity promises a plethora of benefits. European scientists are developing the next generation of low-cost, highly efficient solar devices to exploit this potential.

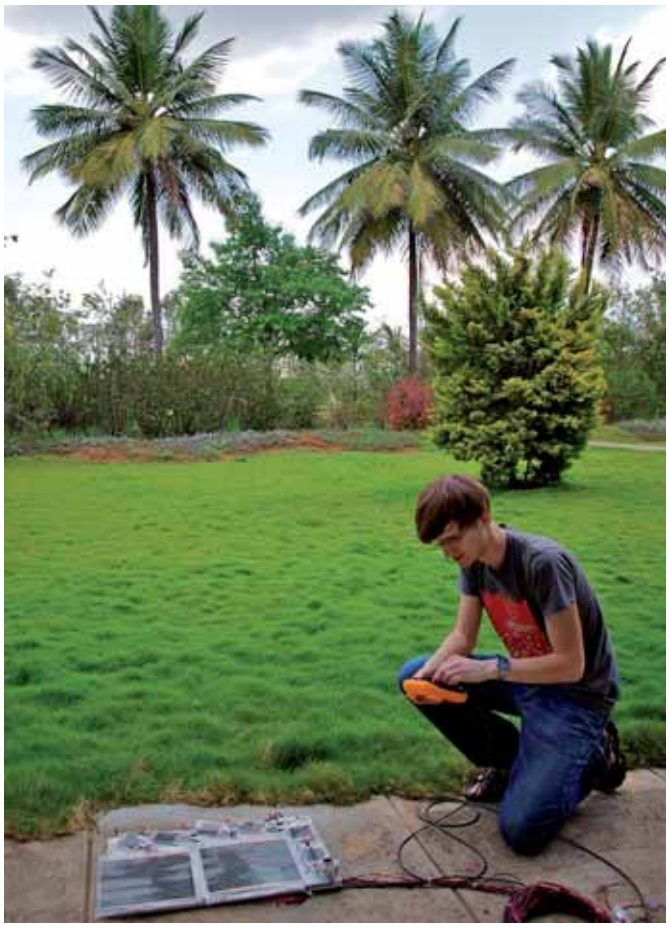
Since the development of a silicon (Si)-based photovoltaic (PV) device was first reported in 1954, solar-cell technology for converting the Sun's energy to electricity has progressed tremendously. The first generation of solar devices was based on crystalline materials. The next and essentially current generation is based on thin-film technology.

'Thin-film solar cells' (TFSCs), made by depositing a thin film of highly photosensitive material on a substrate, are a low-cost and flexible alternative to conventional solar cells with high power-to-mass ratio. Most current devices are based on inorganic semiconductor materials, with high material and manufacturing costs limiting widespread application.

The third generation, still in the lab, is employing novel materials, device concepts and fabrication methods to TFSC technology to further reduce cost and achieve even higher efficiencies.

Polymer-based (organic) solar cells and hybrid (organic polymers-inorganic nanoparticles) systems promise reduced costs as they are suitable for modern fabrication methods such as 'roll-to-roll' (R2R) processing.

A European consortium is developing novel materials for such modern systems with EU funding for the Largecells[1] project. A number of different solar cells and solar-device modules have been designed. Several have already been manufactured and are in the evaluation phase for processing parameters and efficiency.



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Outdoor stability testing has been initiated both in normal operating conditions (in India) and accelerated ageing (in Israel) in order to produce innovative PV devices with long-term stability. Preliminary tests have pointed to potential causes of reversible degradation.

High efficiency has been demonstrated and is expected to be improved in the coming months. While focus up to now has been on small devices, the technology will be adapted for large-area modules made using R2R processing. Largecells is making important progress in the field of printable third-generation solar cells for large-area coverage.

With novel materials for organic and hybrid TFSCs scalable for R2R processing, Largecells should significantly increase solar-cell efficiency while reducing costs. This promises to make clean solar energy a truly viable alternative to current fossil-fuel-derived electricity.

The project was coordinated by the University of Bayreuth in Germany.

1 'Large-area organic and hybrid solar cells'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Energy'.
http://cordis.europa.eu/marketplace > search > offers > 9834

Algae as an alternative source of fuel

European scientists have explored the prospect of using algae and 'other aquatic biomass' (OAB) as innovative raw materials for biofuel production. By performing a full-cycle analysis — from collection to fuel use — the project activities are expected to unlock the potential of algae for applications other than energy.



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Central to biofuel sustainability is the way in which feedstock is produced, particularly with respect to their carbon dioxide (CO_2) balance, land and water use, and competition with food. In this respect, algae have the advantage of producing potentially high yields with minimum land requirements.

The EU-funded Aquafuels[1] project aimed to explore the overall feasibility of algae entering biofuel production chains. The scientists would then be informed as to the most appropriate strategies to develop such production chains.

As a first step, project partners evaluated the actual economic, technical and sustainability potential >

of large-scale biofuel production pathways in order to identify their strengths and weaknesses. With the help of a questionnaire, the project team generated a 1000-member directory of algae stakeholders in Europe and worldwide. The project also supported the creation of the European Algae Biomass Association (EABA) to continue its work.

In addition, the Aquafuels project addressed the taxonomy, biological and biotechnological aspects of various algae species. Overall, 72 relevant algae species were identified for biomass, biodiesel and bioethanol production. Only 30 species were commercially produced, while 47 species showed a potential for cultivation in sea water. A functional taxonomy of all these algae species was created to assess their suitability for the production of all kinds of biofuels, such as biodiesel, bioethanol and biogas.

When assessing the major scientific and technology research still needed for the practical production of biofuels from algae, the project partners concluded that algae-based biofuels were still at the research stage. Nonetheless, they found a promising infant industry growing in several EU countries, which could lead to a significant algae-biofuel market in the future.

The Aquafuels project demonstrated the potential of algae and aquatic biomass in the EU's agenda for both current and future renewable energy sources, with beneficial sustainability and societal implications. Furthermore, it set the basis for future research and scientific cooperation in the EU algae sector.

The project was coordinated by the European Biodiesel Board in Belgium.

1 'Algae and aquatic biomass for a sustainable production of second-generation biofuels'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Energy'.
http://cordis.europa.eu/marketplace > search > offers > 9818

Advanced in-flight testing for better aircraft design

Building on previous lab tests, scientists are bringing important in-flight aircraft testing technology from the laboratory to industry. This will generate substantial cost, time and safety benefits.



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Flight testing of new or modified aircraft is an integral part of the design and certification process, the final step in validation of full-scale aircraft design. Under pressure to ensure ever-increasing levels of safety in increasingly shorter time intervals, the aircraft certification process relies on installation of heavy instrumentation to predict behaviour and detect potential problems.

Previously, the AIM[1] project demonstrated the feasibility of applying advanced optical measurement techniques used in wind-tunnel testing to in-flight testing for certification. It also identified challenges to be overcome in order to optimise techniques.

With the follow-up AIM2[2] project, scientists are taking the technology from the lab to industry to enable routine in-flight applications able to satisfy industrial demands.

AIM2 is developing reliable and dedicated mobile optical measurement systems and application rules. Project scientists are testing them in an industrial environment.

The consortium has already made substantial improvements to AIM technology. Notably, it enables better deformation measurements on wings and control surfaces, as well as improved surface and strain measurements, thanks to the development of advanced sensors and a new data-acquisition system.

Investigators are also improving air-flow measurements. They have included a pressure sensor and an air-speed probe in the measurement system. The team has designed hardware for measuring propeller deformation spanning 360°, and the set-up for propeller flight tests is being built.

Continued work will focus on testing and optimising technology as well as developing a toolbox and a handbook for measurement techniques developed in the project. Using a number of advanced optical measurement techniques, AIM2 is further developing in-flight testing capabilities for industrial application to the certification process.

The mobile technology and an easy-to-use guide should enable non-experienced users to apply optical measurement techniques to flight tests, substantially reducing the time and cost of the certification process while enhancing overall safety.

The project is coordinated by the German Aerospace Centre in Germany.

1 'Advanced in-flight measurement techniques'.
2 'Advanced in-flight measurement techniques 2'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Transport (including aeronautics)'.
http://cordis.europa.eu/marketplace > search > offers > 9830

Adapting seat safety to women as well

Scientists have set out to provide guidance on evaluating the protective performance of vehicle seat designs. The aim is to reduce the incidence of whiplash-associated disorders, offering enhanced protection for both male and female occupants.

In-depth knowledge of various features, particularly those related to the risk of injury to occupants, is needed to develop adaptive vehicle safety systems. Even in a low-severity crash, all vehicle occupants are at risk of sustaining whiplash injuries.

Whiplash-associated disorders (WADs) — also known as whiplash injuries — result from vehicle crashes. They are a serious transport safety issue costing Europe over EUR 4 billion, with more than 300 000 European citizens each year joining the long list of people suffering from neck problems. Among them, 15 000 face long-term difficulties.

Women are at a higher risk of suffering from these problems. They have different anthropometry and mass distribution compared to men — factors that can influence the interaction of the upper body with the seat backrest and head restraint. This marks an injury risk differential. In fact, epidemiological studies state that, since the 1960s, the difference in risk between the two genders has ranged between 40 % and 100 %. However, the only available occupant model for assessing vehicle safety in impact scenarios is the average male.

In light of this discrepancy, the Adseat[1] project is working to establish properties for a model of the average woman, and to implement these in a computational model. This will result in an improved tool for developing and evaluating adaptive systems, with special emphasis on protection against neck injury and WADs.

Project partners are focusing on more beneficial ways of evaluating the protective performance of seats for both female and male motor vehicle occupants. To this end, they propose to develop a 'finite-element' computer model of an average female dummy. Such a research tool will be used together with the existing 'rear-impact dummy' (RID) of an average male and the 'Biofidelic rear-impact dummy' (BioRID–II) to evaluate enhanced whiplash injury protection.

Adseat has already conducted an extensive literature review and analysis of databases, with results showing that >



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height and weight approximating the 50th percentile of the female population is appropriate for a representative dummy model.

Biological data have also been gathered, upon which EvaRID — the first version of a finite element dummy model of the average woman — has been founded and developed. It is based on the same design concept as BioRID II. Volunteer tests have been carried out, and test results and their analyses will offer new knowledge for future dummies and occupant models. The project team has also manufactured and tested two test rigs for whiplash exposure.

Work on computational modelling has highlighted the potential of the EvaRID dummy model as a valuable tool for the design and evaluation of seats and whiplash protection systems. Going forward, further model refinement is required to improve on initially positive evaluations.

Ongoing work promises to deliver a working computational model of a female for low-severity testing and enhanced design and evaluation of adaptive seat systems. The results of such efforts will benefit the traffic safety of both men and women.

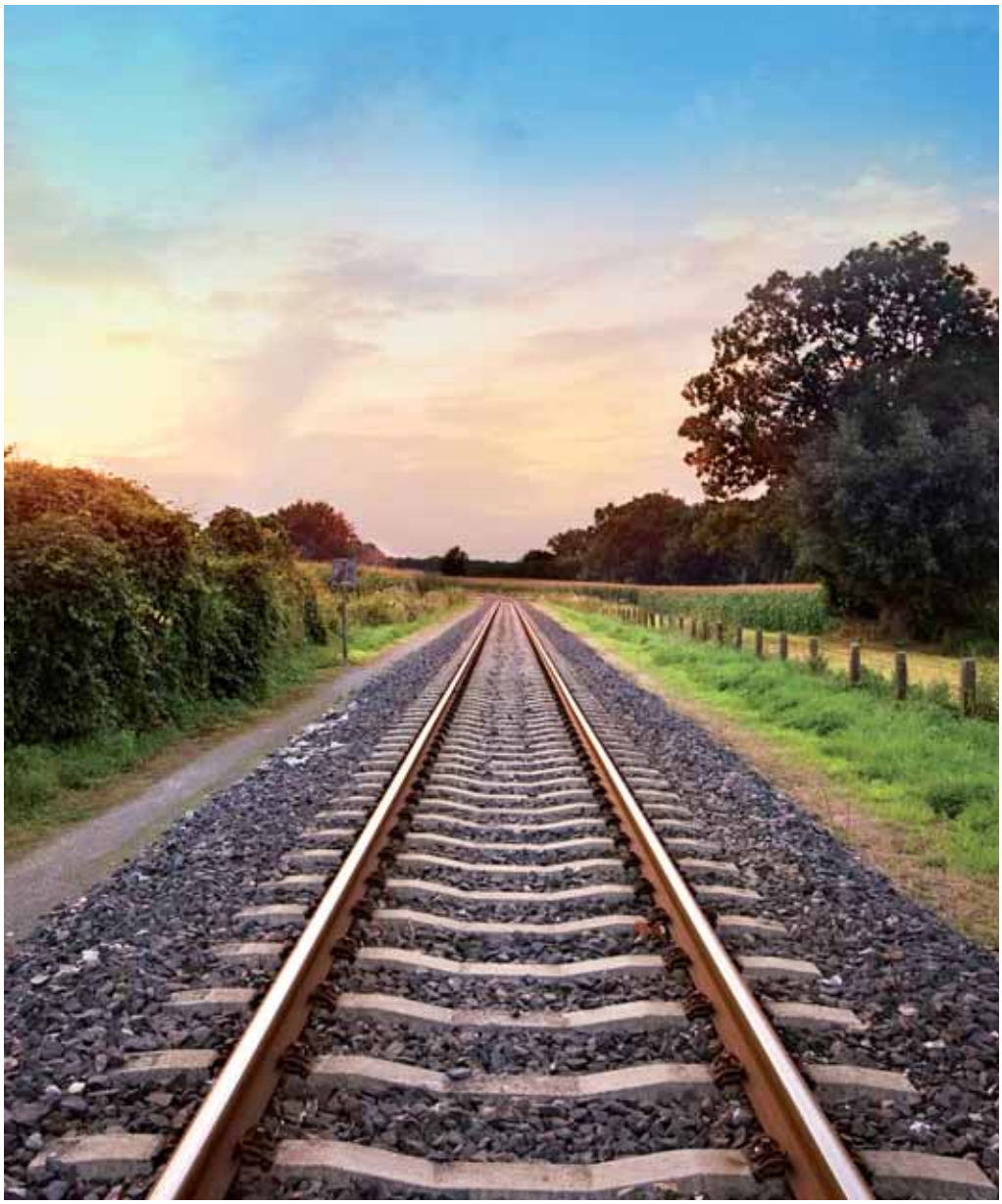
The project is coordinated by Statens väg- och Transportforskningsinstitut in Sweden.

1 'Adaptive seat to reduce neck injuries for female and male occupants'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Transport (including aeronautics)'.
http://cordis.europa.eu/marketplace > search > offers > 9926

Safer rail transport has arrived

Ongoing efforts to divide the pressing issue of rail security into more manageable sub-projects is paving the way to a powerful comprehensive security vision for EU rail transport.



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Railway security has become a pressing concern in the wake of the global threat of terrorism, and Europe is working fervently to safeguard its rail sector. Protectrail[1] is an EU-funded project that is dealing with the challenge of railway security by dividing this massive mission into smaller ones.

Based on cutting-edge technologies, the project is developing a system that ensures synergy and compatibility among security sub-projects or 'sub-missions'. Each of these sub-missions is focusing on a different feature of the railway system — including physical, operational and cargo aspects — when under different threat within a global context. The project is articulating a common vision of current and future risks, proposing specific technologies and designing an advanced rail-security solution for the future.

Protectrail has already defined user requirements and analysed regional differences, in addition to articulating functional and technical specifications related to security. Enhanced protection of trains and railways will include safeguarding power distribution and signalling against terrorist acts and detection of foreign

objects on the tracks. It will also feature novel ways to ensure the safety of on-board luggage.

The project is defining actual and future rail-related risks for comprehensive security, promoting concrete standardisation of technologies and procedures across Europe. It is therefore set to substantially improve performance, reliability, speed, cost and security, enabling smarter detection of threats and better risk management in crisis situations. Thanks to Protectrail, Europe's rail system is on track to take on the challenges of the 21st century.

The project is coordinated by Ansaldo STS in Italy.

1 'The railway-industry partnership for integrated security of rail transport'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Security'.
http://cordis.europa.eu/marketplace > search > offers > 9827

Breaking down cell walls for biofuels

The increasing emissions of greenhouse gases (GHGs) have raised considerable concern regarding their effects on the environment. A large European study has investigated ways to improve plant cell-wall utilisation to generate environmentally friendly alternatives to fossil fuels.

It is becoming evident that our fossil fuel-dependent economies cannot be sustained indefinitely, necessitating the urgent use of alternative fuels. Plant biomass, also known as lignocellulose, is gaining ground as a limitless source of raw fuel material. Its composition of energy-rich polysaccharides makes it ideal for fermentation to produce bioethanol and other products.

However, the complex structure of cell walls means they are very resistant to degradation. This makes the sugar conversion (saccharification) process a major technological hurdle that needs to be overcome to allow for plant-fuelled biorefinery.

The key objective of the EU-funded Renewall[1] project was to advance our understanding of plant cell walls and to use this knowledge to enhance the saccharification process. Plants with modified wall properties could subsequently be exploited for the production of biofuels.

The hypothesis was that certain plant genes involved in cell-wall biosynthesis or other (often microbial) genes could modify the plant cell-wall properties or degrade cell-wall polymers when expressed in plants. Once identified and cloned, these genes would be incorporated into genetically modified (GM) species to cultivate improved plant feedstock for biorefining.



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Scientists performed a broad genetic screening of mutant or transgenic plants exhibiting altered cell walls or digestibility. Key genes were identified that improved cell-wall digestibility alongside others that were involved in lignin and secondary cell-wall biosynthesis.

This information was successfully utilised to genetically transform model plants and modify their cell wall structure, cellulose biosynthesis and digestibility. Coupled with basic biochemical studies on the saccharification process, this data provided invaluable insight into what controls biomass digestibility and how it could be modified in biomass crops.

From this in-depth understanding, Renewall scientists are hopeful they will be able to develop well-informed strategies for the generation of biomass crops improved for biofuel and biorefinery applications.

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

1 'Improving plant cell walls for use as a renewable industrial feedstock'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology' (KBBE).
http://cordis.europa.eu/marketplace > search > offers > 9663

ENVIRONMENT AND SOCIETY



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Cleaner water for a safer future

Population growth among Europe's North African neighbours, Morocco and Tunisia in particular, is putting increasing pressure on clean water. As supplies slowly dwindle, there is a growing need for efficient technologies to improve water quality and treatment in a bid to cut down on waste water.

Supporting initiatives in Morocco and Tunisia, two Mediterranean Partner Countries (MPCs) suffering from scarce water resources, the EU FP7-funded project SOWAEUMED[1] set out to help these two countries improve water quality and treatment.

Water in Morocco and Tunisia is not only scarce but is also under threat from pollution. The SOWAEUMED project is working with research groups in Moroccan and Tunisian laboratories to develop new systems based on conventional, advanced, and nanotechnologies. These will address both the demand for water as populations in these countries increase and the need for new treatment regimes which will make the valuable resources cleaner and safer.

'A segment of our research activities is directed towards the area of nano-environment by focusing on the use of nano-particles and nano-composite materials in environmental clean-up, including water purification and treatment of waste water,' says project coordinator Professor Manuel Valiente.

'Nanoparticles are very suitable for water treatment due to their high reactivity and a very high surface-to- volume ratio; they can be up to 1000 times more efficient than conventional ion-exchange resins for the removal of dissolved species from water streams.'

To provide Morocco and Tunisia with the tools to better manage their water resources, the project is strengthening the capacities of the institutions participating in these MPCs. This involves upgrading research equipment, hiring new senior researchers, and fostering contacts and exchanges between researchers.

This connection between Moroccan and Tunisian laboratories and the wider research community has allowed research results, ideas and new technology to be shared. It has also empowered the laboratories in the MPCs to enhance their contribution in the European Research Area, and increased their appeal as potential research partners for European scientists.

'The improvement, modernisation and upgrading of laboratories at the partner institutions has brought their research infrastructure up to the standard of those European research centres the project wants to engage with in the future,' says Prof. Valiente. 'The project has also been instrumental in preparing the laboratories to participate more fully in future international research programmes aimed at solving the Earth's waste water and solid waste problems.'

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

1 'Network in solid waste and water treatment between Europe and Mediterranean countries'.

Funded under the FP7 specific programme 'Capacities' under the theme 'Stimulating the realisation of the full research potential of the enlarged European Union Community'.
http://ec.europa.eu/research/infocentre > search > 28941

Automated weed management for farmers

Ground-based and aerial robots may soon be responsible for weed control of crops. Scientists are developing technology that should reduce chemical use and costs while safeguarding human health and the environment.



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Historically, agriculture has not been a very high-tech sector. Over the last 20 years, however, advances in sensors, imaging — such as global positioning systems (GPS) and geographic information systems (GIS) — and automation of agriculture equipment have led to what is now commonly called 'precision agriculture'.

In a precision agriculture paradigm, crop management relies on collecting and processing information from various sources to make informed decisions about crop production.

European scientists have decided to develop a new generation of automatic and robotic systems for weed management — using EU funding for the RHEA[1] project. The consortium focused on both agricultural and forestry products, including tomatoes, maize, strawberries, wheat, and walnut, almond and olive trees.

RHEA is developing mobile ground units based on small commercial tractors for enhanced reliability and reduced delivery time. These will be supplemented by unmanned aerial units. Both types of unit will be equipped with advanced sensors and multi-point 'hands' capable of applying the requested processes to large areas simultaneously.

RHEA technology aims to reduce agricultural chemicals used in weed management by 75 % while providing significant cost savings through automation and reduction in chemical use. Along the way, it should improve crop quality and the health and safety of humans.

The project is coordinated by Agencia Estatal Consejo Superior de Investigaciones Cientificas in Spain.

1 'Robot fleets for highly effective agriculture and forestry management'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP).
http://cordis.europa.eu/marketplace > search > offers > 9889

Retrofit for energy-efficient landmark buildings

Scientists are developing solutions to transform Europe's historic landmark buildings into modern, energy-efficient gems worth keeping.

Sustainable energy usage and reduced emissions and climate impact are important goals for new buildings. Historic buildings are notoriously energy inefficient, contributing substantially to greenhouse gas (GHG) emissions and rising electricity bills.

Historic landmark buildings representing Europe's rich cultural heritage and social identity are in need of what could be called an 'energy facelift'. They must provide comfort and safety for their inhabitants while decreasing emissions and costs.



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With EU funding of the 3ENCULT[1] project, European scientists are developing retrofit solutions for significant reductions in energy consumption based on both new and existing technologies.

Using eight case studies representative of the majority of European heritage buildings in urban areas, the consortium is developing solutions based on both passive and active, or intelligent, systems for monitoring and management.

Conservationists have helped to define energy-demand and preservation criteria leading to a task-oriented energy classification of historic buildings. Installation of monitoring systems has been carried out at the case study sites and calculation and simulation of energy demands has begun.

3ENCULT has laid the groundwork for the development of energy-efficiency solutions for historic buildings, enabling retrofit in line with preservation criteria. Completion of the project is expected to validate developed technology and pave the way for transforming Europe's landmarks from industrial age relics to modern, energy-efficient buildings.

The project was coordinated by the Accademia Europea per la Ricerca Applicata ed il Perfezionamento Professionale Bolzano in Italy.

1 'Efficient energy for EU cultural heritage'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
http://cordis.europa.eu/marketplace > search > offers > 9894

ENVIRONMENT AND SOCIETY

Sustainable industrial water usage

A European consortium worked to develop important technology for managing water usage in water-intensive industries. Expected outcomes include lower consumption and less environmental impact with enhanced end-product quality.



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Water use has been increasing much faster than the world population over the last 100 years. Such an imbalance means that water scarcity is not confined to dry, arid regions with plenty of sunlight. In fact, according to the United Nations (UN), groundwater is being used faster than it can be replenished in 60 % of European cities with a population of more than 100 000.

Sustainable management of industrial water usage and discharge has the potential to facilitate an economical, safe and sustainable water cycle — contributing to improved product quality and process stability.

The EU-funded Aquafit4use[1] project exploited intensive cooperation among water-intensive industries to develop and disseminate new technologies able to ensure water that is 'fit-for-use'.

The end goal is to substantially reduce fresh-water needs (by 20-60 %), and discharge waste-water volume to mitigate environmental impact, while enhancing the quality of industrial products and the efficiency of industrial processes.

Scientists delivered a prototype Water Quality Management Tool (WQMT). It incorporates water-quality indicators, water demands for different industrial sectors, environmental and utilities data, and models of treatment technologies.

The consortium also introduced a tool based on Hazard Analysis and Critical Control Points (HACCP) methodology for water-quality control.

Results of the Aquafit4use project have led to updates in the research agenda of the European Water Supply and Sanitation Technology Platform (WSSTP), the European Commission organisation formed in 2004 to lead research and technology development (RTD) in the water industry.

The consortium also drafted assessment standards for sustainable water usage in industry, an action coordinated by the European Water Partnership (EWP). EWP is an independent non-profit organisation formed to develop strategies to achieve European water objectives and implement them.

Aquafit4use results have the potential to achieve significant progress in delivering technologies for water treatment in water-intensive industries. The tools and standards developed should decrease water usage, increase the quality of effluents and, in the end, improve end-product quality while protecting the environment.

The project was coordinated by the Organisation for Applied Scientific Research (TNO) in the Netherlands.

1 'Water in industry, fit-for-use sustainable water use in chemical, paper, textile and food industry'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'. http://cordis.europa.eu/marketplace > search > offers > 9883

Decision tool for rural development policy-makers

Rural development and effective allocation of funding obviously has an important spatial dimension. Scientists are developing a tool for policy-makers taking all three aspects into account for effective programme decisions.



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Mathematical models and statistical analyses are critically important to policy-makers. They facilitate assessment of the likelihood of certain outcomes as a result of policy implementation (*ex-ante* assessment). They also enable characterisation of the actual effects of policies once they have been put in place (*ex-post* evaluation).

Spatial econometrics is a specific type of statistical analysis incorporating spatial variation and dependence into an evaluation of economic effects. A European consortium is using spatial econometrics to develop a Decision Support System (DSS) for those in charge of Rural Development Measures (RDMs).

The EU-funded SPARD[1] project seeks to develop, in its final form, a tool for *ex-ante* analysis to identify appropriate RDMs for a given region and thus increase the efficiency and effectiveness of programme planning.

The first step involved developing tools for *ex-post* evaluation. Scientists set out to develop a framework for collecting and analysing regional baseline data and

evaluating real outcomes of specific policies in certain regions in a systematic way.

Although a basis for evaluation of Rural Development Programmes (RDPs) exists in the form of indicators associated with the Common Monitoring and Evaluation Framework (CMEF), econometric analyses of RDPs are relatively scarce.

SPARD scientists collected and standardised data from CMEF, Eurostat and other sources, identifying major gaps and outliers. They were then able to select three key measures for further econometric analyses based on high implementation rate throughout Europe and, over time, consistency across various administrative units and impact.

A spatial econometric model has been developed and is currently being tested for the three measures. Explanatory spatial data analysis (ESDA) has highlighted several important caveats to be taken into account.

SPARD is expected to deliver a decision-support tool to help policy-makers at Member State and EU level make effective rural development decisions. The quantitative model will enable analysis of programmes' cost effectiveness along a spatial dimension, facilitating higher impact of allotted funds.

The project was coordinated by the Leibniz Centre for Agricultural Landscape Research (ZALF) in Germany.

1 'Spatial analysis of rural development measures'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology' (KBBE).
http://cordis.europa.eu/marketplace > search > offers > 9839

High-tech tools protect against flooding

New low-cost methods and technologies promise to help alleviate flood damage and support the operation of critical utilities during flooding.

One of the most important natural hazards threatening Europe is the prospect of floods, which destroy a large number of homes and leave many homeless. The EU has spent over EUR 40 billion per year to address floods and repair the damage, which occurs mainly in urban areas.

In this context, the EU-funded project Floodprobe[1] is developing less costly ways to protect populations against floods.

While maps of flood-prone areas can help identify regions that need more help, they do not in themselves help deal with the threat or pinpoint the type of damage. The project is therefore assessing key infrastructures, buildings and construction methods to create a tool that helps protect them against floods. It focuses on flood defences like levee systems, public buildings, office buildings and other structures apart from homes, examining the effect of floods on walls, floors and materials to assess damages and costs involved.



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In addition, the project is articulating ways to evaluate risks and threats to main infrastructure systems such as electricity and water, including how these are linked with one another. It is also developing tools to highlight vulnerabilities of these utilities and to identify the most critical components in the overall urban infrastructure.

Finally, Floodprobe has undertaken modelling scenarios and conducted case studies to help mitigate the effects of a flood, conducting in-depth risk and vulnerability assessments in the process. From the pilot test site in Trondheim, Norway, the project is expected to result in new tools and methods that will help address and pre-empt flood disasters across the EU.

The project was coordinated by Stichting Deltares in the Netherlands.

1 'Technologies for cost-effective flood protection of the built environment'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
http://cordis.europa.eu/marketplace > search > offers > 9891

'Recycling' materials from plants and trees

European scientists are developing a 'biorefinery' concept to turn abundant plant and tree materials into numerous types of fuels and compounds for the chemicals sector.

Most Europeans recycle on a regular basis, collecting all the plastic, glass and paper they accumulate at home and helping companies turn large portions of it into useful products. More and more people are also composting, essentially 'recycling' their kitchen scraps into fertiliser for their gardens.

Along the same lines, a large European consortium is creating a biorefinery for sustainable processing of agricultural and forestry materials into fuels, chemicals, heat and power — using EU funding for the Biocore[1] project.

Using biomass as a source of energy helps relieve dependence on fossil fuels and reduce carbon dioxide emissions. Implementing technologies for refining abundant plant resources that are energy- and water-efficient with low-carbon footprints will provide truly sustainable production of added-value products.

The concept is ambitious, requiring processing and manufacturing lines for multiple inputs and >

multiple outputs. However, the benefits will be great, not only for the agriculture and forestry industries but also for the energy sector, chemical and biotech industries, as well as the general public.

To date, the consortium has made important progress in developing refining technology to extract three important constituents from the biomass (lignins, cellulose and hemicelluloses). It has also researched a large number of processes for transforming the biomass intermediates into other compounds and chemicals.

Laboratory results verify the ability of extending current technology — using wheat and barley straw — to a number of other crop and forestry materials. Thus, results support the ability of future biorefineries to process a number of different feedstocks.

Scientists established a process model to be used for simulation studies. Combining data on crops and harvestable volumes — along with transport networks and geographical constraints — facilitated the selection of sites for future case studies.

Upon completion, Biocore is expected to deliver a clear definition for sustainable operation of small and medium-scale biorefineries that take abundant plant materials and turn them into a portfolio of products based on a given local environment.

The project was coordinated by the Institut National de la Recherche Agronomique in France.



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1 'Biocommodity refinery'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology' (KBBE).
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Climate satellites help Central Asia

Intensive training, sophisticated equipment and new offices for environmental monitoring can help Central Asia advance development and address climate change.



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The five Central Asian countries of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan are in relatively close proximity to Europe and have been active trading partners with the continent. Europe has steadily supported the region in areas of science, education and humanitarian aid, bringing a host of benefits to its populations in a number of ways.

Keeping in mind the region's rich natural resources and potential, the EU-funded GEOCA[1] project has delivered pivotal Earth Observation (EO) technology on high-level environmental monitoring to Central Asia.

The project first examined the capabilities of these nations in exploiting data from the technology to advance the region's well-being. It published an online 'White Book' on the needs and capabilities of each country, outlining major environmental challenges and the kind of EO information required by the five nations. The report contains valuable information about key stakeholders in the region which can use or provide EO data.

In effect, GEOCA has brought Europe's global network of satellite-based data dissemination systems, Geonetcast, much closer to important stakeholders across the region. It has trained project members from the different countries to act as multipliers in the region, opening up Central Asia to valuable satellite-monitoring data.

Uzbekistan was the first of the five countries to install Geonetcast equipment in its capital, Tashkent, thanks to the project's efforts. In addition, Kazakhstan, Tajikistan and Uzbekistan have also become members of Geonetcast, with Kyrgyzstan and Turkmenistan due to join soon. Eventually, all five countries will boast Geonetcast local offices that will help the environment, promote geological exploration and encourage development.

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

1 'GEO capacity building initiative in Central Asia'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
http://cordis.europa.eu/marketplace > search > offers > 9890



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TV and the internet: a marriage made in entertainment heaven

If you have bought a new television lately, the chances are it is a lot smarter than your old one. 'Smart TVs', also known as connected or hybrid televisions, featuring integrated internet connectivity, currently account for around a third of TV sales in Europe. They are the end point in a huge and rapidly expanding value chain driven by the intensifying convergence of television and the internet.

Just as accessing the internet solely from a desktop PC is rapidly becoming a thing of the past, so too is broadcast TV in the traditional sense — along with the complaint that 'there's nothing on television!' With connected TVs, channels become interactive, content can be shared, rated and commented among friends, videos can be streamed and watched at will, and a favourite programme will never be missed.

'Connected TV', in the words of Neelie Kroes, Vice-President of the European Commission responsible for the Digital Agenda, gives consumers 'the potential to combine the best of what they get from existing media, with the best of what they can get from the new. To combine their favourite TV shows with their favourite games and social networks; material on demand, not on schedule, from the comfort of your sofa.'

And it is not just about the TV set in your living room. Increasingly, both traditional broadcast TV and new multimedia content is accessible across a range of devices — you can start watching a programme at home over coffee in the morning and seamlessly continue watching it on your smartphone on the commute to work.

For consumers it sounds like entertainment heaven, but making it happen is both a major opportunity and challenge for network operators, system developers and integrators, content providers and creators. Several EU-funded projects are addressing the challenges, from finding the best methods to deliver content to ensuring a seamless integration of all media for end-users.

Bandwidth hunger: from HD to 3D

The Optiband[1] project, for example, is focusing on the delivery of high-definition (HD) and Video-on-Demand (VoD) via 'internet-protocol television' (IPTV) networks. Today, these typically use a high-speed Digital Subscriber Line (DSL) to deliver media content from the internet to end-users alongside more traditional voice and data services. By applying innovative algorithms to efficiently distribute content while preserving video quality, the Optiband researchers have been able to demonstrate the delivery of three HD-video streams over a single 15 Mbps DSL connection. In effect, this allows three users to share one connection to watch different HD content >

with no loss in quality — a significant improvement on the current state of the art.

Optimising delivery methods is perhaps the most crucial factor for the widespread roll-out of connected TV services today. According to some estimates, by 2016, it would take one person 6 million years to watch all the video content that will cross networks worldwide in a single month. That requires a lot of bandwidth, although perhaps not as much as feared.

'The golden rule to remember is that all bandwidth available will be consumed,' says Jari Ahola, a project coordinator at the VTT Technical Research Centre of Finland. 'Just as bandwidth increases, the ways to consume it are increasing too: high-definition video is one example.'

So adding more bandwidth — essentially laying more cables and other network infrastructure — is not the only way to address the problem. Changing the way video is distributed would also help.

Instead of using the traditional unicast model, based on servers sending data to each client, Mr Ahola and a team of researchers working in the P2P-Next[2] project have shown that content can be distributed much more efficiently over a peer-to-peer (P2P) network in which data hops from one user to the next. By deploying a modified version of the P2P technology used for illegal file sharing, the P2P-Next team demonstrated a system for delivering video that uses at least 65 % less bandwidth compared to the unicast streaming approach.

Such improvements will become increasingly useful as content becomes even more bandwidth intensive. After HD, 3D is set to become the new viewing revolution, and researchers working in the Romeo[3] project are attempting to ensure it gets to users with sufficient quality. Their approach is to combine a quality-aware P2P system with Digital Video Broadcasting (DVB) technology and innovative real-time compression methods to deliver 3D video content and spatial audio — including live streams — to multiple users on both fixed-line and mobile networks.

Still, network operators worry that, even with content optimisation and more efficient P2P delivery methods, user demands will lead to uncontrollable increases in traffic over time. The issue is being dealt with in the Napa-Wine[4] initiative, in which researchers in France, Italy, Hungary, Poland and the UK are carrying out an in-depth analysis of the impact a large deployment of P2P-TV services would have on the internet. Based on their work, they plan to provide recommendations for P2P-TV developers for best-in-class design of systems that minimise network load; also demonstrating low-cost changes that network operators can make to better exploit the available bandwidth for P2P traffic.



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Two-way TV

For service providers and network operators, understanding what is going on over the network is crucial to ensure quality of service. Equally, content providers and creators want to know how their content is being received by their audience. Since linked TV can be interactive and data is able to travel both ways there is a huge opportunity to mine viewer information, enabling more accurate market research for providers — compared to relying on viewer feedback surveys — and the possibility of much more personalised viewing experiences for end-users.

The recently launched Vista-TV[5] project is developing a system to extract, mine and analyse anonymous viewing data from connected TV users. The end result, the project team hopes, will be the creation of an entirely new SME-driven market in TV viewing-behaviour information.

For end-users, however, the most revolutionary aspect of connected TV is the fact that it effectively puts them in control. You want more information on the subject of a documentary? A couple of clicks and it is on your screen, along with a list of other programmes you might be interested in watching via a video-on-demand service. You want to watch the football with your friends but do not feel like going out? Watch together, comment and interact via a social network. Just returned from holiday and want to share your photos and videos with family and friends? Upload them and create your own private channel from the comfort of your sofa.

A range of projects are working on the underlying technologies to make this integration of different media, delivery methods and viewing devices as seamless and transparent to the end-user as possible.

Getting social

In the HBB-Next[6] initiative, researchers are developing user-centric technologies for enriching the TV-viewing experience with social networking, multiple-device access and group-tailored content recommendations, as well as the seamless mixing of broadcast content, complementary internet content and user-generated content. In NoTube[7], a team from nine countries has focused on using semantic technologies to annotate content so that computers can understand the meaning of what someone is watching which, combined with data on viewing habits and social networking activities, enables highly personalised, intelligent services. And in Comet[8], researchers are focusing primarily on user-generated content, developing an architecture for content-aware networks to make it much easier to locate, access and distribute videos.

Meanwhile, in LinkedTV[9], a team from eight European countries are going one step further, putting cloud computing firmly at the centre of the TV-internet convergence mix. By weaving content together to deliver a single, integrated and interactive experience, the researchers are building an online cloud of networked audio-visual content that will be accessible regardless of place, device or source. Their goal is to provide an interactive, user-controlled TV-like experience — whether the content is being watched on a TV set, smartphone, tablet or personal computing device.

'Browsing TV and web content should be so smooth and interrelated that in the end even "surfing the web" or "watching TV" will become a meaningless distinction,' the LinkedTV team says.

1 'Optimization of Bandwidth for IPTV video streaming', coordinated by Orckit Communications in the United Kingdom.
2 'Next generation peer-to-peer content delivery platform', coordinated by Teknologian Tutkimuskeskus VTT in Finland.
3 'Remote Collaborative Real-Time Multimedia Experience over the Future Internet', coordinated by University of Surrey in the United Kingdom.
4 'Network-Aware P2P-TV Application over Wise Networks', coordinated by the Polytechnic University of Turin in Turin.
5 'Linked Open Data, Statistics and Recommendations for Live TV', coordinated by the University of Zurich in Switzerland.
6 'Next Generation Hybrid Media', coordinated by Berlin-Brandenburg Broadcasting in Germany.
7 'Networks and Ontologies for the Transformation and Unification of Broadcasting and the Internet', coordinated by Vereniging voor christelijk hoger onderwijs, wetenschappelijk onderzoek en patiëntenzorg in The Netherlands.
8 'COntent Mediator architecture for content-aware nETworks', coordinated by Telefónica Investigación y Desarrollo in Spain.
9 'Television linked to the Web', coordinated by the Fraunhofer Gesellschaft zur Förderung der angewandten Forschung e.V. in Germany.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Information and communication technologies' (ICT).
http://cordis.europa.eu/marketplace > search > offers > 9967

Rescue and eco-protection go high-tech

Using sophisticated, lightweight overhead drones for collecting sounds, images, video and other data, a new online system can monitor the environment, manage disasters and facilitate rescue in impressive ways.



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The EU's Global Monitoring for Environment and Security (GMES) system has made significant progress in deepening our understanding of climate change and addressing phenomena such as flooding. The EU-funded project GEO-Pictures[1] exploited position-based image and sensor communication technologies to advance GMES significantly.

Armed with cutting-edge technology and the latest in satellite connectivity, the project helped users access real-time information for managing disasters and emergencies quickly, easily and securely. It facilitated collection and exchange of geographically-based digital photos, video and sound via the web using advanced sensor technology, taking data gathering to unprecedented levels. GEO-Pictures has even worked on dedicated solutions for global players such as the United Nations, the EU Civil Protection Mechanism and the government of the Amazonas state in Brazil.

To achieve its aims, GEO-Pictures refined solutions for satellite and mobile links by optimising image compression, speeding up transfer of data, and designing the required network architecture. It then completed several trials successfully and conducted training on the technology to ensure its viability. The system was designed to be practical and dynamic, i.e. growing in complexity with more and more services and features being added on.

Novel features include the use of cost-effective micro-drones, which weigh just a few kilogrammes, to collect relevant data and provide advanced digital imagery from a variety of angles. The system can also use social media in emergency situations and disseminate crucial information through cell phones, as well as provide online access through smartphones. This ingenious technology was designed to help environmental management of the rainforest and illegal logging, among others, paving the way for managing other endangered regions of the world. It was also conceived to support unparalleled pre- and post-disaster management and flood surveillance.

GEO-Pictures promises to be of high value for supporting large humanitarian disaster management, from tsunamis and earthquakes to refugee influxes and political conflicts. It will assist in civil protection, environmental emergency prevention and rapid rescue response, both inside and outside the EU.

The project was coordinated by AnsuR Technologies AS in Norway.

1 'GMES and Earth observation with position-based image and sensor communications technology for universal rescue, emergency and surveillance management'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'. http://cordis.europa.eu/marketplace > search > offers > 9984

Police patrolling social media

From the city's mean streets to Facebook, the police are responding to ever-changing developments, making sure that people are kept safe and criminals apprehended. A new report discusses in detail how social media can be used to support police work — from compiling criminal profiles based on their 'Likes', to communicating with the general public.



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The report, entitled 'Best Practice in Police Social Media Adaptation', is an outcome of the Composite[1] project which is funded with more than EUR 6.6 million under the 'Security' research theme of the EU's Seventh Framework Programme (FP7). It is based on in-depth analyses, interviews and group discussions with information technology (IT) experts and officers representing the police forces of 13 European countries.

The report reveals that, used in the right way, social media can help improve trust and understanding between citizens in an area and their police. This is Composite's second report on technology adaptation and it effectively brings together the experiences of the pioneers and early adopters of social media among the European police forces. One example from the United Kingdom reveals that many police stations actively use social media as a regular part of their normal business. Police officers act as their own press office and use social media to keep the people in their constabulary informed about their activities, and publish warnings or search warrants.

Project coordinator, Dr Sebastian Denef, from the Fraunhofer Institute for Applied Information Technology (FIT) explains that moving into cyberspace and using these social media platforms is in part inevitable, and that positive outcomes can be achieved if properly embraced.

'Police work in general and specific incidents are discussed in the social media anyway. Therefore, the question is not whether the social media are appropriate for police

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topics, but how the police forces get involved and reap the benefits. If the police are not active, others fill the void,' observes Dr Denef. One example is an unofficial Facebook page offering news on the Berlin police, with more than 15 000 fans. And in the Dutch region of Haaglanden, a Twitter channel of a self-appointed police fan has some 2500 followers. The lack of a trustworthy police presence in the social media can thus provide a fertile ground for rumours, speculations and misunderstandings.

Another outcome of the report in favour of social media reveals that traditional communication platforms, such as newspapers, TV and radio, are not effective channels for communicating with the younger sections of the population — groups that are very important for many aspects of police work. Social media has also proved to be very useful in exceptional situations like a terrorist attack or a disaster. In a major crisis, social media are a proven means of communication to keep people informed independent of the police IT infrastructure.

In spite of the potential benefits, important questions still remain to be answered; for Germany there are legal issues, while in other countries, such as Great Britain or the Netherlands, the legal hurdles appear to be lower. A major legal and procedural issue for the police forces is co-operation with service providers like Facebook or Twitter, private companies that are based abroad, under foreign jurisdiction. Here, the police forces will have to collect and evaluate additional experience. However, these efforts are seen as worthwhile compared to the potential benefits of social media use by the police.

The project was coordinated by the Erasmus University of Rotterdam in the Netherlands.

1 'Comparative police studies in the EU'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Security'. http://cordis.europa.eu/news > search > 35325

Keep it simple: bring software complexity under control

'Fools ignore complexity. Pragmatists suffer it. Some can avoid it. Geniuses remove it.' The words of pioneering computer scientist Alan Perlis who would probably be shaking his head in dismay at the complexity of modern software systems. Although they may not describe themselves as geniuses, a team of EU-funded researchers are bringing complexity under control, deploying an alternative approach to software engineering to build systems that are safer, cheaper and more robust.

Software has not only become more complex, but it has also become more pervasive: it is in your car, in the electricity meter and power station, in planes, trains, banks and hospitals. It runs critical systems where a single error can have disastrous consequences. And the increased risk of failures due to increasing software complexity is not the only problem. Complexity also raises costs: testing software for bugs currently accounts for around half of pre-release spending and as much as 70% of post-release expenses.

At the heart of the problem is the fact that traditional software engineering processes are ill-designed to handle the enormous complexity and diversity of modern software systems.

'Look at a modern car, for example, there are hundreds of software elements that come together, from controlling sound quality to cruise control. As more and more elements and more functionality are packed into systems, engineers say they are losing control of complexity and worry they won't be able to provide the quality assurances required,' explains Alexander Romanovsky, a professor of computer science at Newcastle University in the United Kingdom. 'And this complexity is everywhere and in everything: companies that make cars, trains, planes, etc. actually dedicate a lot of their time and resources — perhaps as much as half — to developing software: ultimately all industry is producing software.'



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The question is, can industry find a better way to make software, particularly for critical systems? Researchers involved in the Deploy[1] project, supported by EUR 12.4 million in funding from the European Commission and coordinated by Prof. Romanovsky, believe they can. Their approach follows formal engineering methods which, thanks in no small measure to the team's efforts, are now starting to gain acceptance among companies and engineers as a more efficient, practical way to develop complex software systems. Deploy processes have already been used to develop safety critical software for metro lines and airport shuttle trains.

Unlike traditional software engineering approaches, formal methods are grounded in mathematical modelling and analysis, supporting reasoning at multiple levels of abstraction to enable

a systematic engineering flow from requirements specification, through architecture modelling and detail design to implementation, testing and deployment. For the project, the team continued the evolution of 'Event-B', a formal method for system-level modelling and analysis first developed in the EU-funded Rodin[2] project, and supported by 'Rodin tools', an integrated development environment.

Encouraging engineers to think differently

'For engineers, it's quite a fundamental change. Typically, when they embark on a project, they are accustomed to starting to develop the software, adding to it, expanding it, and then doing a lot of the hard work — implementation, verification, testing — at the end. Formal engineering reverses that: the hard work is at the beginning, starting with an abstract of the system requirements and following a rigorous, logical and mathematical development process,' Prof. Romanovsky explains.

The advantage is that errors are caught early in the development and the rigorous, logical approach means that complexity is kept within predefined limits, all of which reduces the need for testing at the final stages. That ultimately leads to more robust and dependable systems, potentially at noticeably lower costs than using traditional engineering methods.

It sounds like a win-win situation, but there is a key challenge: engineers are typically not mathematicians. The Deploy project, probably the largest deployment of formal software engineering at the industrial level ever carried out, has gone a long way to overcoming those hurdles.

Working with project partner SAP, for example, the team implemented formal processes transparently so that engineers could continue using domain-specific programming languages to develop business-critical software, which were then automatically translated into Event-B, backed up by formal engineering specialists.

With Siemens, where engineers already had considerable experience with formal modelling, Event-B has been used to develop software that is currently in use in the Barcelona and Paris metro systems and elsewhere for train control and signalling systems. With Bosch, the approach was used to develop cruise control and start-stop systems for cars. And with Space Systems Finland, another project partner, the process has been employed for components of the European Space Agency's BepiColombo space probe and for altitude and orbit control systems.

French partner Systerel, meanwhile, is using Event-B for a range of railway and aerospace systems. The Deploy researchers have set up two spin-off companies — Rodin Tools and Formal Mind — to commercialise the tools and extend deployment. They have also embarked on a follow-up project with EU funding called Advance[3].

The successful deployment and continued use of formal engineering methods in the companies involved offers a clear example of strategies for other firms to follow as they seek new ways to deal with complexity.

'We're definitely giving industry food for thought about current engineering methods and the advantages in certain circumstances of switching to a formal approach,' Prof. Romanovsky notes.

The tools, extensive Event-B documentation and support offered by the Deploy partners are also likely to help convince engineers to embark on formal engineering projects.

'In the long run, software systems are only going to keep getting more complex — formal engineering, as we have shown, is one way to address that problem,' Prof. Romanovsky concludes.

The project was coordinated by University of Newcastle upon Tyne in the United Kingdom.

1 'Industrial deployment of advanced system engineering methods for high productivity and dependability'.
2 'Rigorous open development environment for complex systems'.
3 'Advanced design and verification environment for cyber-physical system engineering'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Information and communication technologies' (ICT). http://cordis.europa.eu/marketplace > search > offers > 10012

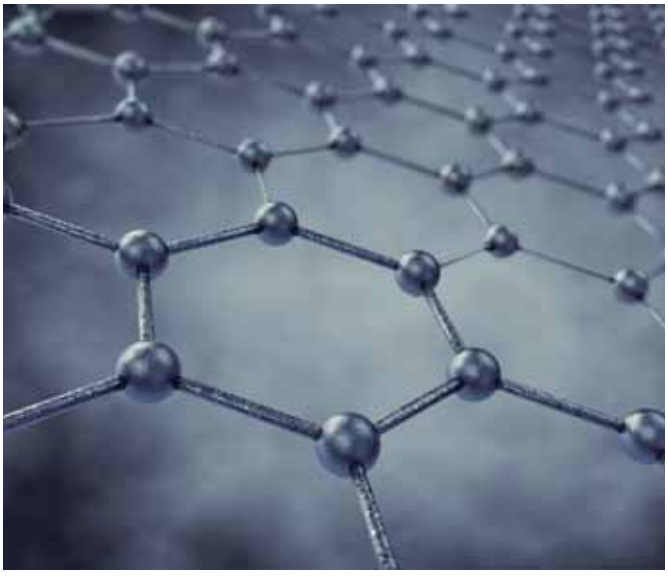
Novel carbon structures for telecommunications

European researchers are using one of the most exciting new substances of the 21st century to make innovative components for mobile telecommunications devices.

Resonators are devices that oscillate at certain frequencies called resonant frequencies. Transmission, filtering and sensing of all kinds of signals often rely on resonators. Guitar strings and tuning forks are common mechanical resonators that transmit sound signals based on frequencies of vibration.

The timing devices in electronic systems often use 'Microelectromechanical system' (MEMS) resonators to manage the timing of data transfer. MEMS resonators are finding increased use in radio-frequency (RF) applications including wireless communications. Using EU funding for the Rodin[1] project, a European consortium is developing beyond-state-of-the-art technology to fabricate a tuneable graphene resonator for RF applications.

Graphene is a form of carbon consisting of a single layer of carbon atoms, one-atom thick and arranged in a honeycomb lattice. Since its discovery in 2004 — which later led to the Nobel Prize in physics — it has become central to the field of nanotechnology due to its unique strength, flexibility and electrical properties.



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Rodin is pushing the frontiers of graphene research by developing technology to produce suspended single- and few-layer graphene nanostructures and sculpt them into desired shapes exploiting

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their intrinsic mechanical and electromechanical properties.

Manufacturing suspended structures, in which the material does not rest on a substrate, requires the development of nanofabrication technology beyond current state of the art. The Rodin consortium has already established and demonstrated the success of fabrication methods leading to production of functioning graphene resonator devices.

Project scientists have also made significant progress in developing alternative fabrication methods for large-scale production, and developing models for design and evaluation of graphene resonators.

Current RF filters are bulky and expensive with limited tuneability. Continued research leading to the successful demonstration of a tuneable RF filter based on Controlled Vapour Deposition (CVD) graphene will have major impact on radio front-ends in mobile telecommunication terminals.

Rodin technology is expected to change the entire paradigm of present radio electronics with a significant enhancement in performance and flexibility at a lower cost.

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

1 'Suspended graphene nanostructures'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP).
http://cordis.europa.eu/marketplace > search > offers > 9829

Looking through the opaque screen for sharper images

Taking images through opaque, light-scattering layers is a vital capability and essential diagnostic tool in many disciplines, including nanotechnology and the biosciences. A joint research team has succeeded in this exercise.

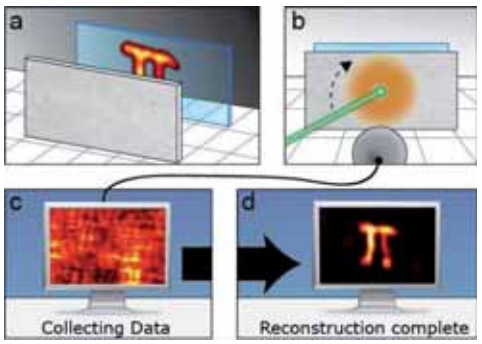
Skin and other materials such as paper and ground glass appear opaque because they scatter light. Many may remember the image of light bending when it strikes a prism. When light strikes these opaque materials it ceases to move in a straight line, and instead travels along an unpredictable and erratic path. The result of this is that it becomes impossible to get a clear view of objects lying behind such materials. Powerful methods have been developed to retrieve images through materials in which a small fraction of the light follows a straight path. To date, however, it has not been possible to resolve an image from light that has been completely scattered.

Against this background, a joint research team from Italy and the Netherlands have succeeded in taking non-invasive sharp pictures of objects hidden behind a screen of opaqueness. The study, published in the journal *Nature*, was supported by a European Research Council (ERC) Starting Grant awarded to Dr Allard Mosk at Universiteit Twente in the Netherlands, as part of the Pharos[1] project under the Seventh Framework Programme (FP7).

In the researchers' report they acknowledge the great progress which has been made in recent years with methods such as ghost imaging and wave-front shaping. However, they note that present procedures are still invasive because they require either a detector or a non-linear material to be placed behind the scattering layer. Their report describes their breakthrough: namely an optical method that allows non-invasive imaging of a fluorescent object that is completely hidden behind an opaque scattering layer.

The researchers, led by Dr Allard Mosk, scanned the angle of a laser beam that illuminated an opaque diffuser. At the same time, a computer recorded the amount of fluorescent light that was returned by a tiny object hidden behind the diffuser. According to Dr Mosk: 'While the measured intensity of the light cannot be used to form an image of the object directly, the information needed to do so is in there, but in a scrambled form.

'The two young scientists who are the first authors of this paper had the brilliant idea to find out whether that scrambled information is sufficient to reconstruct the image — and they found a way to do so,' he adds. Their method involves a computer program that initially guesses the missing information, and then tests and refines the guess. They succeeded in making an image of a hidden fluorescent object, such as a typical cell, which can be merely 50 micrometres (µm) across.



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The researchers realise that their breakthrough is just the beginning and expect their work to lead to new microscopy methods capable of forming razor-sharp images in a strongly scattering environment. Dr Mosk notes: 'This will be very useful in nanotechnology. We would like to bring structures to light that are hidden inside complex environments, like computer chips.' The researchers also dream of extending their method to examine objects under the human skin. 'But for the moment,' acknowledges Dr Mosk, 'our method is too slow for that.'

The project was coordinated by the University of Twente (CNRS) in the Netherlands.

1 'Guiding light through disorder in adaptive photonic resonator arrays'.

Funded under the FP7 specific programme 'Ideas' (European Research Council).
http://cordis.europa.eu/news > search > 35321

The life-saving real-world results of 'Intelligent Vehicle Systems'

Smart automotive technologies that help drivers avoid collisions, navigate and improve fuel efficiency should make Europe's roads safer, ease congestion and reduce pollution. But just how beneficial are they? Potentially very, according to vehicle manufacturers, researchers, automotive suppliers and other stakeholders who answered that question in a landmark EU-funded project.

More than 30 000 people die in traffic accidents every year in Europe — an average of 85 people every day — and more than a million are injured. Research shows human error is a factor in 90 % of accidents.

EU-wide, the road death toll has declined significantly in recent years thanks to a combination of increasing driver awareness, tougher laws and technological developments — from air bags to electronic stability control systems — that have made drivers and passengers safer. Now a range of new smart technologies are starting to be fitted into cars which, if used widely, could reduce the number of accidents even further and, in the process, save on fuel, cut emissions and reduce traffic jams.

That is the overall conclusion of the team behind the Eurofot[1] project, which carried out the first-ever Europe-wide field operational test to assess the benefits of Intelligent Vehicle Systems (IVS) on traffic safety and efficiency.

With the support of almost EUR 14 million in funding from the European Commission, the Eurofot team gathered data from in-vehicle sensors, cameras and driver questionnaires from a thousand cars and trucks that travelled 35 million kilometres (km) on Europe's roads for more than a year.

Eight IVS technologies were tested, including Adaptive Cruise Control (ACC), which uses radar to maintain a pre-set distance from the vehicle in front, and collision warning systems that alert drivers to potential front-end collisions. Curve-speed warning systems, blind-spot detectors, fuel-efficiency monitors and navigation systems were also tested.

'When a new technology is developed it is usually tested individually, but a field operational trial using real drivers in real vehicles in real traffic conditions allows us to assess how these systems perform in the real world and how ordinary drivers interact with them,' explains Aria Etemad, a senior research coordinator at Ford Research & Advanced Engineering Europe in Germany.

Fewer accidents, less congestion, better fuel efficiency

The team found, for example, that cars equipped with both ACC and Forward-Collision Warning (FCW) systems could have a positive impact of up to 5.7 % on the number of accidents on motorways which result in injury or death.

Fewer accidents, in turn, the Eurofot researchers calculated, should lead to less motorway congestion, reducing the total amount of time drivers spend sitting in traffic jams across the EU by more than 3 million hours. And, it turns out, the use of ACC and FCW systems result in more efficient driving, reducing fuel consumption by an average of 3 % — as much as 7 % in some vehicles — without taking into account the positive impact on road congestion.

'The data shows that there are widespread social and economic benefits from IVS technologies, in addition to avoiding potential accidents,' Mr Etemad, the Eurofot coordinator, says. 'We also noted that the use of these systems has a positive impact on drivers' experiences: they felt safer, more supported and more comfortable.'

Surveys of drivers, conducted before, during and after they took part in the trials, showed that more than 70 % believed systems such as ACC, FCW and other tested technologies such as speed-regulation systems, curve-speed warning and blind-spot detectors helped reduce critical situations and made them safer. Navigation systems, the researchers found, also had a positive impact on driver behaviour, reducing sudden lane changes and harsh braking, for example.

'There is a lot of interesting information that can be gleaned from this research, and there is a lot of data that still needs to be analysed. In total, we generated more than 100 terabytes (TB) of data and will soon make more than 1500 pages of our reports publicly available,' the coordinator says.

Raising awareness of the benefits of IVS

On the one hand, the 28 Eurofot partners want to increase awareness about the benefits of IVS technologies. Mr Etemad notes, for example, that many drivers who participated in the project had little idea about what different systems do before they began the trials.

On the other hand, automotive and research partners plan to use the data to further improve IVS systems in terms of both functionality and performance and human-machine interaction. They have already proposed a follow-up project to carry out a more in-depth analysis of the data.

In the future, Mr Etemad envisions integrated IVS >



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being developed, incorporating multiple technologies that can more easily and widely be fitted to vehicles than current stand-alone systems. In addition, further analysis of the data could also lead to entirely new systems, for example, as developers gain a clearer idea of the kind of support drivers need to improve their safety, comfort and driving habits.

Meanwhile, other stakeholders also plan to make use of the research. Project partner Allianz Insurance, for example, is considering using the results of the Eurofot study for its insurance products.

'Allianz Insurance is now in a better position to create new insurance products which take into account the accident- and claim-reduction potential of driver-assistance systems,' says Johann Gwehenberger, head of Accident Research, AZT Automotive, Allianz Centre for Technology, Germany. 'We aim to extend loss-prevention activities, for instance, by motivating drivers and fleet owners to buy and use promising driver-assistance systems.'

In the long run, Mr Etemad believes that increasing awareness of the benefits of IVS will lead to increasing demand. Ultimately, that will lead to more widespread deployment, safer roads, fewer accidents and a range of other social and economic benefits — fulfilling key goals of the EU's 2011-2020 Road-Safety Action Plan that aims to halve the number of road deaths within a decade.

The project was coordinated by Ford Forschungszentrum Aachen in Germany.

1 'European field-operational test on active-safety functions in vehicles'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Information and communication technologies' (ICT).
http://cordis.europa.eu/marketplace > search > offers > 9966

Traffic management goes wireless

Although wireless technology to enhance traffic management exists in limited forms, there is a need for a platform that consolidates disparate data sources and transmits them effectively to relevant authorities.

Managing traffic has become easier with the advent of the Global Positioning System (GPS) and Global System for Mobile Communications (GSM) technologies, used for example by bus companies to assess punctuality and service quality. But full data sharing with traffic control operators has not happened yet due to incompatible standards and lack of formal agreements among stakeholders.

The EU-funded Viajeo[1] project designed a system that connects different data sources to facilitate real-time traffic management, improve transport planning and enable travel information services. The project worked on implementing the system in different locations worldwide, particularly for Athens in Greece and Sao Paulo in Brazil, as well as for Beijing and Shanghai in China. In a bid to minimise duplication of information and improve information availability, it aimed to facilitate data for transport operators, research institutes and information service providers.

The project team successfully outlined the system's requirements and specifications, designing a powerful open platform that interfaces with a wide range of mobility services. It negotiated agreements with the necessary data owners and secured access to key data sources in order to ensure integration of all the data required.

In Athens, the system has begun collecting real-time traffic information for transport authorities, improving taxi management, facilitating multi-modal trip planning, promoting route navigation and extending real-time traffic services. In Sao Paulo, the platform was installed to read data from 100 vehicles in order to estimate real-time traffic conditions, enhance safety standards, avoid congestion and assist travellers online.

As for Beijing, the system has been encouraging the use of public transport, facilitating passenger information, collecting travel data, forecasting travel times and even highlighting safe cycling routes. Shanghai saw the system forecast bus arrival times and display them at bus stops, in addition to merging environmental data with traffic information to assess environmental impacts of road transport.

If these pilot cases catch on and stakeholders adopt the system wholeheartedly, it may become standard technology in large cities, improving traffic control and commuter comfort significantly.

The project was coordinated by the European Road Transport Telematics Implementation Coordination Organisation (Ertico) in Belgium.



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1 'International demonstrations of platform for transport planning and travel information'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Transport (including aeronautics)'.
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Planning for a sustainable plastic future

Sustainability in the plastics sector will become a more pressing issue in future as legislation and public demand force companies to manufacture more environmentally friendly products. A European project has been developing alternative materials, production processes and even products like a composite bus seat which could, in time, replace oil-based plastic versions.

While oil-based plastic products have improved over the last 30 years, the nature of the raw material used in production means that the issue of sustainability has yet to be satisfactorily addressed.

The SustainComp[1] project, financed by the EU's FP7 funding instrument, set out to develop a series of completely new wood-based composite materials — made up of several parts or elements — which could be used to create durable, inexpensive yet sustainable plastic products.

'If you're replacing something, you need to meet the demands of what you're replacing and that's what we have been trying to do,' says project coordinator Mikael Ankerfors. 'Oil-based products are good, but in time there will be more pressure to create sustainable materials which can do the same jobs — our composite wood fibres, bioplastics, and nanocellulose have shown real potential in this area.'

By combining materials derived from natural sources, SustainComp has successfully addressed the sustainability question. Bioplastics and wood fibres are derived from renewable biomass while nanocellulose is simply wood fibre that has been carefully crushed into pieces, and then reformed into neatly woven nanoscale crystals and fibres. These can then be formed into a thick paste and shaped into any desired shape.

From composite bus seats to nanofoams

One such form is the composite bus seat that SustainComp considers to be one of its main successes. 'A wood-fibre biopolymer nanocellulose compound was created and rolled into a sheet on a traditional paper press which was then moulded into the frame of the bus seat,' Mr Ankerfors explains. 'The result is a cheaper, lighter, more environmentally friendly product with all the mechanical properties of the oil-based version.'

The bus seat, produced by SustainComp partner Elatopoli Oy, is also a symbol of the cross-sector co-operation that SustainComp is promoting. 'Our ambition is to bring the traditional forestry industry closer to sectors such as the automotive and electrical industries which use a lot of plastic,' Mr Ankerfors says. With the European forestry sector under pressure due to its use of resources and the rising cost of its products, new market sectors are increasingly attractive, he adds: 'If we can show that natural products can be used in traditionally plastic-dominated sectors, then both sides can benefit.'

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With legislation and public opinion likely to demand more sustainable products in future, car manufacturers and the consumer goods industry will look towards using more composite materials in their production processes. As existing machinery can be used to create composites with little adaptation, the costs associated with change would be minimal.

Others will also benefit. 'Most plastics-part manufacturers are small and medium-sized businesses (SMEs),' continues Mr Ankerfors. 'Including these in the chain will help them grow. Europe has identified SMEs as an area for increased growth and jobs and it is our hope that we can help to build a new sector in the plastics industry in which they can prosper.

With SustainComp also developing products such as nano-reinforced foams designed to replace styrofoams in the packaging and construction sector and nanostructured membranes with the potential for small-scale liquid applications in the medical field, there is significant potential for widespread composite material use in many industrial sectors in the future.

The project was coordinated by Innventia AB in Sweden.

1 'Development of sustainable composite materials'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP). http://ec.europa.eu/research/infocentre > search > news > 28793

Cosmetics and agrochemicals from natural sources

The European project Agrocos[1] is sifting through nature's molecules to derive a collection of promising substances for development. Extracts from plant collections are being subjected to rigorous testing for chemical candidates for the cosmetics and agricultural chemical industries.

Around 1800 species from plant collections — collected at centres of high biodiversity in Africa, Asia-Pacific, Europe and Latin America — are the focus of investigation by the Agrocos project, looking for potential products for commercial development. It is assumed that the extensive diversity of plant materials will provide 'chemo-diverse' molecules.

A total of 2700 extracts were produced, formatted into two-dimensional (2D) 'barcodes' and forwarded for biological evaluation. The nanomolecules will be able to tackle agricultural problems like pathogenic fungi, weeds and insects. In the cosmetics world, the substances will help protect against ultraviolet (UV) rays, delay ageing and prevent hyper-pigmentation, commonly known as age spots.

Agrocos scientists selected and purified 500 molecules from existing plant collections based on their potential to fulfil one or more of these uses. The project team not only developed suitable extraction procedures but defined protocols for the initial collection procedures.

The first results have yielded the most promising extracts for micro-fractionation, which enables the separate analysis of molecular components in the chemical mixture. At the same time, project researchers are progressing with phytochemical profiling as well as a newly designed spectral database to house these results.



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Currently, Agrocos is working on specific software development for integration of the analysis results. A total of 11 compounds and 270 extracts have been recorded in the spectral and meta-databases.

The press, websites and scientific conferences have publicised the first promising results. Bioprospecting at Agrocos look set to make available commercially viable products for the agricultural and cosmetics industries.

The project was coordinated by the National and Kapodistrian University of Athens in Greece.

1 'From biodiversity to chemodiversity: novel plant-produced compounds with agrochemical and cosmetic interest'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology' (KBBE). http://cordis.europa.eu/marketplace > search > offers > 10069

Nanotech clusters benefit EU economy

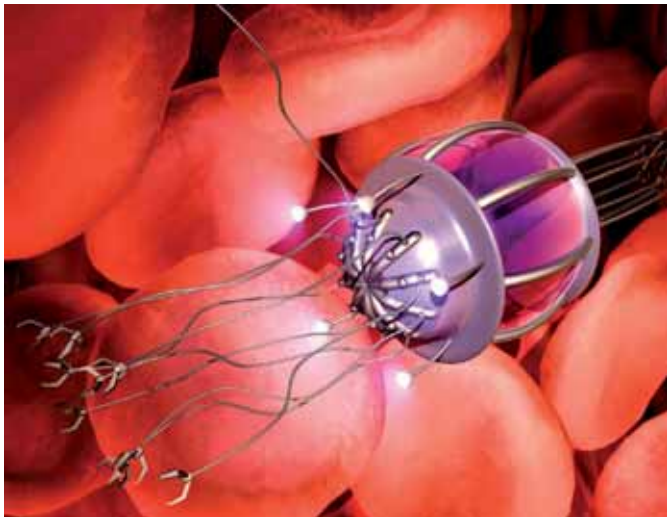
Efforts to establish a master plan that creates and strengthens synergistic clusters in the nanotechnology sector are already starting to bear fruit.

If the EU wants to excel in the promising new nanotechnology sector, it needs top-notch resources in human capital, sophisticated equipment and robust business networks. The EU-funded project KEEN-Regions[1] worked towards creating powerful research-driven nanotechnology clusters that involve industry and government as well. It designed a Joint Action Plan (JAP) that involves all stakeholders to achieve this aim and eventually link with other EU clusters.

The project team mapped available data and built relationships to improve mutual learning on a global scale. It then reinforced links with regional authorities, local businesses and research institutes by highlighting best practices and fostering cooperation initiatives. Next, KEEN-Regions developed a JAP at European level by conducting a technical feasibility assessment and defining the plan's economic sustainability.

The action plan was designed to mobilise financial sources available at local and European levels, both public and private, ensuring continuity of initiatives and agreements after the project's end. It investigated research resources, policy frameworks and business needs to advance the nanotechnology sector significantly.

After several project meetings in 2009 and 2010 held in Spain, France and Italy, the project team published useful reports that can help in furthering the vision of powerful nanotechnology clusters. It also established an online platform for collaboration, including a database of research resources.



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These efforts were supported by exchange visits, matchmaking events and a SWOT analysis that highlighted the aims of the project. They led to the identification of best practices that covered cluster management, use of funding, start-up assistance and other key topics. Another important project achievement involved defining local and regional strategies to improve a cluster's performance and its co-operation initiatives.

In essence, the project has helped build a formidable European network and platform to share knowledge on nanotechnology and optimise the use of available resources. This will guide policy-makers to improve the sector and enhance research excellence, as well as maintain EU competitiveness via bridges between education, research and innovation. As EU companies benefit from access to research infrastructure and cutting-edge technology, the nanotechnology sector across the EU is expected to flourish.

The project was coordinated by Veneto Innovazione SPA in Italy.

1 'Knowledge and excellence in European nanotechnology — regions'.

Funded under the FP7 specific programme 'Capacities' under the research theme: 'Regions of knowledge'. http://cordis.europa.eu/marketplace > search > offers > 9937

Automated production for individual textile features

A new software tool for European textile manufacturers will enable them to input textile properties important to production processes. Resulting automatic set-up of production machines will save valuable time and money.

Computer-Aided Design (CAD) is a term familiar to most and basically self-explanatory. CAD is widely used in industry, particularly in the field of engineering.

Perhaps what is not evident in the name is that CAD files are now used by other programmes to automatically set up the machines that will produce the component or product. The most advanced of these now incorporate important parameters in addition to geometry, such as material strength and stiffness.

Such software has not yet been made available to textile designers. Most existing systems stop at visual presentation — colours and patterns — leaving machine set-up for different materials largely a trial-and-error process.

The conventional procedure is thus extremely time-consuming and expensive both in terms of materials and personnel. It is also quite difficult to achieve a customer's exact specifications.

The purpose of the EU-funded Modsimtex[1] project is to develop a virtual simulation system encompassing physical and mechanical properties of textiles for fast set-up of machines throughout the manufacturing chain. The tool will be particularly important in the development of new textiles and production of small lots.

Given the objective of independence of specific hardware and software configurations and ease of use, the team decided to use a webpage interface.

Together with a database manager that supports a standard database protocol (Structured Query Language (SQL)), the system will truly be portable to different operating systems and easy to use with any other database manager compatible with SQL.



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Complementing the above with a programming language compatible with any web-server side language, users will easily be able to make their own modifications if necessary.

To date, analytical modules have been developed to simulate basic textile structure and their mathematical methods are currently being optimised. Industry partners, machinery and software providers support the ease of use and innovativeness of the Modsimtex textile design tool.

Implementation could decrease new product development costs by up to 30%, greatly enhancing the competitiveness of the European textile market at a time when much work is being lost to countries employing less-expensive labour.

The project was coordinated by the Polytechnic University of Catalonia in Spain.

1 'Development of a rapid configuration system for textile production machinery based on the physical-behaviour simulation of precision textile structures'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP). http://cordis.europa.eu/marketplace > search > offers > 9897

INDUSTRIAL TECHNOLOGIES

Improved parts for trains and planes

Scientists are developing exceptionally strong, lightweight and cost-effective materials and processing methods for the transport industry. Commercialisation promises to improve trains and planes with reduced effects on the environment.

With the transportation industry turning to lighter-weight and stronger materials for component parts, Carbon Fibre-Reinforced Polymers (CFRPs) have become a widely used alternative to metals.

Polymers, including plastics, are long-chain molecules made up of repeating units (monomers) that typically have low weights compared to their sizes. When reinforced with a stronger material such as carbon fibres they provide low weight and high strength, particularly attractive to the aerospace and train industries.

Conventional carbon fibres are 5-10 micrometres (μm) in diameter and made of carbon atoms in a crystal lattice. They have been successfully produced for commercial use, particularly in the aircraft industry, since the 1960s. In addition to high strength and rigidity, carbon provides them with electrical and thermal conductivity.



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The playing field is changing with the discovery of carbon nanotubes (CNTs). As their name suggests, CNTs are tube-shaped materials made of carbon with diameters in the range of nanometres or billionths of a metre. They are the ultimate carbon fibres with their unique combination of strength, stiffness, and thermal and electrical conductivity.

European scientists working on the EU-funded IMS&CPS[1] project are developing novel CNT-based CFRPs with improved mechanical properties and maximal cost effectiveness for the transport industry.

Over the first reporting period, scientists manufactured a pure CNT fibre fabric, probably the first of its kind, and are now developing pure CNT yarn. Numerical models developed by the consortium are enabling positioning of CNTs within polymers for advanced and optimised properties.

Closed mould-manufacturing technology for producing CFRP components has been optimised and the global manufacturing set-up is nearly finished. Demonstrators for airline and railway applications have also been designed and will be manufactured in the returning phase of the project.

IMS&CPS technology is expected to reduce cost, weight and fuel consumption of associated transport modes as well as energy consumption during manufacturing due to fewer parts being produced separately.

Obvious benefits to the airline and railway sectors abound with cost savings potentially passed on to consumers. Decreasing environmental impact is of particular importance and well in line with the EU's policy on reduced emissions.

The project is coordinated by Coexpair SA in Belgium.

1 'Innovative material synergies and composite processing strategies'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP).
http://cordis.europa.eu/marketplace > search > offers > 9841

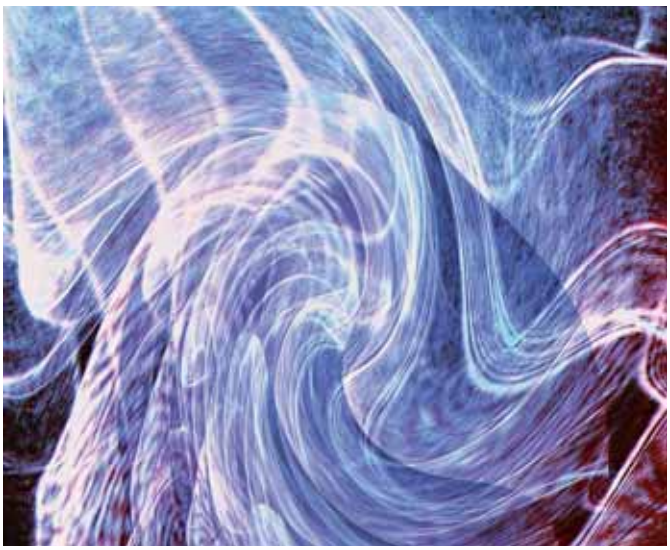
Novel carbon nanocomposites for polymer fillers

Scientists are developing novel materials and processes based on carbon structures to act as fillers in other materials. Enhanced properties should open the way to high-performance products in a variety of fields.

Nanomaterials are those with at least one dimension on the scale of nanometres which corresponds to the size of atoms and molecules. Among these are nanoparticles, nanotubes, nanorods and nanowires.

As scientists and engineers have known for some time, such materials exhibit very interesting properties due in part to their very large surface areas compared to their volumes. While spherical nanoparticles have been of interest for decades, elongated shapes with high aspect ratio (length of the long axis divided by the width of the short one) are currently of great interest.

European scientists are studying carbon-based High Aspect Ratio



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Nanoparticles (HARNs) including carbon nanotubes (CNTs) and carbon nanosheets (CNSs).

With EU funding for the Harcana[1] project, they are studying ways to use HARNs as nanofillers in bulk polymers, polymeric foams and thin-film polymers (membranes). The goal is to control clumping of the HARNs, reorganise them in novel ways and significantly enhance the properties of the aforementioned materials.

Scientists are employing a variety of techniques to control materials organisation, including synthetic approaches and melting or solution-blending approaches. To date, work has concentrated on CNT-based nanocomposites.

Scientists have investigated several strategies for attaching or adsorbing polymers on to CNTs and conducted modelling work regarding the CNT-polymer interface.

They are also continuing studies of the mechanical and electrical properties of bulk polymers, foams and films with a focus on applications to separation membranes, lightweight bulk materials and packaging foam.

Promising results have been achieved for the reinforcement of ultrafiltration membranes that could have an impact on water filtration. A candidate bulk material will be upscaled in the next reporting period. In addition, biocompatibility studies indicate that some nanocomposites may be promising for development of tissue scaffolds for neural cell growth.

Project completion is expected to deliver novel carbon-based HARN nanofillers and dispersion processes for controlling their geometries in polymer matrices. Resulting products with improved performance in a variety of fields should enhance the EU's position in emerging markets.

The project is coordinated by the Centre for Materials and Coastal Research in Germany.

1 'High aspect-ratio carbon-based nanocomposites'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP). http://cordis.europa.eu/marketplace > search > offers > 9963

Machine tools 'chilling out' for longer life

Manufacturing process control facilitates reductions in cost thanks to increases in precision and tool lifetime. Scientists are developing temperature monitoring and control technology to complement existing force, vibration and noise control.

Manufacturers are under great pressure to reduce the cost and time-to-market of their products while enhancing their quality. Most efforts have been focused on process-monitoring systems that provide feedback on forces, vibration and acoustic emissions.

Temperature and heating of tools, particularly for processes requiring elevated temperatures, have been overlooked yet play an important role in part accuracy, tool performance and tool lifetime.

The EU-funded Contemp[1] project was initiated to fill this gap in process control by developing a self-learning temperature-monitoring system combined with a self-cooling tool.

The Contemp system will react to changing process conditions and maintain a constant temperature gradient from hot tool tip to the cooling channels in the cutting tool. The closed coolant circuit will avoid both contamination of coolant as well as release of coolant into the environment.

Such a system will eliminate the need for cooling lubricant, which imposes high costs and environmental and health risks associated with usage and disposal.

To date, the project team have carried out experiments to collect process data required for designing the internally cooled tool. Simulations and bench-top tests complemented this work.



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Investigators developed the control system structure and algorithm based on an artificial neural network with self-learning capacity. Preliminary tests gave excellent results when comparing predicted and measured temperatures. The first tool prototypes have been manufactured and are now being tested for optimisation.

Contemp plans to fill a gap in manufacturing process control by providing a temperature-monitoring system in a uniquely cooled tool. The self-cooling technology should lead to substantial reductions in cost and environmental impact by eliminating the need for cooling lubricants.

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

1 'Self-learning control of tool temperature in cutting processes'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP). http://cordis.europa.eu/marketplace > search > offers > 9904

SPACE



© Prof. F.R. Ferraro

How to look young when you are not — stars reveal the secret of ageing well

Some people are in great shape at the age of 90, while others feel unfit before they are 50. How fast people age is not always linked to how old they actually are — and has a lot to do with their lifestyle. A new study led by Professor Francesco Ferraro, Advanced Grantee of the European Research Council (ERC), reveals that the same is true of star clusters. This ground-breaking discovery was made using the NASA/ESA Hubble Space Telescope and was featured in the renowned scientific journal Nature.

Globular clusters are spherical collections of stars, tightly bound to each other by their mutual gravity. Relics of the early years of the Universe, with ages of typically 12-13 billion years (the Big Bang took place 13.7 billion years ago), the approximately 150 globular clusters in the Milky Way contain many of our galaxy's oldest stars.

But while the stars are old and the clusters formed in the distant past, astronomers in the Cosmic-Lab[1] project have used the NASA/ESA Hubble Space Telescope and a set of ground-based telescopes to reveal that some of these clusters are still young at heart. 'Although these clusters all formed billions of years ago, we wondered whether some might be ageing faster or slower than others,' says ERC grantee Prof. Ferraro. 'By studying the distribution of a type of blue star that exists in the clusters, we found that some clusters had indeed evolved much faster over their lifetimes, and we developed a way to measure the rate of ageing.'

Star clusters form in a short period of time, meaning that all the stars within them tend to be roughly the same age. Because bright, high-mass stars burn up their fuel quite quickly, and globular clusters are very old, there should only be low-mass stars within them. However, it appears that this is not the case: in certain circumstances, stars can be given a new burst of life, receiving extra fuel that bulks them up and substantially brightens them. This can happen if one star pulls matter off a neighbour, when two neighbouring stars merge, or if they collide. These reinvigorated stars are called blue stragglers, because of their blue colour and the fact that their evolution lags behind that of their neighbours. These specific stars, with their high mass and brightness, lie at the heart of this study.

Heavier stars sink towards the centre of a cluster as it ages, in a process similar to sedimentation. Blue stragglers' high masses mean they are strongly affected by this process, while their brightness makes them relatively easy to observe.

To better understand cluster ageing, the team mapped the location of blue straggler stars in 21 globular clusters. They found that a few clusters appeared young, with blue straggler stars distributed throughout, while a larger group seemed old, with the blue stragglers clumped in the centre. A third group was in the process of ageing, with the stars closest to the core migrating inwards first, then stars further out progressively sinking towards the centre.

'Since these clusters all formed at roughly the same time, this reveals big differences in the speed of evolution from cluster to cluster,' observes Barbara Lanzoni, a member of Francesco Ferraro's research team. 'In the case of fast-ageing clusters, we think that the sedimentation process can be completed within a few hundred million years, while for the slowest it would take several times the current age of the Universe.'

As a cluster's heaviest stars sink into the centre, it eventually experiences a phenomenon called core collapse, where the centre of the cluster bunches together extremely densely. The processes leading to core collapse are quite well understood, and revolve around the number, density and speed of movement of the stars. However, the rate at which they happen was not known until now. This study provides the first empirical evidence of how quickly different globular clusters age.

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

1 'Star clusters as cosmic laboratories for Astrophysics, Dynamics and Fundamental Physics'.

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

Protecting satellites from space debris

Landfill sites are not the only places overflowing with waste these days. Scientists are developing technology to protect satellites from small particles in space, ensuring missions can be accomplished successfully.

The amount of debris remaining in low Earth orbit (LEO) — from about 80 kilometres (km) to 2000 km above the Earth's surface — is steadily increasing. Simultaneously, so is the number of satellites launched to orbit in this vicinity.

Particles less than 0.1 centimetre (cm) in diameter are already factored into satellite designs, while those larger than 10 cm can be avoided. However, the debris in the mid-range remains a problem as although it is not currently taken into account, it has the potential to cause serious damage.

A European consortium initiated the EU-funded REVUS[1] project to develop solutions to this growing problem, focusing on particles between 0.1 and 50 millimetres (mm) in diameter.

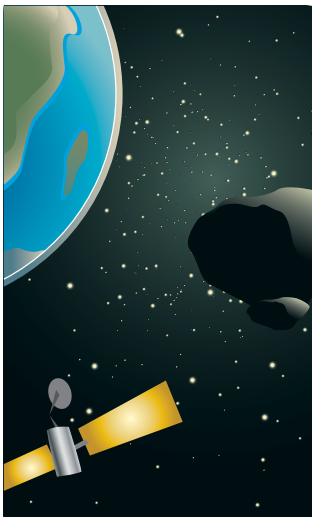
Project work began by evaluating the probability of damage from small debris and the specific satellite components which could be considered most vulnerable. Vulnerability analysis has been completed using a debris environment model (MASTER 2009) and a functional damage assessment tool (SHIELD 3).

Scientists concluded that radar satellites are minimally vulnerable due to low altitude and geometry. Debris particles in the range of 2 to 6 mm in diameter pose the greatest threat.

They have identified potential solutions including systems (active detection and mitigation), and modifications to satellite exterior (shielding) and interior (equipment configuration). These solutions are now being subjected to resilience analysis to generate design rules and recommendations potentially leading to standardisation.

REVUS solutions to protect satellites in LEO from small debris are expected to have an important impact on the aerospace and, in particular, the satellite sectors. Applied, they could save industry a significant amount of money otherwise lost due to equipment damage and mission failure.

By demonstrating long-term reliability and return on investment, REVUS could potentially also make it easier to receive funding for satellite projects in the future.



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The project was coordinated by Astrium S.A.S. in France.

1 'Reducing the vulnerability of space systems'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
http://cordis.europa.eu/marketplace > search > offers > 9838

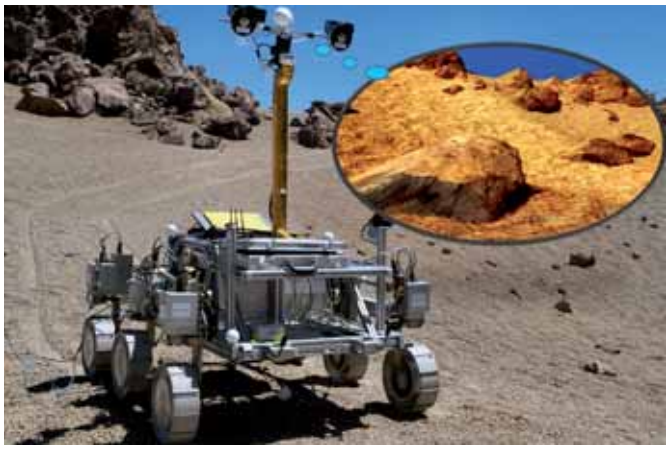
Seeing what robots see on planetary surfaces

A European and United States partnership for robotic space exploration of planetary surfaces has come to fruition. The technology developed should advance the EU's position in advanced robotic vision and data processing for future space missions.

Surface exploration of planets and other bodies using robots is a vital part of any space exploration programme. Robotic surface explorers have come of age, so to speak, since the first Moon exploration missions and the success of the *Mars Explorer*. Future missions are planned or under way for other planets, moons and asteroids.

Currently, the United States is the leader in robotic vision and image processing for planetary space exploration. Technology is quite expensive and equipment is subjected to extreme environments that drastically shorten its service life. A high return on investment in the form of extensive and high-level data collection and processing is critical to

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a mission's success and thus to future funding.

A European consortium together with two partners from the United States built a computer-vision technology framework to ensure high returns.

With EU funding for the Provisg[1] project, scientists established a competitive position for European robotics vision technology for the surfaces of planetary bodies. Research and development focused on vision sensors, three-dimensional (3D) data processing and visual navigation technology.

Such robotic-vision and image-processing technology required careful study and integration of data formats from robotic sensors and existing planetary databases. As a result, specialised sensor suite for panoramic stereo imaging was developed and a range sensor adapted to provide 3D vision. The two performed quite well in field tests.

High-level vision tools produced by project partners were integrated into Provisg's vision-processing chain, Provip. High-level field testing demonstrated the ability of 3D vision to facilitate a detailed 3D reconstruction of surface terrain.

Successful completion of Provisg has provided firm foundations for Europe's planetary robotics vision technology.

The project was coordinated by Joanneum Research in Austria.

1 'Planetary robotics vision ground processing'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
http://cordis.europa.eu/marketplace > search > offers > 10003

Propulsion chips for miniature satellites

Miniature satellites weighing less than 100 kilogrammes (kg) are a less-expensive and easier-to-launch alternative to large spacecraft. EU-funded scientists are developing a 'thruster-on-a-chip' to provide the necessary boost.

The potential for discovery provided by space exploration is a source of excitement to those both within and external to the planetary science community. However, the cost of space exploration missions is very high and limits the research that can be successfully moved from theory to practice.

Complex electronics and scientific equipment, together with their structural housings, impose significant propulsion requirements and expense. In an effort to curb costs, governments are pursuing the use of much smaller satellites that are cheaper and faster to build and launch. Microsatellites weigh in the range of 10-100 kg, and nano-satellites 1-10 kg.

European researchers are making such miniature satellites even more cost effective and flexible by developing a micro-fabricated propulsion system using EU funding for the Microthrust[1] project.

Advanced propulsion will allow significant changes in orbit by miniature satellites that are currently not possible, facilitating exploration missions that have remained on the drawing board.

Colloid thrusters that extract droplets from a liquid and accelerate them away from the spacecraft to provide thrust have been studied since the 1960s. However, low thrust levels were prohibitive and other propulsion systems were pursued. The Microthrust system integrates two important and mature technologies in a new way to provide the propulsion previously lacking.

'Microelectromechanical systems' (MEMS) produced by micromachining technology have reached maturity over the 30 years since their inception. MEMS can incorporate very large arrays of very tiny and densely packed emitters, greatly increasing the efficiency of colloid thrusters.

Microthrust aims to deliver MEMS thruster chips and associated technologies to yield a thruster module whose mass and volume



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is 90 % smaller than those of existing systems.

Reducing costs dramatically will make space exploration possible for universities and small companies in addition to making it easier for governments and large corporations.

Thus, Microthrust technology will have an important impact on the number and types of Solar System exploration missions that can be realised, as well as on levelling the playing field by encouraging new teams to participate.

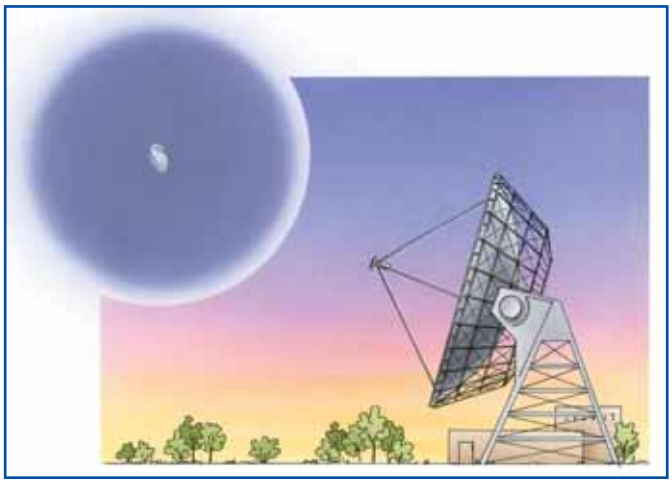
The project is coordinated by the École Polytechnique Fédérale de Lausanne in Switzerland.

1 'MEMS-Based Electric Micropropulsion for Small Spacecraft to Enable Robotic Space Exploration and Space Science'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
http://cordis.europa.eu/marketplace > search > offers > 9681

New material for microwave devices

Scientists are developing a novel material to significantly increase the performance and reliability of space electronics.



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Electronic devices are often defined in terms of their 'bandgap', which is essentially a region of energy between non-conducting and conducting states. This is very large for an insulator and small for a conventional semiconductor such as silicon (Si) or gallium arsenide (GaAs).

'Wide-bandgap' (WBG) materials are defined as those with bandgaps larger than that of Si, such as gallium nitride (GaN). They are commonly used in high-temperature applications as well as in microwave-frequency devices. Microwave technology is essential to most satellites and spacecraft, whether for telecommunications, global navigation or radar systems. Thus, development of space microwave systems is largely linked to developments in semiconductor devices.

European scientists initiated the Al-in-won[1] project to develop a new generation of WBG GaN-based devices for space technologies. The devices will exploit two materials (aluminium gallium nitride (AlGaN) and indium aluminium nitride (InAlN)) to create a new epitaxy (crystalline overlayer) material, InAlN/GaN.

Microwave components, such as 'Metal-oxide semiconductor high-electron-mobility transistors' (MOSHEMTs), using the novel material should provide significant increases in performance and reliability compared to components using conventional materials.

To date, project scientists have already optimised the novel epitaxy material, applied it in tests and manufactured transistor devices. The devices are currently being characterised and circuit designs for 'Monolithic microwave integrated circuits' (MMICs) are under way. Simulations are supporting the manufacturing and testing work. Finally, reliability specifications for operation in space have been defined and a future reliability test planned.

Al-in-won has the potential to deliver a breakthrough in GaN technology. With InAlN, scientists expect to significantly enhance the reliability and performance of microwave devices, of particular relevance to space applications, but also important in many other devices.

The project is coordinated by United Monolithic Semiconductors SAS in France.

1 'AlGaN and InAlN-based microwave components'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
http://cordis.europa.eu/marketplace > search > offers > 10248

Making more sense of space

A novel data-processing system for space research will help scientists exploit the huge amount of data it receives from beyond Earth and prepare for future space missions.



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Space research requires sophisticated tools to simulate conditions in outer space and make use of the data it receives from ongoing missions. One breakthrough in this direction has been the development of sophisticated modelling tools that help researchers advance space missions and reduce costs. The EU-funded IMPEX[1] project set out to build a system that enables high-tech simulation outputs and measurements gathered from space.

The project worked on specifying the requirements of the system and conducted web conferences to outline the different inputs from stakeholders. This paved the way to designing the software involved and defining a common data model, along with interfaces and protocols of the envisioned infrastructure.

IMPEX created an online document management system, communication networking mechanisms and a project website to further its goals. One of the website's smartest features is a series of audio podcasts that explore the project's goals and introduce stakeholders to specific modules of the project.

The simulation data model was finally designed to be compatible with the 'Space Physics Archive Search and Extract (SPASE) effort', a project which facilitates information retrieval across the space and solar physics data environment. In addition, the website has been designed to promote information exchange, initiate remote procedures, and exploit services within the infrastructure.

Once the system goes online, it will boost collaboration between modelling experts and space mission data experts, making great strides in interpreting space mission data. IMPEX will also encourage joint analysis of space mission data that will further our understanding of space significantly and lay the groundwork for future missions. Last but not least, the influx of data and resulting analyses will represent a powerful boost to the European knowledge economy and European Research Area.

The project was coordinated by the Austrian Academy of Sciences in Austria.

1 'Integrated medium for planetary exploration'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
http://cordis.europa.eu/marketplace > search > offers > 10312

EVENTS

European climate-change adaptation conference

The 'European climate-change adaptation conference' will take place from 18 to 20 March 2013 in Hamburg, Germany.

European research, supported by the EU Framework Programmes, has played a leading role in expanding the understanding of the impact of climate change. At the same time, policy-makers, businesses, NGOs and people at the European, national and local levels have been active on the issue of climate adaptation.

Co-sponsored by four EU-supported projects — Responses, Climsave, Mediation, and Climate Cost — the conference will cover a broad range of issues related to climate-change adaptation. Specific topics will include: climate vulnerability and risk assessment, economics of adaptation, decision-making under uncertainty, mainstreaming climate adaptation, and cases studies at organisational, sectorial and regional levels.

For further information, please visit:
http://eccaconf.eu/index.php/page/ECCA

BioVision 2013: from life sciences to sciences for life

A life sciences forum entitled 'BioVision 2013: from life sciences to sciences for life' will be held from 24 to 26 March 2013 in Lyon, France.

Life sciences are a spectrum of disciplines that involve the scientific study of living organisms such as plants, animals and human beings. While biology remains the main branch of life sciences, recent technological advances in molecular biology and biotechnology have led to a burgeoning of specialisations and new, often interdisciplinary fields.

This year, the BioVision forum will focus on various topics ranging from micro-organisms to improved human capacities, sustainable use of natural resources, personalised medicine and lifestyle diseases. It will place special emphasis on solutions having a real impact on citizens.

For further information, please visit:
http://www.biovision.org/

Biophotonics and imaging conference

The 'Biophotonics and imaging conference' (BioPIC 2013) will be held from 25 to 27 March 2013 in Dublin, Ireland.

With revolutionary advances in biomedical science, the ability to observe, analyse, and manipulate living tissue at cellular and molecular levels has become essential for continued progress in biomedical research and development. Biophotonics is widely regarded as the key science upon which the next generation of clinical tools and biomedical research instruments will be based.

The conference will gather research leaders who wish to shape the future of bio-imaging in Europe, from researchers developing new imaging techniques to those who will apply them.

For further information, please visit:
http://www.nbipireland.ie/events/232-biopic2013

International symposium on mining and web

The University of Victoria in Canada will organise the sixth 'International symposium on mining and web' from 25 to 28 March 2013 in Barcelona, Spain.

Data is being collected and accumulated at a dramatic pace across a wide variety of fields. Extracting useful information requires new computational theories and tools. Among these techniques, data mining and knowledge discovery play a key role in many of today's web applications, such as e-commerce and computer security.

The event will bring together stakeholders interested in general data-mining techniques and methodologies, as well as their application to the web.

For further information, please visit:
http://www.ece.uvic.ca/~kinli/MAW13/

Volcanism, impacts and mass extinctions: causes and effects

An international conference on 'Volcanism, impacts and mass extinctions: causes and effects' will be held from 27 to 29 March 2013 in London, the United Kingdom.

Asteroid impacts, climate change, volcanoes — there are many existing theories on what caused Earth's worst mass extinctions. If no single cause has ever satisfied all scientists, it may be because big extinctions are not simple events.

This conference will focus on presenting the data that must be accounted for in any comprehensive theory of mass extinctions' causal mechanisms and their effects. Presenters will be able to offer their interpretations and opinions on likely causal scenarios, before an audience of researchers from geological, geophysical, astrophysical and biological disciplines. The aim will be to foster new, collaborative, interdisciplinary approaches to resolving outstanding problems in this field.

For further information, please visit:
http://massextinction.princeton.edu/

International conference on desalination using membrane technology

The first 'International conference on desalination using membrane technology' will take place from 7 to 10 April 2013 in Sitges, Spain.

Water scarcity has become more and more of a concern in Europe, and yet so far society has concentrated on increasing the supply of water rather than exploring ways to limit demand. As a result, southern Europe in particular is experiencing chronic water scarcity, while parts of the north are also under growing water stress. Climate change can only worsen the situation.

The development of effective desalination processes can make a major contribution to meeting the demand for drinking water, and membrane desalination seems to be the most promising approach. The conference will bring together researchers and other stakeholders to discuss cutting-edge research as well as technological and industrial development in this field.

For further information, please visit
http://www.desalinationusingmembrane.com

International conference on internet science

The first 'International conference on internet science' will take place from 10 to 11 April 2013 in Brussels, Belgium.

Hosted by the Royal Flemish Academy of Belgium for Science and the Arts, and the European Commission, this multi-disciplinary conference will encompass computer science, sociology, art, mathematics, physics, complex systems analysis and other relevant disciplines. The event aims to provide an understanding of internet networks and their co-evolution with society while addressing the fragmentation of European research in this area.

For further information, please visit:
http://internetscienceconference.eu/

Protein engineering: new approaches and applications

The Biochemical Society will organise a conference entitled 'Protein engineering: new approaches and applications' from 10 to 12 April 2013 in Chester, the United Kingdom.

Protein engineering continues to be pivotal in researchers' efforts to understand how natural proteins fold and function, paving the way for exploitation outside their natural biological context and even to the design of proteins not present in nature.

The conference will bring together researchers specialised in this field to discuss and exchange ideas on their latest works. Session topics will include computational protein engineering, directed evolution, constructing functional biocatalysts, synthetic biology from the bottom up and engineering protein-protein interfaces.

For further information, please visit:
http://www.biochemistry.org/Conferences/AllConferences/tabid/379/View/Conference/MeetingNo/SA143/Default.aspx

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