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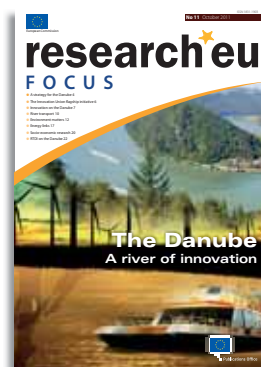
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Increasing cooperation to tackle rare diseases

Although health issues symptomatic of our societies, such as cancer, cardiovascular diseases, neurodegenerative disorders or HIV, tend to remain the centre of attention, there are many other conditions — often considered as rare — which can affect people in sometimes extreme ways. In Europe, 30 million citizens suffer from one or more of these rare diseases, which currently total 6000 to 8000.

Two major problems are typical of rare diseases: first, symptoms can vary among patients suffering from the same condition. In other words, making a correct diagnosis can be a major challenge. Secondly, within the Union, resources are currently fragmented across Member States. It is this issue that the EU set out to tackle, notably through increased cooperation in research.

Under the first six calls of the Seventh Framework Programme (2007-2012), the EU has funded some 100 projects relevant to rare disease research, with a budget of close to EUR 500 million. And on the occasion of the Rare Disease Day in February, it announced EUR 144 million of new funding for 26 research projects on rare diseases.

To highlight these continued efforts, this issue of *research*eu results magazine* puts 'Rare diseases and genetic disorders under the microscope' by showcasing the latest findings from EU-funded projects in the regular 'biology and medicine' section. We interviewed Dr Gloria González, principal researcher in the AIPGENE project which is looking into a new treatment for Acute intermittent porphyria (AIP), as well as Dr Charles Redwood from the University of Oxford who coordinated the BIG-HEART project. The latter looks into hypertrophic cardiomyopathy, one of the main causes of death among athletes.

Following 'biology and medicine', the 'social sciences and humanities' section opens on page 14 with 'Enriching European humanities'. The 'energy and transport' section starts on page 18 with 'The road to greener SME involvement', followed by the 'environment' section which kicks off with 'Infrastructure recycling hits the road' on page 23.

'IT and telecommunications' begins with 'Advanced radio technologies for fairer 4G communications' on page 29, followed by the 'industrial technologies' section with a story entitled 'Researchers help develop next-generation bio-plastic materials', on page 36. Finally, 'space' reveals how the EU is on track for 'Advancing engine technologies for space exploration', on page 41.

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

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

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Watch this space!

Coming up in issue 23 of *research*eu results magazine* — a special dossier called 'Preparing the advent of smart cities'.

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BIOLOGY AND MEDICINE



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New hope for Acute intermittent porphyria patients

Acute intermittent porphyria (AIP) is a rare genetic disease which can result in irreversible nerve damage, liver cancer and kidney failure. Until now, no cure has been available. But a new gene therapy developed by the AIPGENE project could soon make patients' lives much easier.

According to the American Porphyrria Foundation, one person in 20 000 is at risk of contracting AIP. This rare genetic disease, in which mutations in the porphobilinogen deaminase gene (PBGD) result in insufficient activity of a protein necessary for heme synthesis, leads to an accumulation of toxic intermediates. Common symptoms include acute, severe abdominal pains, psychiatric and neurological disorders, as well as muscular weakness and acute porphyric attacks, and can also be life-threatening.

For patients, this rare disease is often synonymous with long-term suffering and little hope of being cured, as the therapies currently available are simply palliative and do not prevent the symptoms or consequences of acute porphyric attacks. The only curative therapy is liver transplantation, but finding a compatible donor can be a real challenge.

In this context, the seven partners in the AIPGENE¹ project set out to develop the clinical use of the new orphan drug

AAV5-AAT-PBGD in the treatment of AIP. *research*eu magazine* interviewed Dr Gloria Gonzalez, project coordinator of AIPGENE, to discuss the great potential of this new therapy.

What are the main objectives of the project?

The main aim of AIPGENE is to alleviate the negative impact of Acute intermittent porphyria (AIP) on the quality of life of patients and their families, the duration of a

patient's life, as well as the socio-economic burden of their condition. So, for the last four years we have been developing a new gene-therapy vector which has already been proven to be highly efficient in preventing acute porphyria attacks in a mouse model. Going by the name of AAV5-AAT-PBGD, this vector was granted Orphan Drug Designation for the treatment of AIP in 2009, by the European Medicines Agency.

The AAV vector is a recombinant adeno-associated virus that carries the corrected version of the PBGD gene and expresses it into the liver. It has been modified to deliver the PBGD expression cassette directly into hepatocytes [liver tissue cells]. In a heterozygous AIP patient who demonstrates 50% of normal PBGD activity, the vector will prevent the accumulation of toxic metabolites and thus, porphyric attacks.

Our main objective is to implement a well-founded and designed clinical trial to assess the tolerance and effectiveness of this gene therapy for patients with AIP, although positive results may also immediately benefit other rare genetic disorders.

What is new or innovative about the project?

Gene therapy is still in its infancy. Although highly promising results have been achieved over the last 10 years in preclinical animal models, the number of clinical trials — in particular, successful ones — is very modest. Similarly, AAV vectors, which are also considered promising due to their long-term expression and excellent safety profile, have hardly been used in medical trials. Our AIP gene therapy trial will be a first for the treatment of a genetic metabolic liver disorder.

The second innovation lies in the fact that, until now, one of the major drawbacks for the clinical application of AAV vectors has been the difficulty of producing large amounts of the vector. One of the AIPGENE consortium partners, the Dutch company uniQure, has solved this problem by developing its own production process for AAV serotype 5 using a baculovirus production system.

What first drew you to research in this area?

The history of this project goes back 10 years, with the hospitalisation of an AIP-affected patient at the Clínica Universidad de Navarra who was going through a very severe crisis. The absence of a curative option for this patient and the poor performance of the palliative treatments available prompted the clinician in charge of this patient to investigate new therapeutic options.

In parallel, researchers in the Department of gene therapy and hepatology at the Centre



Mrs Angeles Guillamon, Dr Jesus Prieto, Dr Fontanellas

for Applied Medical Research have been working for many years on new therapeutic strategies for liver malignancies and infectious diseases based on gene transfer. So we decided to apply our knowledge on liver-gene transfer to a genetic metabolic disorder. Thanks to the involvement of investigators and clinicians experts on AIP, and to the participation of uniQure, we were finally able to develop a vector treatment.

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

One of the main difficulties for the smooth progress of this project is the scarcity of patients suffering from a very severe form of AIP. Since gene therapy for AIP represents a very innovative therapeutic option, the inclusion criteria for an AIP patient to enter the phase I trial are very stringent, and not many AIP patients fulfil them. Furthermore, not all the patients suffering from a severe form of AIP are willing to be test subjects for a new therapeutic product. Thus, we had to contact many patients and clinicians from Spain and abroad to find patients willing to participate in the trial.

Originally, the trial was designed as a phase I/II trial to test both the safety and efficacy of the gene-therapy vector. However, the absence of a therapeutic treatment to compare it with made establishing a therapeutic end point very difficult. After several meetings to discuss this between AIPGENE partners and the consortium's expert advisory board, we switched to a phase I clinical trial to determine the safety of the therapy and the best doses to administer.

What are the concrete results from the research so far?

As well as being able to produce clinical grade AAV5-PBGD vector in sufficient amounts to treat the patients taking part in the phase I trial, we already have some encouraging trial results. The vector showed no relevant toxicity in preclinical animal models, and no adverse events have been observed so far in the six human patients who have already received the treatment.

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

We started phase I of the AIP clinical trials in December 2012, so naturally for us the next step is to design the next phases of the clinical trial. We are currently in contact with AIP clinicians all over Europe to help us with this. Furthermore, we will explore new target diseases that could benefit from the same type of treatment.

- 1 'Augmenting PBGD expression in the liver as a novel gene therapy for Acute intermittent porphyria'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
For further information, see: <http://www.aipgene.org/>

BIOLOGY AND MEDICINE

A united front to tackle rare diseases

Collaboration among 13 European countries has resulted in the generation of a project-building platform to help researchers in the field of rare diseases. The consortium has set up efficient, multi-disciplinary teams to tackle research challenges.

Diseases that affect one in 2000 people are considered to be 'rare'. They are often life-threatening or chronically debilitating disorders and most of them have a genetic origin.

The very small numbers of patients affected by a specific rare disease often results in fragmentation of research efforts and in limited potential for commercial development of medicinal products. However, patients with rare diseases are entitled to the same level and quality of health care.

For this reason, cooperation among research groups working on rare diseases with clinical teams and biotech companies is urgently required in order to convert scientific developments in the field into diagnostic tools and therapies.

The EU-funded project RARE DISEASE PLATFORM¹ aimed to create a set of tools intended to facilitate collaboration among academic teams, small and medium-sized enterprises (SMEs) and even major companies in the field of rare diseases. These tools

will help to speed up research and development by supporting the cooperation of experts, researchers and companies. The ultimate goal is to generate and share diagnostic tools and medical products.

Partners constructed a publicly available website (<http://www.rdplatform.org/>) highlighting the scope and activities of the project. Any information on expert groups in Europe, ongoing funded research projects, technological platforms, databases and biobanks relevant to rare diseases research was published on the existing Orphanet website.

A new multiple-criteria search engine was set up to facilitate accessibility to information regarding rare diseases research and availability of orphan drugs. In addition, a new Orphanet report series was published to present the rare disease networks in Europe, alongside reports on patient registries and databases in Europe.

The information collected during the project was disseminated in two workshops, providing a clear picture of the current status of

research and funding in the field of rare diseases. The work of the consortium culminated in a final report on the state of the art of research and development in Europe in the field of rare diseases and orphan drugs.

The RARE DISEASE PLATFORM project worked to bring all stakeholders in the field of rare diseases closer so as to integrate related research. The Orphanet website is seen as a valuable step towards achieving that goal.

http://asso.orpha.net/RDPlatform/upload/file/RDPlatform_final_report.pdf

The project was coordinated by the National Institute of Health and Medical Research (INSERM) in France.

1 'A European platform of integrated information services for researchers in the field of rare diseases and orphan drugs'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
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Advancing our understanding of Addison's disease

Leading European investigators teamed up to study the pathogenesis and natural course of the rare autoimmune adrenal insufficiency disease (Addison's disease). Overall, the work enhanced present knowledge of disease genes and autoreactive immune cells and paved the way for the design of new therapies for this debilitating disorder.

Autoimmune Addison's disease (AAD) is a rare endocrine disease resulting from the destruction of hormone-producing cells in the adrenal cortex by the immune system. It is found more often in women than men and frequently occurs with other autoimmune diseases such as diabetes mellitus.

The key aim of the EU-funded EURADRENAL¹ project was to

enhance our understanding of the disease pathophysiology. Based on a European network of patient registries and biobanks, the Euradrenal consortium followed a translational approach in order to improve diagnosis and treatment, as well as to offer strategies for future disease prevention.

Studies of over 2800 patients identified reduced bone mineral



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density and a higher number of fractures. Despite the lower levels of androgens, sexuality was normal but AAD patients exhibited higher frequency of premature ovarian insufficiency (POI) and a lower birth rate.

Scientists conducted single nucleotide polymorphisms (SNPs) genotyping on six pedigree dog breeds, which showed increased risk for canine hypoadrenocorticism, and identified a number of novel genes. This line of work could be extrapolated to humans and may prove to be relevant to the onset of AAD.

Using a candidate gene approach, the Euradrenal consortium associated new susceptibility genes such as NALP1, PD-L1, CLEC16A, CD226, CYP27B1, STAT4, Rel and GATA3 with AAD, extending the number of potential loci to 14. Deep sequencing of AAD patients' DNA is expected to discover rare variants important in disease pathogenesis.

Investigation into the mechanism of immune-mediated destruction of adrenocortical cells identified a T lymphocyte component directed against the enzyme

21-hydroxylase that is involved in cortisol and aldosterone biosynthesis. Further dissection of this process revealed two distinct immune-dominant epitopes in the 21-hydroxylase molecule, towards which immune responses were directed.

The EURADRENAL project also succeeded in developing replacement therapy in the form of subcutaneous hydrocortisone infusion. Using this approach, partners managed to reconstitute the normal diurnal cortisol rhythm, thereby offering improved

quality of life and ability to work for many patients.

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

- 1 'Pathophysiology and natural course of autoimmune adrenal failure in Europe'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
<http://cordis.europa.eu/marketplace> > search > offers > 10506



EU project goes to the heart of hypertrophic cardiomyopathy

Although, generally speaking, sport is good for our health, it can also have dramatic consequences for those suffering from inherited heart diseases. One such disease, hypertrophic cardiomyopathy, is the most common cause of sudden cardiac death among athletes. The BIG-HEART project is playing a major role in better understanding this condition.

With well-known events such as the death of Hungary's Miki Fehér and Scotland's Phil O'Donnell, who both died from hypertrophic cardiomyopathy (HCM) in 2004 and 2007, respectively, the football world is no stranger to this disease. In fact, the condition is one of the most important causes of death among athletes across all disciplines. On average, around one in 500 people suffer from HCM — that is, about 1 million people in the European Union.

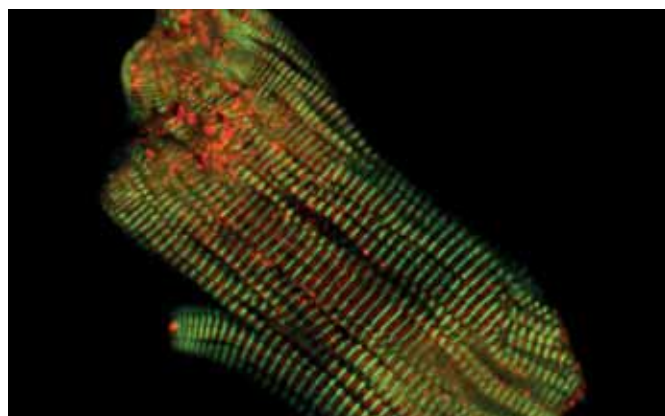
HCM can cause shortness of breath, chest pain, palpitations, abnormal fatigue, fainting and, in the worst cases, sudden cardiac death. Due in part to the death of high-profile athletes, HCM has received considerable attention in the medical press over the last 10 years. However, in light of the variety of symptoms leading to clinical presentation, prognostic advice in the absence of a genetic diagnosis is not an easy task.

In this context, the BIG-HEART¹ project set out to use human genetics to dissect the mechanisms of HCM. Started in January 2010 and involving five academic centres, the project is very close to its completion

at the end of June this year. Dr Charles Redwood, project coordinator of BIG-HEART, has granted *research*eu results magazine* an exclusive overview of the project results.

What are the main objectives of the project?

BIG-HEART is focused on gaining a greater understanding of the inherited heart disease hypertrophic cardiomyopathy (HCM), which is characterised by left ventricular hypertrophy and myocyte disarray. It was the first inherited heart disease to be characterised at the molecular genetic level, with the demonstration that it is caused by mutations in genes that encode different components of the cardiac contractile apparatus. Existing *in vitro* and mouse model studies have suggested that HCM mutations enhance heart-muscle contractility and impair its relaxation. We have hypothesised that these changes may result in energetic compromise, due to inefficient ATP utilisation [Adenosine triphosphate — used in cells to transfer energy], and also in altered calcium ion (Ca²⁺) handling. If validated in the human heart, these hypotheses will identify tractable therapeutic targets that suggest



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Incorporation of a HCM mutant protein (red) into the myofilament structure of a cardiomyocyte with the individual contractile units (sarcomeres) separated by the protein alpha-actinin (green).

that HCM, perhaps more than any other cardiomyopathy, will be amenable to disease-modifying therapy.

With this project, we have set out to collect and genotype a large collection of both affected HCM and appropriate control human myocardium, and to measure the differences in protein expression, contractility, protein phosphorylation and sarcomeric structure. We have tested novel therapeutic strategies to address aspects of HCM pathogenesis in several mouse models and, finally, we have employed patient-based studies to interrogate aspects of disease progression and to test

specific intervention based on existing hypotheses. This multidisciplinary approach should help us gain further understanding of HCM in order to yield improved therapeutic strategies.

What is new or innovative about the project and the way it addresses these issues?

Due to our collaborative interaction, we have collected samples of heart tissue from over 160 HCM patients along with over 20 control samples. We have coordinated the sharing of this unique and extremely powerful resource to allow analyses to be undertaken



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at the different partner laboratories. We have used it to systematically measure the differences in contractile parameters, protein expression and phosphorylation, electrophysiology and sarcomeric structure between normal and affected samples.

What first drew you to research in this area?

My background is in protein biochemistry, and during my PhD I studied structure-function relationships of caldesmon, a protein involved in the regulation of smooth muscle contraction. I was interested in which specific amino acids of this multifunctional protein were responsible for a given function. When it became apparent that missense mutations causing single amino acid substitutions in cardiac contractile proteins can cause cardiomyopathy, this immediately presented as an exciting new field in which to investigate how these mutations alter contractility and to give insight into the molecular mechanism of disease.

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

Some of our work has used mouse models of HCM. In more than one instance, the particular mouse model held by one of the partner laboratories did not sufficiently replicate aspects of the human disease. We have overcome this by the transfer of transgenic mouse lines between partners.

What are the concrete results from the research so far?

We have made significant progress on many fronts and I will give two illustrative examples.

First, the work led by Lucie Carrier in Hamburg has explored the use of 'Spliceosome-mediated RNA trans-splicing' (SmaRT), an emerging tool for RNA-based therapy of genetic diseases. [Ribonucleic acid (RNA) is vital for a number of roles in coding or expression of genes — messenger RNA (mRNA), for example, can convey genetic information]. SmaRT is very attractive since trans-splicing occurs by using the endogenous spliceosome machinery in the nucleus and does not require the introduction of the complete target gene. Trans-splicing occurs between an engineered 'pre-trans-splicing molecule' (PTM) and the target pre-mRNA precursor. Neonatal cardiomyocytes were isolated from mice in which a *Mybpc3* mutation results in exon skipping. Transfection of the cardiomyocytes with adeno-associated virus containing different PTM constructs resulted in production of full-length mRNA and protein in which the mutation had been corrected. This is an important proof of principle for this strategy, and gives encouragement for the use of this or similar gene-therapy approaches in the treatment of HCM.

Then, clinical work led by Iacopo Olivetto in the Florence group has focused on differences between HCM patients with sarcomeric gene mutations and those in which no mutation has been detected. HCM patients with sarcomeric gene mutations are characterised by more severe impairment of microvascular function and increased prevalence of myocardial fibrosis, compared to genotype-negative individuals. These findings

suggest a direct link between sarcomere gene mutations and adverse remodelling of the microcirculation in HCM, accounting for the increased long-term prevalence of ventricular dysfunction and heart failure in genotype-positive patients. These findings emphasise the clinical relevance of systematic genetic screening in HCM populations, potentially guiding surveillance strategies and early medical intervention aimed at preventing disease progression in predisposed individuals.

How and when do you expect BIG-HEART findings to help HCM patients?

I hope that the different aspects of our broad approach to the understanding of HCM will yield significant benefits for HCM patients. The clinical investigations and the testing of novel therapeutic strategies in mouse models are likely to have the more immediate impact. Furthermore, our basic science work — led by Jolanda van der Velden (Amsterdam), Corrado Poggesi (Florence) and Steven Marston (London) — on gaining a fuller understanding of the effect of HCM mutations on heart muscle function is resulting in changes to our models of HCM pathogenesis. This will prompt further modifications of existing strategies and suggest investigations into additional new translational approaches.

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

The closing months of the grant will allow us to complete our BIG-HEART work, including the study of the efficacy of the drug



© BIG-HEART

Dr Charles Redwood

perhexiline in reversing aspects of the HCM phenotype in a mouse model. In future, we will continue to define the functional alterations in cardiac muscle in HCM, both at the clinical and *ex vivo* levels, and develop mouse models of the disease to test therapeutic strategies. We will also study the mechanism of disease caused by HCM mutations in genes which encode non-sarcomeric proteins. The strong collaborations established between the centres will continue in future joint research projects.

- 1 'Bench-to-bedside integrated approach to familial hypertrophic cardiomyopathy: to the HEART of the disease'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
For further information, see:
<http://www.big-heart.eu/>



Gene therapy for CNS disorders

Gene therapy entails the specific transfer of genetic information into affected cells and tissues to restore function in diseased areas. European scientists aimed to apply this approach to neurological disorders where no alternative treatments are available.

Significant progress has been made over the last decade in understanding mechanisms and principles of both normal brain

function and central nervous system (CNS) disorders. Although this information makes new treatments for nervous system

diseases more realistic, current pharmacological treatment strategies for neurodegenerative diseases offer only symptomatic

relief and cannot influence the course of the disease.

Although still an experimental approach, gene therapy presents a promising strategy for permanently correcting a genetic phenotype. Several proteins and regulatory RNAs have been

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identified to regulate normal brain function and affect disease progression. Targeting these molecules directly through gene therapy may be more time- and cost-effective compared to medications developed through classical pharmacology.

Seeking to treat major neurodegenerative disorders, the EU-funded NEUGENE¹ initiative worked to overcome existing limitations of current gene therapy vectors for safe and efficient approaches. The consortium used Parkinson's disease as a model, the goal being to target viral vectors to specific cell types of the brain and achieve regulated, efficient and safe expression of therapeutic molecules in either neurons or glia.

Vectors based on adeno-associated virus (AAV) and lentivirus (LV) were developed that

specifically delivered therapeutic genes to astrocytes and to the main target cell population affected by Parkinson's disease. Through specific promoters and regulatory protein-based approaches, partners achieved targeted transgene expression.

With respect to safety of the developed vectors, the consortium showed that existing immunity towards AAV serotype 2 could compromise the efficiency of transfer and transgene expression. The use of alternative vectors based on 'equine infectious anaemia virus' (EIAV), to which humans are not naturally immunocompetent, argued for a superior safety profile.

NEUGENE vectors were functionally validated in a mouse model for Parkinson's disease, demonstrating restoration of motor performance. Also,



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neurotrophin-expressing vectors were patented and put forward for clinical development.

Overall, the NEUGENE research solved significant issues regarding the gene therapy of CNS disorders. The newly developed vectors boasted efficient yet cell-restricted and regulated transgene expression, setting the basis for gene therapy for CNS disorders.

The project was coordinated by the University Medical Center Göttingen in Germany.

- 1 'Advanced gene therapy tools for treatment of CNS-specific disorders'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
<http://cordis.europa.eu/marketplace>search>offers>6481>



Improved diagnosis of paediatric mental retardation

An interdisciplinary Eastern Europe and Central Asia (EECA) consortium carried out an extensive study on patients with intellectual disability to identify the genetic origin of the disease. Project results could lay the basis for a significant improvement in clinical and educational developments.



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Intellectual disability (ID) is a neurodevelopmental disorder that affects 1-3% of the population and is characterised by a substantial limitation in cognitive functioning. Nearly half of the cases are of genetic origin and retardation manifests before the age of 18 years.

Any possibility for early diagnosis or prevention is dependent on the identification of gene defects and chromosome abnormalities associated with this disorder. Based on this, the EU-funded CHERISH¹ project aimed to contribute to the diagnostic investigation of affected children in countries involved using genetic testing.

By means of an interdisciplinary consortium of experts, the overall goal of the project was to develop a standardised approach for clinical diagnosis of ID and, through a clinical

biobank, to identify cryptic chromosomal rearrangements, mutations and genes responsible for the disorder. To this end, researchers performed 'whole genome array-comparative genomic hybridisation' (CGH) and single nucleotide polymorphism (SNP) analyses on blood samples from patients and family members.

Many cryptic rearrangements were detected by CGH in patients where conventional karyotyping, targeted FISH, molecular tests and investigations for metabolic disorders had previously failed to reveal any causative anomalies. This clearly indicated that the Cherish-proposed technologies could significantly improve current molecular diagnosis of ID.

Copy number variations (CNVs) were screened against databases of national



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general populations, and the potential clinical significance of CNVs not present in non-affected individuals was evaluated using OMIM and DECIPHER databases. With respect to ID causative genes, two genes involved in small interstitial deletion (CADPS2 on chromosome 7q31 and PCDH18 on chromosome 4q28) were considered excellent candidates and were used for further studies.

Affected individuals from families with ID were selected for whole exome sequencing (WES) to analyse almost all the known exons (protein-coding gene portions) of ID-causing genes. This method offers the advantage of speeding up the molecular diagnosis of heterogeneous genetic disorders such as ID.

By applying different state-of-the-art methodologies, the

CHERISH consortium succeeded in characterising the genetic basis of various forms of ID while providing novel means for diagnosis. The work is expected to increase awareness on the possible genetic origin of ID and the beneficial implications of novel therapeutic strategies.

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

- 1 'Improving diagnoses of mental retardation in children in central eastern Europe and central Asia through genetic characterisation and bioinformatics/statistics'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
<http://cordis.europa.eu/marketplace> > search > offers > 10810



New hope for treating a rare, lethal skin condition

There is light at the end of the tunnel for sufferers of a rare, autoimmune blistering condition known as pemphigus vulgaris. EU-funded scientists and clinicians have joined forces to find out how the disease develops so they can identify potential targets for therapies.

Without treatment, pemphigus vulgaris sores could become so infected that the condition becomes fatal. Although well characterised, there are still no specific therapies available to treat this potentially lethal disease. Unfortunately, current treatments, like the

administration of steroids, have many side effects.

Researchers already know that the characteristic lesions on the skin and mucous membranes are caused by an autoimmune response: the body's own immune system destroys desmoglein

(Dsg), the 'glue' that keeps adjacent skin cells together. What they do not know is how and why this happens, which is the question that EU-funded scientists wanted to answer with the PEMPHIGUS¹ project.

The scientists used three different mouse models to characterise the body's immune response to Dsg3. They found that CD4+ T cells sensitive to Dsg3 are necessary for the immune response. The CD4+ T cells and B-cells interact to create antibodies specific to Dsg3.

When these antibodies then interact with the skin cell membrane, the cell relays information about the antibody through various molecules right down to its own DNA to turn genes on or off in response. By characterising this signalling pathway, project researchers were able to identify a number of new potential therapy targets.

The insights gained into how the immune system responds to Dsg3 can be used to create more specific diagnostic tests, which will enable doctors to monitor a patient's condition more effectively. Better diagnostic tools and potential targets for therapies will also allow doctors to improve treatment and prevent side effects and comorbidity. In future, Pemphigus vulgaris sufferers should be able to live longer, happier and healthier lives.

The project was coordinated by Philipps-Universität Marburg in Germany.

- 1 'From autoimmunity to disease'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
<http://cordis.europa.eu/marketplace> > search > offers > 6121



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Single molecule important in many brain diseases

European scientists studied a molecular mechanism that may underlie a variety of neurodegenerative brain diseases including Alzheimer's disease (AD) and a form of dementia.

Changes in brain function are mediated predominantly by changes in the structures of neurons (cells of the nervous system including the brain) rather than in their number. While a very small

population of neurons may retain the ability to divide into adulthood, increased functionality is primarily due to an increase in the number of contacts among already existing neurons.

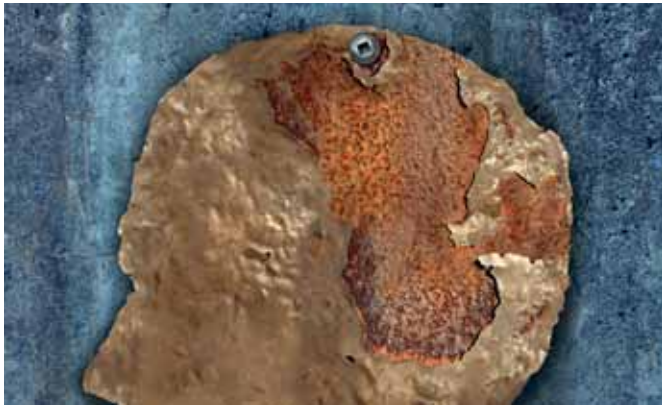
Although neurons have a spherical, water balloon-type cell body characteristic of many other cells, they also have specialised signal-receiving and -sending structures extending in opposite directions. The dendritic tree (receiving structure) is literally like the many branches of a tree and provides a huge surface area over which axons (transmitting structures) of

other neurons can make contacts (synapses).

Very specialised tiny mushroom-like bumps on the dendrites (dendritic spines) are the actual sites of signal transmission. The mechanisms underlying the formation of synapses on the spines are a very important area of research. Normal learning and memory

BIOLOGY AND MEDICINE

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rely on dendritic spine formation. Dysfunction of spine-formation processes is involved in cognitive decline in normal ageing as well as in pathological conditions such as AD and 'familial

fronto-temporal dementia' (FTD), a type of dementia.

European scientists studied the rapid movement and reorganisation via microtubule (MT)-mediated

transport of the building blocks of spines. In particular, they focused on the molecule GSK-3 that controls, in part, the phosphate groups bound to the MT-associated protein tau and tau's associated activity. With EU funding of the NEURO.GSK3¹ project, scientists developed preclinical models (transgenic mice and transfected cultured neuronal cells) of tau-related AD and FTD.

Enhanced understanding of the role of molecular transport dysfunction in synaptic spine formation could help explain the similarity in mechanism of clinically diverse neurodegenerative diseases. Identification of a similar mechanism could make the

possibility of a single treatment for numerous debilitating diseases a reality.

The project was coordinated by the University of Leuven in Belgium.

- 1 'GSK-3 in neuronal plasticity and neurodegeneration: basic mechanisms and preclinical assessment'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
<http://cordis.europa.eu/marketplace> > search > offers > 10071



New global initiative to tackle neurodegenerative diseases

European countries and research teams have joined forces, pooling national expertise and resources to wage battle against debilitating neurodegenerative diseases such as Alzheimer's. Neurodegenerative disorders are incurable debilitating conditions that lead to progressive degeneration or death of nerve cells. Today, in Europe, over 7 million people suffer from Alzheimer's disease and related disorders. This figure is expected to double by 2020 as the European population ages.

In 2010, to tackle this challenge, 22 EU countries launched the first Joint Programming Initiative (JPI) on combating neurodegenerative diseases (JPND) – <http://www.jpnd.eu>. JPND is a completely new collaborative approach to European health research between countries, with a shared vision to speed up progress towards new treatments, identify preventive strategies and improve patient care. In September 2010, a three-year coordination action in support of the implementation of JPND, entitled JUMPAHEAD¹, was established to help achieve this vision.

JUMPAHEAD partners carried out a mapping exercise of the combined resources and current research status in neurodegeneration in Europe. The resulting mapping data estimates that EUR 370 million is spent annually on research into neurodegenerative disease across Europe, but several areas are notably underfunded, particularly clinical research and research

into healthcare and social care. JPND is looking to build capacity in the research areas of most need particularly in clinical and health-care/social research with the aim of fighting the fragmentation of funding in Europe.

In 2012, JPND countries launched a common strategic research agenda (SRA) for the next five to 10 years, with five scientific priorities identified as key areas of need in order to address the challenge in its totality. The strategy establishes a platform for future EU-wide activity and a reference point for developing national and organisational strategic plans.

Through JUMPAHEAD, and together with all JPND partner organisations, standard procedures for common joint activities have been developed; over EUR 45 million has been made available since 2011, through a number of joint transnational calls for proposals. Four collaborations, including 82 sub-projects, are being



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funded under the first joint transnational call for European research projects for the optimisation of biomarkers and harmonisation of their use between clinical centres, launched in May 2011 with a total budget of about EUR 15 million. The first phase of SRA implementation (2012–2014) has already begun, with the total projected investment from participating JPND countries over the next three years expected to be over EUR 100 million in cash contributions (importantly, this does not include in-kind resources).

JPND has worked to communicate and disseminate the benefits of participation to both internal and external audiences, and has engaged in strategic relationship-building with key stakeholders. They have also published articles in relevant publications, such as *Lancet Neurology*, *Nature* magazine and the EU's *Parliament Magazine*. Other activities include the creation

of a stakeholder database and monitoring exercises to track progress and measure the project's impact. Options for future engagement and partnership with key stakeholders are being considered to address the huge challenge that neurodegenerative diseases pose to health and society across Europe.

The project was coordinated by the National Institute of Health and Medical Research (INSERM) in France.

- 1 'Coordination Action in support of the implementation of a Joint Programming Initiative for Combating Neurodegenerative Diseases, in particular Alzheimer's disease'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
<http://cordis.europa.eu/marketplace> > search > offers > 10222

SOCIAL SCIENCES AND HUMANITIES



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Enriching European humanities

Two new humanities-related themes under the European Research Area will probe cultural dynamics and creativity through a myriad of projects in a cross-European context.

The humanities are a complex set of academic disciplines that include language, literature, philosophy, religion and history. Critical and/or speculative approaches are used in humanities research.

While a main EU focus is on scientific research and technology, the Union is also interested in advancing the humanities in different ways. The EU's HERA JRP¹ recently established two themes that help further humanities across Europe. One is 'Cultural Dynamics: Inheritance and Identity', and the other is 'Humanities as a Source of Creativity and Innovation'.

The two themes are set to address major social, cultural, and political challenges facing the continent. HERA JRP is bringing together 13 national funding organisations across the EU. Together, partners from different EU nations developed common research priorities, created a national funding mechanism and pooled much of their funding.

Projects under these themes were then opened to scholars in Austria, Croatia, Denmark, Estonia, Finland, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Slovenia, Sweden and the UK, regardless of their nationality. To apply for project funding (a total of EUR 16.5 million) under these grants, interested scholars and researchers formed consortia with members from three different HERA JRP countries.

The project proposals were evaluated by two international, independent HERA JRP review panels. A pleasingly high number of proposals were submitted for the two humanities fields, and the budget was eventually awarded to the 19 most successful proposals. The two theme-specific launch conferences, referred to above, took place in Vienna during June 2010.

In parallel, the HERA JRP formulated a knowledge-transfer strategy aimed at increasing awareness of the impact of funded research beyond academia. Already, knowledge

transfer and networking are bringing together academic and non-academic partners from more than one HERA JRP project, extending the study of humanities to different sectors. Thought-provoking results as well as different approaches to subjects such as philosophy, history, sociology, law and politics will undoubtedly enrich Europe in novel ways.

The project was coordinated by NWO in the Netherlands.

1 'Joint Research Programme on Humanities in the European Research Area'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Socio-economic sciences and humanities'.
<http://cordis.europa.eu/marketplace> > search > offers > 6338

Turning the volume down in Europe's cities

Millions of European city dwellers endure urban noise pollution every day. Apart from its nuisance value, noise in Europe has health risks, with stress and cardiovascular issues being particular concerns, according to the World Health Organization (WHO). The social costs of traffic noise in Europe have been estimated at 0.4% of total economic output, mainly from road transport.

This phenomenon has now been recognised by the EU as an environmental issue. The European Commission unveiled plans in December 2011 to cut vehicle noise in the coming years. And the 2002 EU Environmental Noise Directive already placed heavy obligations on city authorities to address the problem. To support them, the Commission has invested millions of euros in research projects to find new ways of reducing urban noise.

Until recently, research into noise reduction focused mainly on insulating buildings against urban noise. Little attention has been given to quietening the urban environment itself, although this is now changing.

'Urban noise can be tackled in two ways. If we can do something with the source of the noise first, we will. After that, we look at the way sound is propagated and perceived,' explains Jens Forssén of Chalmers University of Technology, Gothenburg, and the project coordinator of HOSANNA¹, an EU-funded project tasked with investigating urban noise.

HOSANNA provided a toolbox to reduce road and rail noise pollution that goes beyond traditional solutions such as sound barriers and speed limits. 'We looked at a range of solutions that can help with urban noise reduction. For example, sound barriers that exploit soft materials, vegetation or possibly recycled materials could achieve significant reduction in noise compared to the straight-sided sound barriers commonly used now,' Forssén says. 'The perception of the sound scope overall is very important, which is why we applied a range of assessments, including questionnaires and even physiological measurements of stress, to assess the effectiveness of the measures we will finally recommend.'

The 13 project partners involved in HOSANNA, which ran for three years until November 2012, were supported by a EUR 3.9 million EU grant. The project's wide-ranging proposals have already attracted interest from architects, city planners, acoustic consultants, noise control engineers, and various other decision-makers.

One success story supported by HOSANNA focused on Lyon in France, where researchers showed that a natural plant sound shield could deliver significant noise reduction. A barrier just 15m long, 1m high and 40cm thick was set up in front of the Church of St George on Lyon's busy Quai Fulchiron. The wall was made of recycled materials, including coconut fibres, lava stones and around 1200 different plants.

'Although it is low in height, it is able to muffle sounds,' says Bruno Vincent, a director at Acoucité, a Lyon-based urban noise observatory that worked on the HOSANNA project. The acoustic performance of the barrier was measured before and after it was erected, with pedestrians asked to assess the sound environment. 'The prototype was able to stop sound waves and create a quiet acoustic zone: the noise reduction behind the wall was estimated at between four and eight decibels,' Vincent says.

Vincent, who has a PhD in environmental psychoacoustics, says the barrier was also successful in raising interest among politicians and city engineers. 'It addressed a real problem with a solution that is both practical and visually pleasing. And being acoustically efficient and aesthetically attractive it is good for us and for our quality of life,' Vincent concludes.

Reducing noise at source is an obvious place to start when tackling noise pollution. While tyres are widely acknowledged as the biggest source of noise in the urban environment, noise from cooling systems in vehicles such as cars and trains can come close.

ECOQUEST², supported by a EUR 2.4 million EU grant, addressed the issue by looking into vehicle cooling systems. The project, which runs until mid-2013, has developed innovations that could lead to cooling units with reduced noise profiles and decreased CO₂ emissions.

The project has focused on cooling systems in trains and cars, designing new compact layouts, innovative heat-management strategies and low energy/noise components. 'We developed methodology for tools to make predictions about more efficient and quieter systems. And we have been applying these tools to fans,' says Manuel Henner, one of ECOQUEST's researchers.

Henner, who is also an expert on fan systems and airflow management at French car-parts maker Valeo, says ECOQUEST has already written some patents from its research on how to use the fan system to counter downswings, and adapt to the real conditions of the engine. 'This will reduce costs, weight and electrical consumption, which improves fan-system efficiency, and therefore the performance of the engine,' Henner explains. A prototype of the system was planned for the end of 2012 to test the research and show the various efficiency gains. 'It is about reducing 1 or 2 % of engine consumption. That might not seem much, but it matters when you talk about the entire European car market,' he says.

Henner says that the project arrived at the right time, just as the economic downturn was hitting. 'Without this project, we probably would not have been able to learn what we did,' he says. 'Sometimes, you are shooting in the dark, so you need a framework of a project, with a budget and partners. ECOQUEST gave us the consistency to carry on. This project was an opportunity to invest, continue and learn.'

- 1 'Holistic and sustainable abatement of noise by optimised combinations of natural and artificial means', coordinated by Chalmers in Sweden.
- 2 'Efficient Cooling Systems for Quieter Surface Transport', coordinated by the University of Siegen in Germany

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://ec.europa.eu/research> >
 Information Centre > search > 29353



SOCIAL SCIENCES AND HUMANITIES

The privatisation of war

An EU-funded project conducted a comprehensive study of the privatisation of war and its regulation. Researchers also examined the role of the EU in ensuring compliance with international humanitarian law and human rights in related events.

The PRIV-WAR¹ project was initiated to assess the impact of hiring private military companies and private security contractors (PMCs/PSCs) and outsourcing preventive maintenance checks and services (PMSCs), in situations of armed conflict. The research was motivated by concerns that such companies effectively operate in a legal vacuum. This has implications

for the employees involved, human rights issues, and individual approaches of EU Member States.

In seeking to promote a greater understanding of this phenomenon, the project achieved considerable success across its many and varied objectives. For example, a database of companies was created to gather

information on the main characteristics of PMSCs. Workshops encouraged dialogue on the use of such organisations, and a report was produced that identified the risks of 'outsourcing' international security to private entities.

The legal status of PMSC employees under international humanitarian law (IHL) was researched, with a number of points being highlighted for clarification of their status as either combatants or civilians.

Protecting human rights is the core concern of the PRIV-WAR¹ project, as was made evident in the book *War by contract* and in working papers published on the project website. Private military activities can impact human rights — a thorough overview was provided of applicable regional and universal instruments. The project also shed light on the role of obligations and remedial processes in regulating PMSCs, and highlighted their accountability in cases determined to be in violation of human rights.

Partners further analysed the international responsibility of Member States and the accountability of PMSCs, and examined existing regulations at national and EU levels. The latter prompted discussions leading to proposals for ways the EU can adopt regulatory measures and approach essential objectives, means and legal bases.

In addition, a series of events contributed to the creation of a wider network of experts with varied backgrounds, lending a clear interdisciplinary character to the PRIV-WAR project.

The project was coordinated by the European University Institute in Italy.



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- 1 'Regulating privatisation of 'war': the role of the EU in assuring the compliance with international humanitarian law and human rights'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Socio-economic science and humanities'.
<http://cordis.europa.eu/marketplace> > search > offers > 10134

Exploring culture-specific responses to crises

Do people across cultures respond differently in times of crisis? An international consortium sought to answer this question from a number of perspectives, with a view to improving communication during emergency situations.

Funded under the EU's Seventh Framework Programme, the BESECU¹ project investigated cross-cultural and ethnic differences in human responses to crisis situations. The aim was to generate evidence supporting better security-related communication, instructions and procedures. Advances in this area will improve evacuation procedures and public protection. Partners also sought to offer information useful to first

responders, building designers and developers of emergency operating procedures.

On the heels of more than a decade of major disasters and terrorist incidents, the international consortium considered key questions concerning human behaviour during emergency events. BESECU followed a two-pronged research strategy: a cross-cultural survey of individual experiences of disaster

survivors, workers and first responders, and those in the community affected; and experimental trials simulating real-time evacuation scenarios in standardised settings.

Analysis of almost 150 interviews with disaster survivors in various countries indicated that one set of psychological instruments can be used to cross-culturally assess different types of incidents. Results also revealed

that the type of event experienced influenced later psychological impact.

Reports by survivors facilitated the development of a standardised psychological instrument, the BESECU-S, for assessing responses from cognitive, behavioural and emotional standpoints. The crisis situations were domestic fires, fires in public buildings, floods and earthquakes, and terrorist attacks.

Project partners also developed BESECU-FR, a standardised psychological instrument for first responders. This tool

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was developed using interviews conducted with emergency personnel in participating national centres.

The project's experimental component, involving unannounced building evacuations in the Czech Republic, Poland and Turkey, produced response-phase data for comparison with data generated from a similar exercise carried out in the United Kingdom.

Study results suggest that differences in human behaviour in crisis situations are based on cultural influences on behaviour in the response phase. BESECU outcomes thus provide a wealth

of information useful for informing future research and developments aimed at better communication and evacuation.

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

- 1 'Human behaviour in crisis situations: a cross-cultural investigation to tailor security-related communication'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Security'.
<http://cordis.europa.eu/marketplace> > search > offers > 5720

Unravelling the mysteries of migration

The reasons behind migration to Europe and the dynamics that govern it have become less clear in recent years. An elaborate EU programme is well on the way to addressing the topic and improving relevant policy-making.

Migration is on the rise and is changing the face of Europe as we know it. While, on one hand, this makes Europe more multicultural and dynamic, it also presents challenges such as xenophobia, social exclusion and higher unemployment. The EU-funded programme NORFACE PLUS1 is investigating all the social, economic, cultural and policy-related challenges converging on Europe in the wake of

increasing migration. The multidisciplinary programme is aiming to produce valuable data for policy-makers both in Europe and abroad to manage socio-economic issues related to human migration.

Armed with a budget of almost EUR 30 million, the programme is funding 12 transnational projects that are collaborating through workshops and forums to

address the migration challenge. In more detail, the projects are tackling a myriad of hot topics such as migrants' choices, children of immigrants, residential segregation, temporary migration, social integration and the impact of migration.

In the meantime, NORFACE PLUS is working diligently on collecting qualitative and quantitative data on key migration issues. It has launched a rich, comprehensive website on migration research that outlines the 12 projects, in addition to featuring related conferences, publications and news. The website now acts as a powerful platform that highlights research findings, engages stakeholders, and raises awareness on key migration issues among stakeholders and concerned parties.

In April 2011, NORFACE PLUS hosted its first international conference on migration studies in London. This attracted 300 scholars from a wide variety of disciplines and probed the often contradicting approaches to migration studies. It also

highlighted funding possibilities for researching migration issues and encouraged joint academic discussions. A plethora of new partnerships, projects and publications have already emerged from the event.

By the time the project ends in early 2014, Europe will possess a much deeper understanding of migration-related issues. This will enable policy-makers to design better migration policies and connect with countries abroad, allowing governments to effectively balance the needs of European citizens and those of migrants. The results of such an ambitious programme can only be a fairer, more knowledgeable and more tolerant Europe.

The project was coordinated by the Suomen Akatemia in Finland.

- 1 'Norface transnational programme on migration in Europe'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Socio-economic science and humanities'.
<http://cordis.europa.eu/marketplace> > search > offers > 10104



ENERGY AND TRANSPORT



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The route to greater SME involvement

There is a need to find effective ways of involving small and medium-sized enterprises in surface transport projects. An EU-funded initiative worked to respond to this ahead of the upcoming European Commission Horizon 2020 research programme, which calls for 'smart, green and integrated transport'.

The SMART¹ project brought together a diverse range of stakeholders in the area of surface transport. These included private technology-transfer companies, public innovation agencies, regional small and medium-sized enterprise (SME) clusters, and large enterprises linked to regional clusters.

Services supporting SME participation in research and technological development (RTD) under the European Transport Work Programme should include regional clusters from different countries, and facilitate networking and the creation of partnerships between SMEs and larger organisations. SMART sought to provide a basis for providing such services through a number of activities, and was largely successful in achieving its objectives.

A website was launched as the main platform offering project services and a means of maintaining contact among network participants. It also provides information that can be used to exploit project results and encourage

the community to go beyond the scope of the project. This takes the form of databases of organisations and funding opportunities, as well as related tools.

Various lessons learnt during the SMART project can be applied for increased and more effective SME participation in European surface transport research. Online events proved to be very useful in involving organisations in project activities, since attending international events is prohibitive for many SMEs' budgets. Although SMEs in surface transport show a high degree of innovativeness in terms of research project ideas, the challenge lies in matching these with specific calls. As such, a shift to bottom-up funding schemes would enable greater participation within the specific transport area. This would also help SMEs to access networks of large enterprises and generate interest among them of the added value of SME involvement in RTD projects.

SMART activities highlighted the effectiveness of online collaborative tools and networks for

sharing ideas and projects, and fostering open innovation. Furthermore, such tools can be used to support SMEs in putting forward their ideas and joining large projects.

Results of the SMART project and their strategic exploitation have the potential to boost research activities that will bring significant benefits for citizens as surface transport continues to expand and impact daily life.

The project was coordinated by Ciaotech in Italy.

1 'Services for SMEs in collaborative transport research projects'.

Funded under FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace> > search > offers > 10156

Industrial crops to bloom in Europe

In a bid to enhance sustainable development and reduce its dependence on imports, the EU is growing crops that are used to manufacture a variety of products or to make biofuel.

Crops are not only valuable as a food source. They provide an amazing variety of renewable non-food products such as fuels, fibres, chemicals, lubricants and construction materials. Such crops can reduce dependence on fossil fuels, diversify agriculture, boost agricultural feedstock markets and promote sustainable development. In this vein, the EU-funded project CROPS2INDUSTRY¹ looked at

how these crops could be grown within EU Member States to reap the rewards.

The project considered supply, consistency, quality, environmental impacts, market demands and price competitiveness in exploring crop growth. It reviewed a number of applicable crops and outlined challenges in large-scale cultivation, focusing on those that have

traditionally been grown on the continent. Importantly, the concept of growing non-food crops was based on exploiting surplus land, i.e. land where food crops are not currently grown.

With particular focus on oils, fibres, resins, pharmaceuticals and feedstock, the project team surveyed industry partners and analysed input, costs and output, facilitating the assessment of socio-economic impacts. It also simulated production and environmental impacts of selected crops, calculating emissions and organic carbon in topsoil.

CROPS2INDUSTRY published several strategies and papers on non-food use of plant biomass to help develop crops-to-industry schemes. The project also published all its results on a dedicated website, in addition to conducting three workshops and initiating twinning activities such as conferences and workshops with other countries.

Lastly, the project mapped out research priorities for the future, such as identifying new technologies, improving yields, exploiting genomic advances and creating a ranking system for non-food cropping. The latter would be based on technical performance, economic viability and environmental impact to boost bioenergy crop-production schemes in a given region. The implications of such research are pivotal for several sectors of the economy and could lessen our dependence on imports, literally enriching the EU with 'home-grown' products, from fuels to pharmaceuticals.

The project was coordinated by the Centre for Renewable Energy Sources and Saving in Greece.

1 'Non-food crops-to-industry schemes in EU27'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology'.
<http://cordis.europa.eu/marketplace>search>offers>10378>



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Detecting defects in mass transit vehicle panels

Scientists have developed vital testing techniques for components of mass transportation vehicles. Application of these methods should enhance safety and reliability while decreasing operating costs.



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Composite materials, those made of more than one individual type, are increasingly used for surface transportation applications. They are typically low-weight and high-strength materials, a combination that provides durability and safety together with reduced fuel consumption and greenhouse gas emissions. However, increased use of composites has not been paralleled by increased development of testing and monitoring techniques for both manufacturing and maintenance phases.

Non-destructive testing (NDT) refers to techniques that enable assessment of a component without destroying any part of it. No samples are taken, no instruments

are inserted and no chemicals are applied. Continuous health monitoring or structural health monitoring refers to methods by which the state of constituent materials, components and the whole structure are monitored continuously.

The transportation industry has identified a need for faster and more accurate NDT techniques to meet current and future inspection requirements. In response, the EU-funded COMPAIR¹ project developed a novel system for continuous health monitoring and NDT of composite panels in trains, buses, trucks and trams. Scientists also initiated guidelines for certification to foster cost-effective manufacturing and maintenance. ➤

ENERGY AND TRANSPORT

Two technologies were exploited. For *in situ* NDT, scanning based on transient thermography and near infra-red (NIR) technology was implemented. Continuous monitoring combined acoustic emission (AE) technology and long-range ultrasonic (LRU) guided waves.

A flexible robot scanner equipped with the NDT technology provided rapid on-site *in situ* inspection of

reinforced plastic panels. Software enables the interface with the operator. Continuous monitoring techniques for in-service assessments were shown to facilitate high sensitivity to changes in components, with software identifying defects at the time and date they exceeded acceptable limits.

COMPAIR technology employed several assessment techniques,

reducing the likelihood of false positives and, perhaps more importantly, of false negatives. Enhancing the reliability and service life of composite materials will have wide-reaching benefits for manufacturers, operators and consumers.

The project was coordinated by TWI Limited in the United Kingdom.

- 1 'Continuous health monitoring and non-destructive assessment of composites and composite repairs on surface transport applications'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace> >
 search > offers > 6438

Natural gas-burning diesel engines for marine fleets

Scientists are developing technology for greener marine fleets. Diesel engines that utilise natural gas will significantly reduce the emissions and pollutants produced by ships.

Dual-fuel engines have been around for years, primarily for use in diesel generators. They are diesel engines fitted to burn natural gas as well. Their uptake in the transport market has been rather limited until recently.

Technology is now available to convert conventional road transport engines to dual-fuel ones using compressed natural gas (CNG) or liquefied natural gas (LNG). Many consumers and transport companies are taking advantage of this.

Adapting dual-fuel technology for marine transportation could make a sizeable contribution to the reduction of emissions, given that 99% of the commercial fleet is currently powered by diesel engines. Thus, a simple retrofit of existing engines would make a huge impact.

European scientists initiated the HELIOS¹ project to create a research platform for developing a marine gas-diesel engine concept.

To do so, they developed a number of tests related to engine function, compliance with emissions legislation and fuel economy. Simultaneously, they are developing guidelines for the installation of the gas tank and distribution systems on-board.

Preliminary performance and emissions tests on a prototype retrofitted gas engine demonstrated higher efficiency and lower emissions than achieved with diesel fuel. With

confirmation of the concept's benefits, testing and optimisation will be intensified in the coming months.

Aside from a final deliverable of a dual-fuel marine engine running on diesel and CNG/LNG, HELIOS has already produced a novel hand-held calibration device, and a sensor system for online analysis of gas mixture composition is being developed.

Commercialisation of HELIOS' concepts should thus have far-reaching effects on marine transport, engine design and calibration, and gas sensor technology, too.

The project was coordinated by MAN Diesel & Turbo SE in Germany.



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- 1 'High pressure electronically controlled gas injection for marine two-stroke diesel engines'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace> >
 search > offers > 10055



Safer roads on the horizon

If car tyres and road conditions can be improved, skidding and rolling would be minimised, making road transport safer, more eco-friendly and quieter.

As the EU upgrades its road transport systems with a strong focus on safety and eco-friendliness, it is striving to find ways to raise and harmonise road standards across the continent. One important area being addressed looks at minimising the skidding of cars to enhance safety and promote greener transport.

The EU-funded project TYROSAFE¹ brought together stakeholders from Belgium, Germany, France, the Netherlands, Austria, Slovenia and the United Kingdom to achieve this aim.

The project studied tyre and road dynamics to establish better interaction between

the two, which would increase safety for drivers, reduce CO₂ emissions and minimise noise. In particular, it outlined cutting-edge technical and scientific advances in the field and mapped future research priorities that advance skid resistance, rolling resistance and noise.

TYROSAFE then produced an in-depth assessment of all the elements involved (tyres, skidding, noise, safety) and their interaction with the environment. It filled knowledge gaps and produced recommendations to manage critical road surface properties, unveiling how best to standardise assessment methods and harmonise design and safety policies.



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This has provided a wealth of knowledge to the car industry, road transport administrations and government authorities. If exploited and applied, the results of the project will enable EU Member States to reduce accidents and road fatalities, in addition to promoting greener road transport and reducing noise pollution.

The project was coordinated by the Austrian Institute of Technology (AIT) in Austria.

- 1 'Tyre and road surface optimisation for skid resistance and further effects'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace/search/offers/5896>

An even more ideal fuel cell

While the world struggles to kick its fossil fuel 'habit', scientists scramble to invent and improve clean, alternative energy sources. The hydrogen fuel cell is one such alternative and, luckily for the oil-addicted globe, new EU-funded science has found a possible solution.



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Four years ago top European scientists began developing a new kind of fuel cell dubbed the IDEAL-CELL. Now, their new technology retains all the good of the old and none of the bad.

In existing 'solid oxide fuel cells' (SOFCs) and 'proton conducting fuel cells' (PCFCs), oxygen and hydrogen react to create electricity and water. This water by-product collects at the cell's oppositely charged electrodes, resulting in corrosion and a lowering of the cell's efficiency.

Coming together under the IDEAL-CELL¹ project, a team of Europe's top researchers in the field have developed a way to prevent this collection of water. Their new system uses the positive electrode of a PCFC with the

negative electrode of a SOFC. The water by-product forms in a porous membrane between the two electrodes and is quickly removed.

In 2008, the researchers started with intensive modelling and testing, and in 2010 they demonstrated the operation of a sample in front of two European Commission experts. The experts felt the team had a valid idea and advised them to focus the next two years on improving the performance of the cell, rather than its design.

Now, in addition to solving the water problem, the team has established that the cell can be fabricated using standard processes and that it performs as well as existing cells. The

chemical reaction that takes place within the cells is also completely reversible, so it could become very useful when coupled with intermittent renewable energy sources.

The vision behind the IDEAL-CELL project has the potential to help power the world to a greener future.

The project was coordinated by ARMINES in France.

- 1 'Innovative dual membrane fuel cell'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Energy'.
<http://cordis.europa.eu/marketplace/search/offers/10086>

ENERGY AND TRANSPORT

Solar energy's new star

Photovoltaic solar cells are proving their value as viable renewable energy sources, but more needs to be done to enhance their efficiency. Designing novel silicon crystals at the nanoscale is making great strides in this area.

Climate change and dwindling fossil fuel supplies is fuelling innovation in the renewable energy sector, including solar power. This, in turn, is stimulating innovation in the materials sector, as researchers look for more efficient and cost-effective ways of capturing renewable energy, such as solar rays.

When it comes to photovoltaic solar cells, silicon nanocrystals

can help enhance the efficiency of various architectures, such as multi-junction solar cells, or low-cost, optimised, thin-film solar cells.

Equipped with EU funding from the Seventh Framework Programme, the SNAPSUN¹ project is seeking to develop fully tailored and optimised silicon nanoparticles and to incorporate them in a wide-band

gap material, such as silicon carbide or transparent conductive oxides (TCOs). This will enable high conversion efficiency of over 25%.

To date, the three-year project, which began in June 2010, has produced silicon nanoparticles using three distinct and original techniques: chemical vapour deposition, physical vapour deposition, and chemical synthesis. Nanocomposite materials based on these silicon nanoparticles were produced using a wide-band-gap semiconductor matrix.

In addition, an advanced characterisation method known as transmission electron microscopy tomography was developed and validated for the three-dimensional distribution of silicon nano-particles inside the nanocomposite materials prepared

by the consortium, which brings together six partners from six EU Member States.

SNAPSUN technology is increasing the efficiency of energy production from renewable resources. As such, it will be possible to reduce dependence on fossil fuels supplies.

The project was coordinated by the French Atomic Energy and Alternatives Energy Commission (CEA) in France.

1 'Semiconductor Nanomaterial for Advanced Photovoltaic Solar cells Using New concept of nanocrystal and conductive host'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies'.
<http://cordis.europa.eu/marketplace> > search > offers > 10336



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Establishing the basis for intelligent transport systems

An EU-funded initiative has worked to provide the information needed for making decisions on transport systems in Europe's busy cities. Efforts thus address the continuing challenges of urban sprawl and citizen mobility.

The main aim of the CONDUITS¹ project was to develop a robust system of key performance indicators (KPIs) to be used by decision-makers for projects on intelligent transportation systems (ITS). In addition, the consortium sought to promote the exchange of best practice experiences between municipalities with experiences in the topic.

Other areas of activity deemed central to achieving the project's objectives included a review of ITS in Europe's cities, examining anticipated developments in ITS, and linking performance indicators with the current traffic situation. Work focused on

highlighting the most promising areas and research avenues for urban ITS, and facilitating the decision-making process with a standard means of measuring the benefits of new systems. Also, partners recognised that by working to lower the risk and uncertainty of ITS application, more private high-tech investment could be attracted.

Project efforts resulted in the launch of the CONDUITS website and the formation of a network of 34 cities ('city pool'). These span Europe and five international cities. City context was analysed and the background set up for reviewing ITS in cities,



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in Europe and internationally. Also, scenarios were defined for studying future needs and ITS applications.

CONDUITS brought together transport authorities from five European cities, three universities, a private small business active in systems integration, and the networking organisation Polis. The KPI system has been scheduled for testing through case studies in London (United Kingdom), Paris (France) and Rome (Italy).

The project was coordinated by the Institute of Studies for the Integration of Systems (ISIS) in Italy.

1 'Coordination of network descriptors for urban intelligent transportation systems'.

Funded under the Joint Technology Initiatives contributing to research themes of the FP7 specific programme 'Cooperation'.
<http://cordis.europa.eu/marketplace> > search > offers > 6547



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Infrastructure recycling hits the road

The latest research from European nations on recycling of material such as asphalt from old roads will contribute to the sustainability of road infrastructure and promote a cleaner environment.

With over 5 million kilometres of road networks, the EU is exploring ways to recycle old road infrastructure and materials once they are decommissioned. Often, tonnes of rejected materials are discarded in a way that compromises the environment and litters the landscape, calling for a reliable, environmentally sound end-of-life strategy for disused infrastructure. This was the objective of the recent EU-funded project DIRECT_MAT¹.

Primarily, the project aimed to disseminate knowledge and recommendations on dismantling and recycling of road and road-related materials. It gathered 20 project partners from 15 European countries to document the latest data, technologies and practices in the field. From this information, the project team built a highly authoritative and informative website that outlines practices about discarded materials such as concrete, steel and

tar. In addition, it published best practice guides and benchmarked the different recycling methods involved.

As well as enabling correct reintroduction of road-related waste products back into new roads, the project provided a tool for keeping daily records of sites where road dismantling was ongoing. Monitoring these job sites helps the EU to refine its standards and technical information to improve recycling even further.

Although half the reclaimed asphalt pavement is recycled in the Union, each country has its own laws and practices, calling for better harmonisation of strategies across the EU-27. With free online access to best practice guides and useful case studies, policy-makers and stakeholders can upgrade the recycling of road materials significantly. Researchers and scientists will also be able

to inform their research and feed their findings back into the project website, positioning the EU as a leader in recycling road materials. This represents yet another victory in ecology and sustainability for Europe.

The project was coordinated by the French institute of science and technology for transport, spatial planning, development and networks in France.

1 'Dismantling and recycling techniques for road materials - Sharing knowledge and practices'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace> > search > offers > 10301

ENVIRONMENT AND SOCIETY

Observing the ocean under Arctic ice

Scientists are developing new technology to study the Arctic Ocean under and through the ice that covers it.

In recent years, numerous research projects have addressed monitoring of the Earth's oceans. While efforts have proved quite fruitful in technological developments for monitoring open oceans, ice-covered areas in polar regions have been severely under-sampled due to technical limitations.

The lack of data makes development of predictive models difficult if not impossible. Thus, understanding of ocean and ice interactions and detection of climate change signals from polar regions has been limited.

EU funding of the ACOBAR¹ project should facilitate significant improvement in understanding. Scientists are developing and testing new technologies to observe systems in the polar oceans.

Deployment of gliders and floats under the ice as well as 'advanced ice-tethered platforms' (AITPs) are being exploited. Technologies to facilitate data collection and analysis include acoustic techniques and communications technology for use between underwater and surface platforms.

Results include the ability to determine the internal Arctic Ocean temperature with an accuracy of 0.01 degrees Celsius over a range of 200 km via acoustic thermometry and tomography. Gliders complemented the excellent temporal resolution of acoustic technology with greater spatial resolution between the surface to a depth of 1 km.

A cluster of AITPs provided regional acoustic navigation for



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gliders and floats under the ice. A high-resolution ice and ocean model was then applied using data collected from the observation platforms together with satellite data.

The Arctic Ocean is among the least-explored areas in the world, yet among those most affected by global warming. Increased understanding of its internal environment made possible by ACOBAR will be critical for environmental monitoring, offshore oil and gas exploration, and preservation of

fisheries and the living conditions of indigenous people.

The project was coordinated by Nansen Environmental and Remote Sensing Center in Norway.

- 1 'Acoustic technology for observing the interior of the Arctic Ocean'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
<http://cordis.europa.eu/marketplace>
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Treating wood wisely

Sustainable forest practices could help save our planet, yet this vision requires strong EU funding to support the best, most innovative projects in the sector.

The European forest-based industry is becoming more sustainable overall and providing a variety of eco-friendly solutions to environmentally conscious consumers. However, to ensure that the sector's sustainability flourishes, it is vital to strengthen relevant business models or value chains by ensuring that the smartest industry projects are properly funded. The EU-funded project WOODWISDOM-NET2¹ set out to achieve this objective.

Primarily, the project helped steer the European forest-based industry from a resource-intensive one to a competitive, innovative, value-added and knowledge-driven one based on using renewable raw materials. It launched two calls for EU-funded project

proposals that propelled the industry to new heights.

Under the banner of 'Sustainable, competitive processing and end-use concepts for forest-based industries', the first call encouraged projects on applied research and development that brought the research community closer to product development. This resulted in the funding of nine projects worth a total of EUR 13 million.

The second equally important call was entitled 'Sustainable forest management and optimised use of ligno-cellulosic resources - bridging gaps between research disciplines, producers, consumers and society'. It aimed to improve the use of trees and forests through innovative research and cooperation, and



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selected 13 projects to be funded from a total of EUR 21 million.

Beyond these key initiatives, which supported the best and most promising projects in the industry, the project team upgraded the EU strategy for the forest-based sector on a global scale. It achieved this through the Union mechanism for strengthening non-EU entities to work with EU-led projects under the European Research Area's ERA-NET+ scheme. This is likely to positively affect the forestry sector and wood-related industries around the globe, fostering sustainable practices and encouraging foreign countries to adopt environmentally friendly practices.

The project was coordinated by Nansen, the Finnish Funding Agency for Technology and Innovation (Tekes) in Finland.

- 1 'Networking and integration of national programmes in the area of wood material science and engineering in the forest-based value chains'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies'.
<http://cordis.europa.eu/marketplace>
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Earth system models predict the climate

Accurate climate prognosis requires advanced understanding of the role of selected processes for feedback in the climate system. The COMBINE project analysed how new processes could function as reliable models to predict climate changes.

Changes to the Earth's climate have a major impact on society and the economy. To mitigate climate-related effects, precise prediction tools are required that could provide a sufficient 'window' for adopting the appropriate strategies. To this end, a number of Earth system models have been developed.

The general goal of the EU-funded COMBINE¹ project is to advance the capabilities of climate prediction and projection based on comprehensive Earth system models. To achieve this, partners have been incorporating additional processing in these models, to represent more Earth system parameters.

Following the protocols of the Coupled Model Intercomparison Project for Intergovernmental

Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) simulations, the consortium is performing research on critical physical and bio-geochemical processes in the Earth system. The natural processes which have been selected for this project consist of the carbon (C) and nitrogen (N) cycles, aerosols coupled with clouds and chemistry, stratospheric dynamics, and ice sheet and sea ice.

Scientists are investigating the natural and anthropogenic factors that determine climate change and affect these processes. For this purpose, new components are being developed and incorporated in Earth system models.

Using an ensemble of seven Earth system models, the COMBINE initiative is assessing the potential



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predictability of climate up to a decade in advance. An important aspect of the project is also to link the climate-simulation models with global and regional impacts, focusing on water availability.

Regarding predictions, the use of surface temperature has shown limited potential, with the exception of the North Atlantic area. The Atlantic multi-decadal oscillation (AMO) appears to be predictable in both the short and long term.

The COMBINE project has successfully generated a substantial number of climate simulations that could broadly support international climate research, and thus the climate

change assessment conducted under the IPCC. Overall, the incorporation of new processes in the Earth system models is expected to facilitate more accurate predictions for future climate conditions.

The project was coordinated by the Max Planck Society in Germany.

- 1 'Comprehensive modelling of the Earth system for better climate prediction and projection'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
<http://cordis.europa.eu/marketplace>
> search > offers > 10057

Zoos for science communication — with public input

A European initiative engaged the active participation of the continent's citizens in helping zoos and marine parks find more effective ways of communicating science.



Changes in the set-up and operation of modern zoos and marine parks in Europe have introduced the areas of education, entertainment, conservation and research for the benefit of visitors. These facilities have great potential for communicating science to the general public and span all ages. They represent a unique vehicle for sharing information on scientific advances and pending challenges to life in Europe.

EU funding of the project EUZOOS-XXI¹ enabled scientists and researchers to take advantage of such settings to engage the public in large-scale activities focused on nature conservation and biodiversity.

Initially, the focus was on identifying available information and resources on topics of biodiversity, endangered species, invasive species and ecological connectivity.

General resources and teaching activities can be accessed on the project website, and many other sources of information have been gathered on each of the four conservation topics. Partners developed a table of contents and several curricula for a teacher activity book that emphasises the use of technology in the classroom.

The project's major contribution took the form of public participation meetings (PPMs). These public consultation workshops brought together particular groups



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of zoo visitors to offer suggestions on how zoos and marine parks can better communicate scientific messages to the public.

The results of each PPM were applied in a demonstration project at selected facilities.

Questionnaires were then used to gather feedback on the effectiveness of the project in engaging visitors with wildlife and habitat conservation. The PPM approach proved very effective, offering zoos and marine parks valuable input on science communication.

Engaging the public in this way has a lot to offer the European conservation landscape — to the benefit of present and future generations.

The project was coordinated by Nordeconsult Sweden in Sweden.

- 1 'EU zoos and science in the 21st century: engaging the public in nature conservation'.

Funded under the FP7 specific programme 'Capacities' under the research theme 'Science in Society'.
<http://cordis.europa.eu/marketplace> > search > offers > 10151

Microbes provide answer to heavy-metal contamination

European scientists joined forces to tackle the problem of soil pollution from heavy metals. Through the extensive testing of various remediation techniques, coupled with modelling approaches, the UMBRELLA consortium provided integrated tools for soil decontamination and future land use.

Heavy-metal contamination constitutes a major environmental problem throughout the world. Emissions from human activities like mining and heavy industry are mainly responsible for this phenomenon. As they are non-biodegradable, heavy metals can persist in the soil, causing severe toxicity to entire ecosystems.

Finding ways to extract heavy metals or to stabilise them in soil minerals preventing wash-out was the subject of the EU-funded UMBRELLA¹ project. The aim was to use micro-organisms as cost-efficient and sustainable bioremediation techniques. To achieve this, project partners focused their research on how microbes could influence

the bio-geochemical cycling of metals and how this could be exploited for soil and water protection.

Among the consortium's aims was to model the remediation processes and understand their influence on large-scale landscapes. This would enable adaptation of the developed technologies to different European climatic, geological and biological settings.

Researchers performed physiological and molecular characterisation of microbial communities and developed microbe-mediated remediation processes. The heavy metal uptake into living systems was closely monitored

and led to the identification of metal-retention mechanisms.

In addition, the uptake of heavy metals by plants was evaluated alongside their growth response in the presence of remediating microbes. The importance of heavy metal transport in water, essential for their uptake into the bio-path, was also examined. Following microbial inoculation, mobilisation by mineral dissolution and stabilisation via biomineralisation were examined to evaluate processes responsible for metal availability in the water in different climates across Europe.

Particular attention was given to the commonly occurring

mycorrhizal fungi, known to colonise the roots of most terrestrial plants. Its beneficial effects on uptake of immobile soil mineral nutrients and increased stability of soil aggregates were given priority for use in sustainable agricultural systems and ecosystem restoration.

Collectively, the information obtained during the UMBRELLA project was incorporated into mathematical models of contaminant dispersion that aimed to link local remediation measures with their regional consequences. Different models applicable to key ecosystem and landscape-scale processes were developed.

The innovation in the project lies in the combination of land-site-specific knowledge with large-scale modelling. Dissemination of these tools to relevant stakeholders will hopefully provide the answer to heavy-metal pollution.

The project was coordinated by the Friedrich-Schiller-University of Jena in Germany.

- 1 'Using microbes for the regulation of heavy metal mobility at ecosystem and landscape scale: An integrative approach for soil remediation by geobiological processes'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
<http://cordis.europa.eu/marketplace> > search > offers > 10053



Minimising viral infection of stone-fruit trees

Sharka viral disease severely impairs the productivity and quality of stone-fruit trees such as the peach. The development of novel, high-throughput detection systems is helping to identify the factors that drive virus infection, spread and diversification.

Sharka, or the plum pox virus (PPV), causes one of the most serious viral infections of stone fruit and the only option of virus eradication is to dispose of infected trees. Understanding the mechanisms of disease onset and progress, combined with sensitive evaluating systems, could help prevent disease outbreaks.

The concept of the EU-funded SHARCO¹ project was to combine prophylactic and genetic solutions to prevent or limit the spread of the sharka PPV. Research activities focused on epidemiology, virology, and genetic and biotechnological aspects.

Using the sequencing information from over 700 PPV isolates,

SHARCO researchers have developed new mini oligo arrays for future virus detection. In parallel, work to understand susceptibility to PPV natural infection as well as the number and species of PPV vectors required for infection aimed to facilitate the development of more accurate assessment methods.

In order to study the biological behaviour and epidemiology of PPV infectious clones, the consortium established orchards at various European locations and tested the impact of PPV infection. The ability of oil treatments to limit natural PPV infection was also investigated.

Since there are no chemical or biological cures for PPV infection, partners focused on the identification of genetic markers associated with plant resistance to the virus. The plan was to use these for improving resistance of plants cultivated in orchards in the future. Coupled with breeding programmes aimed at introducing resistance to PPV in future cultivars, these SHARCO activities were designed to reduce infections in western and eastern European countries.

Furthermore, host and viral factors involved in plant-PPV

interactions were identified and these new resistance mechanisms were transferred to stone-fruit trees by screening for rare alleles of resistance or by silencing host factors indispensable to the virus. Novel host genetic determinants leading to recessive resistance to PPV infection were identified and a patent submitted.

SHARCO deliverables were put forward for the preparation of cultivation guidelines of stone-fruit trees with reduced incidence and spread of sharka disease. Implementation of the biotechnological approaches proposed by the consortium could prove beneficial for stone-tree breeders.

The project was coordinated by the French National Institute for Agricultural Research (INRA) in France.



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1 'Sharka containment'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology'.
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Say goodbye to swine fever

Highly advanced diagnostic and vaccination efforts, coupled with recommendations on how to manage pig farms and wild boar, promise to curb swine fever considerably and eventually eradicate it.

Classical swine fever (CSF), a highly contagious disease among pigs and wild boar, can decimate animal populations and disrupt the food chain. Researchers are constantly looking for ways to

combat the CSF virus (CSFV), including finding effective vaccines. The EU-funded project CSFV_GODIVA¹ is working on a CSF vaccine for both domestic pigs and wild boar. It is also developing

diagnostic tests, looking at better surveillance methods, and improving baiting systems for wild boar.

The project is studying recent developments in new-generation vaccines and molecular diagnostic tools to eventually approve a single-shot live CSF vaccine for use in the EU. It is also assessing the use of antiviral treatment to reduce CSFV transmission, and studying

immunological reactions connected with CSFV infection and vaccination.

Currently, CSFV_GODIVA is working on producing a freeze-dried vaccine for intramuscular injection of domestic pigs and a liquid vaccine for oral administration in wild boar, focusing on quality, safety and efficacy. To increase uptake by boars in their baits, the project team recently determined



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that oak mast and groundnuts are the most attractive flavours for these animals.

Interestingly, the project team ascertained that fast-acting vaccination was more cost effective than pre-emptive culling, a practice that is harmful to ecosystems. It also showed that preventive vaccination of large wild boar populations was necessary to control and eradicate CSF, especially if this was done in early spring.

With respect to surveillance strategies and early-warning systems for CSF, the project team has already identified risk factors and shortcomings, recommending risk-based approaches to fine-tune

surveillance. Work is now being done on improving detection and diagnosis using advanced diagnostic tools and newly developed methods for antibody detection and serological tests. There is also progress using infra-red thermography to easily detect animals suspected of carrying CSF based on skin-surface temperature, although more work is needed in this area.

Another project achievement has been improved knowledge on immunological reactions related to vaccine improvement. Researchers confirmed the effectiveness and reaction times of specific vaccines, in addition to validating that oral vaccination had certain advantages over intramuscular vaccination. More



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findings and recommendations are expected as the project comes to a close, bringing science much closer to the eradication of CSF. This augurs well for the pork industry, animal rights activists and the food chain in Europe.

The project was coordinated by CODA-CERVA in Belgium.

- 1 'Improve tools and strategies for the prevention and control of classical swine fever'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology'.
<http://cordis.europa.eu/marketplace>
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Forests: a renewable resource for everyday materials

With non-renewable resources rapidly running out, scientists are rushing to find viable alternative sources from which to manufacture materials. An EU-funded programme is at the forefront of this research with new innovations that use a nearly inexhaustible resource: forests.

Forests and the by-products of wood and paper mills represent a wealth of renewable resources that can be used to generate

everyday materials. Making and using these materials could reduce energy consumption, gas emissions and harmful waste

disposal, and could even lead to new employment opportunities.

FORBIOPLAST¹ is an EU-funded project that has made huge strides towards developing such eco-friendly materials. The market potential of three of the resulting products (fertilisers, tomato yarn and pots) is already being investigated.

The research team used wood fibres enriched with minerals to create a coated fertiliser that could satisfy a growing demand in cereal and potato crops. They also produced a tomato yarn that could replace over 100 000 tonnes of environmentally unfriendly string currently used in the EU. Tomatoes are the second most important vegetable crop in the world, but the yarn could also be used for cucumbers, grapes and tree grafting.

The project has also produced biodegradable pots which have all the properties of regular pots and are light and inexpensive. These pots can be used in horticulture, tree nurseries and to grow aquatic plants.

FORBIOPLAST researchers have investigated the use of polyurethane foams created from wood

fibres and lignin for certain car parts. In addition, they have developed packaging for the cosmetic industry, which is currently being tested for toxicity and how well it seals. The team found that treating wood fibres with enzymes prior to manufacture made the materials more biodegradable.

The project has given a huge boost to the idea that cheaper, quality eco-friendly materials should be readily available. The fact that these materials are themselves biodegradable means that forests can be continuously recycled and could thus become a virtually inexhaustible resource.

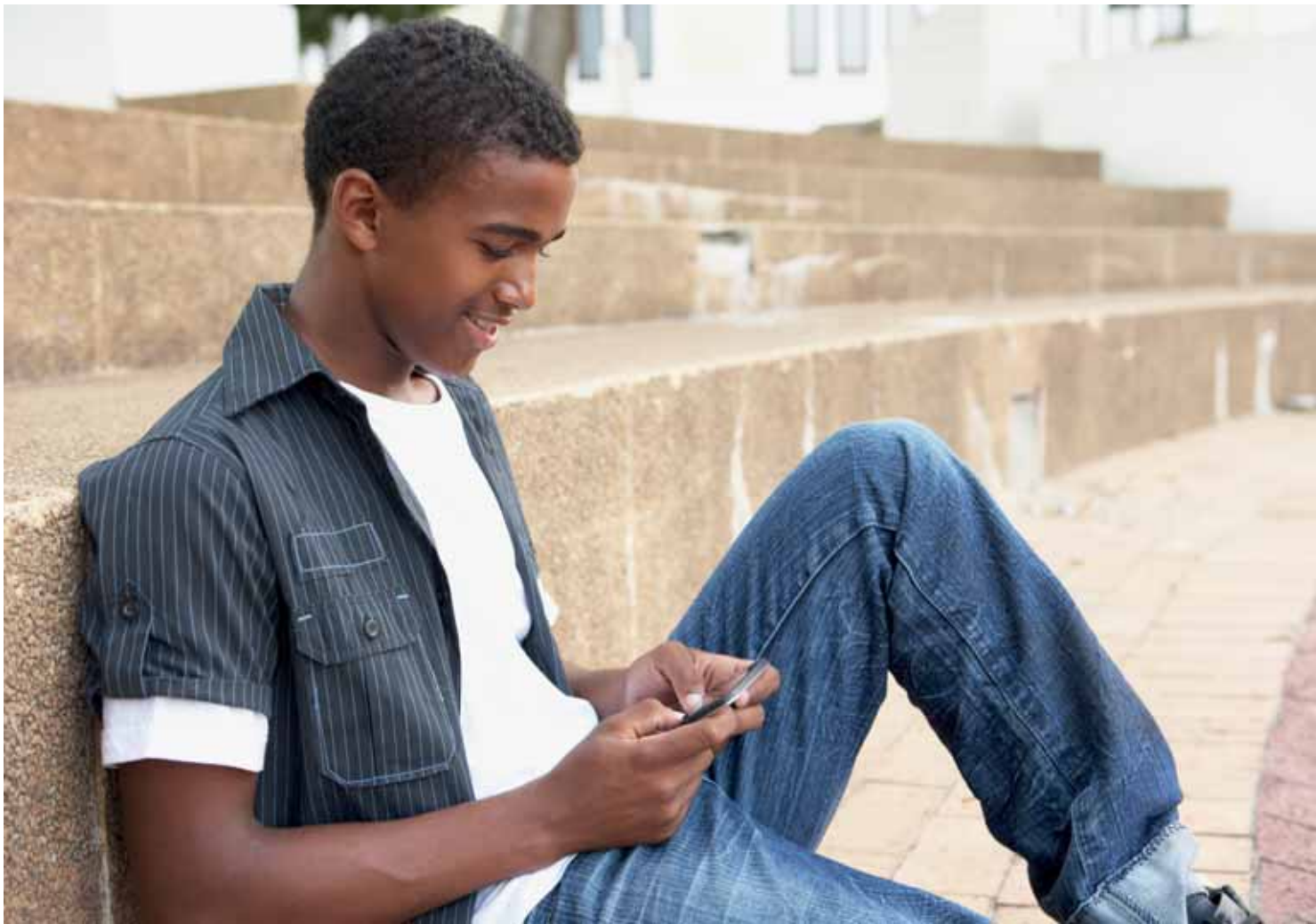
The project was coordinated by the University of Pisa in Italy.

- 1 'Forest resource sustainability through bio-based composite development'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology'.
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Advanced radio technologies for fairer 4G communications

If you live in one of the dozen or so European countries with an up-and-running 4G mobile network, you may have already bought a 4G-enabled phone, hoping to enjoy the blisteringly fast data rates your operator is advertising. 4G services are undoubtedly a big improvement on their 3G predecessors, but significant discrepancies in user experience remain. EU-funded researchers are trying to solve the problem.

'Long-Term Evolution' (LTE) is one of the latest commercial standards for high-speed wireless communication, building upon the GSM/EDGE and UMTS/HSPA network technologies. Besides offering a range of core network improvements and increased functionality, LTE's biggest selling point is its promised increase in network capacity and data-transfer speed. Theoretically, LTE offers download rates of up to 300 Mbps and upload rates of 75 Mbps — around 10 times faster than its 3G predecessor. Operators are not claiming that their networks can achieve those rates in the real world at present, but they are promising LTE clients big gains in speed over 3G. And, while some clients are able to enjoy that, some still do not.

'The advertised rate is essentially the peak rate and that's only possible to reach if you are standing right next to the base station in perfect radio conditions with no one else using the network, if, indeed it's attainable in a real-world setting at all,' explains Alexandre Gouraud, an R&D project manager at Orange's Wireless Interfaces Lab in France. 'For average users, data rates are much less, and for those on the edge of the coverage area, they are lower still.'

Mr Gouraud points out that each change in version and generation of mobile technology has resulted in approximately a factor of 10 difference between peak data rates and average data rates in a cell (the area

of coverage of a cellular base station), and a further factor of 10 divergence between average rates and the rates attained by users located at the edge of a cell. In the case of the LTE standard, this has happened in part because LTE has been competing with WiMAX as an alternative high-speed technology, and developers have focused on peak data rates to win the battle.

'It was important to show the best performance and everybody was focusing on peak rate, but the cell edge has been somewhat ignored,' Mr Gouraud notes. 'Evidently, for operators, this isn't a good thing, as some customers will sometimes experience



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poor coverage and much lower data rates than advertised.'

In order to address that issue and try to ensure a fair service for all LTE users, Orange teamed up with 14 partners, including other mobile operators, equipment vendors and research institutes, to develop and test techniques to boost performance at the cell edge. Their work, carried out in the ARTIST4G¹ project and supported by almost EUR 8.7 million in funding from the European Commission, is feeding into updates of the LTE standard — and will almost certainly be put to commercial use in the near future.

Focusing on interference

The focus of the team, coordinated by Mr Gouraud, has been on two key aspects of cellular networks: reducing interference and advanced signal-relaying techniques.

'If you want to improve cell-edge performance, there are two ways to go about it. One is to densify the network by adding more antennas and making cells smaller, for example, but that is expensive. The second approach is to deal with interference,' the ARTIST4G technical manager explains.

Interference in a mobile network can be thought of as a little like the background chatter at a cocktail party. With many conversations going on at the same time, it can be hard for someone to concentrate on the voice of the person they are speaking to. But if they could easily identify those other conversations and separate them from their own, they could easily blank them out.

That, in grossly simplified terms, is the approach the ARTIST4G researchers took to cancel interference at the receiving end and hence improve data rates and coverage.

Although modern mobile networks were conceived around 'orthogonality', derived from the Greek words for 'straight' and 'angle', implying no overlap, the reality is that transmitted signals will always cross, creating some degree of interference. And although interference can be avoided as much as possible at the transmitter, ultimately it also needs to be dealt with by the receiver.

'Orthogonality does not really exist in practice as there is always some interference. So rather than designing a network around orthogonal signals, we take into account the fact that there will be interference. If we accept that, then we can exploit the interference at the receiving end and hook into the system technologies to cancel it,' Mr Gouraud explains.

Among other techniques, the ARTIST4G team developed and implemented a new framework to improve 'Coordinated multipoint transmission' (CoMP), a 'Multiple-input and multiple-output' (MIMO) technology using multiple antennas to serve cell-edge users from two or more base stations. And they worked on iterative receivers to decode both the core signal and the interference, and cancel out the latter. The team also demonstrated 3D beam-forming in which a signal is directed toward the receiver not just along the horizontal plane as at present but also vertically, greatly reducing interference.

With regard to relays, the team worked on moving relays, which could be placed on the roof of a car or bus, to enhance coverage, as well as deploying so-called Type 2 relays that extend signals from a master base station, with better resource control than Type 1 relays that effectively behave as base stations themselves.

'We developed proof of concept hardware and conducted a large-scale field trial using 15 base stations in Dresden, and some of the technology was demonstrated at the Mobile World Congress 2012 in Barcelona,' Mr Gouraud explains. 'The results have been very promising.'

The project manager points out that the partners have made around 150 contributions to ongoing revisions of the LTE standard, and much of the technology they developed is likely to make its way into commercial use.

'The different partners are using the results of our work internally, and we are also looking to launch a follow-up project to continue the research,' Mr Gouraud concludes.

The project was coordinated by France Telecom in France.

1 'Advanced radio interface technologies for 4G systems'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Information and communication technologies'.
<http://cordis.europa.eu/marketplace> > search > offers > 10536

Satnav innovation benefits Europe

European researchers have come up with a myriad of useful inventions and technological breakthroughs, especially in satellite navigation. The time has come to create demand for these exciting new applications.



A few years ago, Europe registered the highest number of patents worldwide — a good sign in itself for fostering the EU's knowledge economy. However, translation into the expected economic benefits is hampered, largely because of the gap between knowledge generation and low demand for new products and services. The EU-funded project INNOFIT¹ worked on a plan to create demand through different 'instruments', such as competitions and roadshows, particularly in the satellite-navigation sector.

The project approached European regions that wanted to participate in the scheme by adopting

demand-creation mechanisms at regional level to boost local economies, advancing technology and innovation. It raised awareness about opportunities, assessed the potential of the regions and developed policies to support project goals.

In addition, the project created a larger community for global navigation satellite system (GNSS) actors and stakeholders to form partnerships. It sought to encourage the creation of jobs associated with satellite navigation by adopting the new demand-creation mechanisms it had developed.

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Several new ideas for GNSS clusters emerged from the project, with different stages of completion reached in Croatia, Germany, the Netherlands, Spain and Switzerland. The clusters would involve many regional universities and institutes, establishing new platforms for collaboration, technological advancements and job creation. On the international front, even China expressed its interest in networking with the EU, opening the doors for more

collaboration on GNSS technology and helping to boost demand.

Despite the progress, regions implicated in most countries expressed the need for support in terms of designing and implementing policies, as well as creating demand on a regional level. In response, the project helped the regions implement effective mechanisms, processes and supporting policies that create and

safeguard jobs to boost this important high-tech sector.

If the joint action plan is fully exploited, the expected upcoming demand for products and services in the satellite-navigation sector will stoke the economies of many regions. This could, in theory, pave the way for other sectors to follow suit and establish relevant clusters based on demand creation. The novel approach will then become yet

another avenue of success for boosting the EU's knowledge-based economy.

The project was coordinated by CeTIM in the Netherlands.

1 'Innovation benefits Europe'.

Funded under the FP7 specific programme 'Regions of knowledge'.
<http://cordis.europa.eu/marketplace> >
search > offers > 10291



Micro-imaging, analysis and machining in one device

Scientists have developed a multifunctional tool capable of simultaneously visualising, analysing and manipulating materials the size of molecules. The tool will be indispensable in developing miniature devices.

Nanotechnology can be thought of as the engineering of functional systems the size of atoms and molecules. For the field to progress, scientists must be able to see, manipulate and control nanomaterials.

Scanning electron microscopes (SEMs), which use a beam of electrons to illuminate an object, have been around for many years. The technology enables scientists to see objects at the nano scale not visible with light microscopes. They

offer high resolution with large depth of focus and the possibility for microanalysis.

Recently, focused ion beam (FIB) microscopes with both imaging and micromachining capabilities at the nanometre scale have become commercially available. FIB instruments are similar to SEMs except that they use an ion beam (a beam of charged particles generally produced by removing electrons from neutral atoms) rather than an electron beam.

Their use has opened the door to fundamental materials studies and technological applications not previously possible. They are often integrated with SEM columns to produce a versatile dual-beam FIB (SEM) platform.

European scientists took the technology one step further by integrating a dual-beam FIB (SEM) instrument with a hybrid scanning probe microscope (SPM). FIB technology enables micro-structuring and surface modification on the nano scale. The SEM provides options for both chemical and structural analysis. SEM together with SPM facilitates nano-scale chemistry and crystallography imaging.

EU funding of the FIBLYS¹ project enabled investigators to develop a truly unique nano-structuring, nano-manipulation and nano-analysis instrument. The final FIBLYS prototype with complementary use of SEM, FIB, SPM and several analytical techniques thus enables nanotechnological capabilities not previously available with any instrument. Innovations made possible with FIBLYS technology should facilitate the development of entirely new products and processes related to nanotechnology.

The FIBLYS system is certain to become indispensable for research and industrial nanotechnology applications in a variety of fields, including biotechnology, optoelectronics and sensors.

The project was coordinated by the Institute of Photonic Technology in Germany.

1 'Multifunctional analytical focused ion beam tool for nanotechnology'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies'.
<http://cordis.europa.eu/marketplace> >
search > offers > 10084



IT AND TELECOMMUNICATIONS

Make light work for medicine

These days, light is frequently used for all sorts of therapies and medical applications, from cancer diagnosis and treatment to monitoring oxygen in the blood. An EU-funded project to support collaboration between researchers, industry and clinicians is helping Europe become a world leader in this exciting new discipline of biophotonics.

If you were to ask a physicist what they thought was the most important invention of the 20th century, there is a good chance they would mention the laser. The amazing properties of laser light have been used widely in manufacturing, computing, consumer electronics, and telecommunications. You can use a laser to read a CD or weld a supertanker, send data down an optical fibre, or survey a farmer's field for urban development.

Some doctors might have the laser as their top invention, too. Light, and laser light in particular, has become a new tool for therapy and diagnosis.

Shedding light on medical science

Biophotonics is a relatively new scientific discipline which is developing applications for light and lasers in the life sciences — for pharmaceutical research, clinical diagnostics and therapy, and even semi-automated diagnostic systems for doctors and nurses. Biophotonics also deals with the prevention of diseases, and light can be used for precision monitoring of our environment as well as assessing the quality of food.

This is an extremely broad and interdisciplinary field involving physicists, chemists, molecular biologists and other life scientists, physicians and clinicians. However, the healthy diversity comes with a major drawback: fragmentation. Scientists often work in isolation, unaware of important developments and the complementary expertise of their peers in other disciplines. Clinicians, meanwhile, have clear ideas of what technologies they need, but struggle to access R&D expertise.

With a vision to establish Europe as a world leader in biophotonics, the EU-funded PHOTONICS4LIFE, or P4L¹ has spent four years working to unite researchers,



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industry and clinicians from across Europe.

'Biophotonics has great economic potential for many European industrial sectors and will have an even greater socio-economic benefit from earlier, more accurate diagnoses and more targeted therapies,' states P4L's Support Officer, Dr Thomas Mayerhöfer from the Institute of Photonic Technology, Jena, Germany. 'However, many developments in the field are predominantly technology driven, and there is not yet sufficient dialogue between scientists, technology developers, industry, and biomedical end-users. These stakeholders must interact more to identify unmet medical needs and to match them with the latest scientific discoveries and technological innovations.'

P4L is Europe's biophotonics hub. It provides support and training for people working in this area

and facilitates collaborations between research groups, device manufacturers, biopharmaceutical companies and clinical end-users.

The worldwide market value for commercial biophotonics applications and technologies was about EUR 20 billion in 2008. European companies have a strong market presence, accounting for one-third of the production volume worldwide in 2005. 'Europe has so much to gain by building up its capacity, expertise and commercial portfolio in this field,' Professor Jürgen Popp, the coordinator of P4L remarks.

Research spotlight

One of P4L's most significant roles has been to foster collaborative research between European partners, bringing together Europe's best expertise in biophotonics. 'The financial contribution to these research projects is small,' explains Dr Mayerhöfer. 'We cover the cost of travel and

meetings for research partners to meet up and often explore the possibility of working together on larger, more long-term projects.'

So far, P4L has funded over 34 of these year-long feasibility projects which have covered topics such as the use of Raman spectroscopy for non-invasive cancer detection and diagnosis, and the continuous monitoring of brain oxygenation in preterm babies.

'These P4L projects have really focused strongly on end-user involvement,' Professor Popp is keen to point out. 'We insist that clinical end-users are involved in these small projects right from the outset because we believe that R&D in this field must be clinically relevant. There is no point spending time and money on a project that will have no medical benefit at the end or have no real-world application. The only way to make sure new technologies will be adopted and meet

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demand is to get the end-users on board from the very outset.'

P4L also provided the sector with a significant range of training and exchange programmes, conferences and communication campaigns. These include materials such as the 'Handbook of Biophotonics' which has been instrumental in promoting inter-disciplinarity within the scientific community.

An annual summer school has helped to raise the profile of biophotonics across Europe and is highly regarded by biomedical and science students. The event is led by a team of complementary clinical and research-focused speakers who together provide an all-round perspective of the latest medical and technological challenges and breakthroughs in the field.

The network has also funded over 20 PhD students and early

post-doctoral researchers through its short-term exchange programme. These students have enjoyed the opportunity to travel to partner laboratories and facilities to use specialist equipment and learn new biophotonics techniques.

Through local meetings, workshops and 'speed dating' events, the core P4L partners have also established several local clusters for biophotonics researchers and companies. Around 500 participants have been involved with P4L at this local level, many forming new alliances and partnerships and seeking advice on EU collaborations.

The Industry User Club has also been highly successful, attracting 27 members to date. The purpose of the club is to provide a direct link between industrial companies, especially SMEs, and academic network partners. The services of the club have been

presented at six major trade shows.

Lighting the way

Although EU funding for the P4L network has now ended, the core partners are committed to the cause. They will continue to run networking events, the summer school, and support the work of the industrial club. P4L will also make an appearance at the 'World of Photonics Congress' in Munich in 2013 and at the 'European Conference on Biomedical Optics'.

'We are also already planning an event for next year which will bring all our P4L projects together, so researchers can discover the broad scope of biophotonics and meet other researchers,' says Dr Mayerhöfer. 'Going forward, P4L will act a bit like a broker, helping people to work together and facilitating the translation of research into products, new therapies and diagnostics.'

'We will also continue to push the P4L paradigm of demand-driven research. We can already see this filtering into other domains of EU-funded research such as the 'Photonics21 European Technology Platform'. It looks like this approach will also serve to emphasise the Horizon 2020 research programme. In many ways, the promotion of bottom-up R&D is the greatest success of PHOTONICS4LIFE.'

The project was coordinated by Sagemcom SAS in France.

1 'Network of excellence for biophotonics'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Information and communication technologies'.
<http://cordis.europa.eu/marketplace> > search > offers > 10273

A boost for Czech research in communications

EU funding facilitated a significant increase in research capacity in the field of communications for a Czech university. Activities resulted in numerous collaborations with other EU researchers and with industry.

Advanced communication systems and technologies are considered by the EU to be one of the pillars of a competitive knowledge-based economy. Helping Member States in Central and Eastern Europe (CEE) develop their capabilities and become integrated with information and

communications technology (ICT) within the European Research Area (ERA) is an important way to contribute to competitiveness.

The EU-funded ACOST¹ project was conceived to increase the research capacity of the Department of Radio Electronics

(DREL) at Brno University of Technology in the Czech Republic. This was successfully achieved via investment in both human capital and facilities.

ACOST made 40 academic visits that resulted in six new international research projects. Regular seminars by industry experts and project contacts thus produced 37 new research collaborations. The project created eight new post-doctoral research positions (two for women) and two positions for senior researchers.

Funding enabled the update of scientific instrumentation in three different laboratories (experimental satellites, mobile communications and optical communications), all of which joined international research efforts. In addition, ACOST organised or participated in two international conferences and established an industry forum for feedback on research conducted by DREL.

The ACOST project has contributed to a significant

enhancement of DREL's position in the international research scene by strengthening human resources and technology, research-industry collaboration and industry investment. As a result, participation by the Czech Republic in the Seventh Framework Programme (FP7) increased and the university curricula was modified to better meet the needs of industry. Improving the competitive position of the Czech Republic in ICT will no doubt reinforce the standing of the EU in this critically important sector of the economy.

The project was coordinated by Brno University of Technology in the Czech Republic.

1 'Advanced communication systems and technologies'.

Funded under the FP7 specific programme 'Capacities'.
<http://cordis.europa.eu/marketplace> > search > offers > 10126



IT AND TELECOMMUNICATIONS

Public transport for all

A good urban transport system must be inclusive enough to cater for all sections of society, especially the elderly and the disabled. A new set of tools and recommendations will help to achieve this.

Many European cities and governments have established impressive transport systems for citizens, but how accessible these systems are to different commuter segments in reality is debatable. The EU-funded project **MEDIATE**¹ developed different tools to help cities and transport operators upgrade accessibility to urban public transport. From physically challenged travellers to the elderly, the project investigated a number of issues to promote inclusion.

Initially, **MEDIATE** articulated indicators to measure accessibility of public transport that could commonly be used across the EU. It also developed an assessment tool to help stakeholders evaluate strengths and weaknesses of the

transport system in order to outline the steps needed to improve it.

Another valuable outcome was the publication of a good practice guide which featured successful ideas currently in use across Europe to upgrade accessibility. The guide offers specific examples of how accessibility is being advanced in different European cities in very varied geographical, cultural and economic contexts.

In terms of raising awareness and fostering communication, **MEDIATE** launched a comprehensive website to guide stakeholders in furthering transport accessibility and to inform end-users of the latest developments. In parallel, it established an end-user platform that reached out to the different



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sections of society and offered valuable transport advice. Other dissemination tools included newsletters, an engaging video and a brochure published in six European languages.

The most important result emanating from the project has been its contribution to developing a more inclusive urban transport system that offers improved access for all. **MEDIATE**'s tools and recommendations will most certainly help design better transport systems and fine-tune existing ones, increasing the

number of commuters considerably. End-users, cities, communities, economies, job markets and the environment will all benefit from this endeavour.

The project was coordinated by Sintef in Norway.

- 1 'Methodology for describing the accessibility of transport in Europe'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace> > search > offers > 10272



Advancing research collaboration with GÉANT's high-speed infrastructure

GÉANT, the pan-European research and education network infrastructure, is evolving fast. Long considered the most advanced research network in the world, it is now proceeding to comprehensive upgrade to its transmission and switching technology — effectively future-proofing the network to 2020.

GÉANT¹ was set up more than a decade ago to enable research collaboration and knowledge sharing among European researchers and beyond. It has played a pivotal role in facilitating research projects that help maintain European competitiveness and provide insight into solving some of humanity's biggest challenges. **GÉANT**'s advanced network and services enable research across fields as varied as climate change and environmental monitoring, food and energy supply, particle physics and radio astronomy, medicine and bioinformatics.

Together with Europe's National Research and Education Networks (NRENs), **GÉANT** connects over 40

million users in more than 8000 universities, higher education institutes, research institutes, libraries, museums, national archives and hospitals, as well as a further 22 000 primary and secondary schools.

GÉANT is coordinated by DANTE, which plans, builds and operates advanced networks for research and education (including TEIN, CAREN and AfricaConnect). The **GÉANT** consortium consists of a federated community of 31 European national research and education networks (NRENs); Nordunet (representing five Nordic NRENs); the Trans-European Research and Education Networking Association (Terena); and four

associate NRENs plus DANTE. The current iteration of the **GÉANT** project (known as GN3) is also supported by EUR 93 million in funding from the European Commission. It is the NREN partners that deliver the pan-European connectivity and services to users at the local level.

The 500 Gbps roll-out

GÉANT is currently implementing a major infrastructure upgrade, including the latest transmission and switching technology to support up to 2 terabits per second (Tbps) capacity across the core network. In effect, this will future-proof Europe's critical network infrastructure until 2020. 500 Gigabits per second (Gbps) capacity will be available in the core

network from first implementation, delivering circuits across Europe that will allow individual users to transfer data at speeds of up to 100\Gbps, or multiples thereof, thereby enabling faster collaboration on critical projects and meeting the rapidly increasing demand for data transfer.

CERN is the first 100 Gbps customer, linking Geneva to its new data centre in Hungary, to process and store vast amounts of data from the Large Hadron Collider (LHC).

'This is an enormous project, to completely refresh the 50000-kilometre **GÉANT** backbone network, replacing all existing equipment with the latest transmission and switching technology and installing over 150 new pieces of equipment in 10 months,' says Michael Enrico, chief technology officer for DANTE. 'Major projects involving global

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partners, such as CERN's LHC and the forthcoming Square Kilometre Array (the world's largest radio telescope), generate high volumes of data that need to be distributed, analysed, stored and accessed. This need for fast, stable transfer of data depends heavily on the high speed and dedicated bandwidth offered by research networks such as GÉANT, and the need for a terabit network is growing every day.'

The previous version of the GÉANT project (known as GN2) focused on delivering the hybrid network, using the most innovative switching and routing technology. The focus then changed to develop and deliver an expanded service portfolio to enable users to get the best out of the network through their local NREN.

Through its range of connectivity services, researchers (and other users) can select the bandwidth and performance that best matches their needs, with options ranging from high-capacity internet-protocol (IP) connections to ultra-high-speed dedicated point-to-point circuits, including innovative 'on-demand' point-to-point services. These in turn are supported by a comprehensive range of network monitoring and management services to enable consistent, secure, end-to-end performance irrespective of the users' location. Along with its NREN partners, GÉANT's goal is to ensure 99.999% availability through the rapid identification and resolution of network errors and powerful security

features to detect and prevent malicious attacks.

Applications that address authorisation and authentication issues, verifying users' identities and rights in order to grant them access to resources as appropriate, are also being developed and rolled out through the NREN project partners. This enables researchers, academics and others to freely move across network boundaries while maintaining access to their home network and the resources of other NRENs and institutions.

Accelerating scientific research

More than 1000 terabytes of data already pass through GÉANT's IP backbone each day, much of it linked to some of the most advanced and far-reaching research being carried out worldwide.

CERN's LHC, the world's largest scientific experiment, for example, produces over 22 petabytes of data annually, and research networks, including GÉANT, are critical components in delivering this data to scientists around the world.

'We have used the GÉANT infrastructure very extensively... providing us with direct connections between CERN and the major institutes as well as a high-performance IP service that allows us to get the data to and from the smaller institutes around Europe,' says Dr David Foster at CERN.

Similarly, GÉANT and other networks will be crucial for the scientific community to be able to work with the massive amounts of data due to be produced by the Square Kilometre Array, the world's largest telescope — scheduled to be operational in 2020.

Whereas previously scientific data would have had to be physically sent on disks to researchers, via GÉANT the data can be accessed from anywhere at any time, enabling real-time observation of highly detailed information on the universe.

And in the bioinformatics arena, high-speed networks have made possible research breakthroughs, such as DNA sequencing, that have transformed life sciences. With the volume of data generated by biological experiments now doubling every five months, making it available to the global user community has been a major challenge for the GÉANT partners.

Professor Janet Thornton, director of the European Molecular Biology Laboratory-European Bioinformatics Institute (EMBL-EBI), says that without GÉANT, the EBI simply would not exist. 'Because our primary goal is to collect and distribute biological data... without GÉANT we could not do that,' she notes.

Many other scientific disciplines, from earth observation and weather forecasting to chemistry and neuroscience, continue to benefit from the GÉANT network.

GÉANT also has extensive links to networks in North America (via Internet2, ESNET, NLR, NISN and CANARIE), Latin America, North Africa and the Middle East, South Africa and Kenya, the South Caucasus, Central Asia and the Asia-Pacific Region — reaching over 65 countries outside Europe.

Supporting education

In addition, the GÉANT network is supporting the educational community, with many project partners serving universities, high schools, libraries and primary schools.

In higher education, digital learning and lifelong learning are defining trends. As a result, university

campuses are becoming increasingly virtual, creating a need for new collaborative tools and services. Academics and students alike expect end-to-end connectivity and limitless bandwidth, including in the wireless domain.

Similar changes are evident in schools. New, more learner-centric approaches to teaching are being employed, digital tools and resources are being used across the curriculum, while gaming and infotainment are widely seen as an important part of future learning. These and emerging applications will all make increasing demands on the network, with the education sector becoming an increasingly important user group to GÉANT and its NREN partners.

Going forward into the next iteration of the project (GN3plus), GÉANT's vision is to build on its reputation for networking excellence to become a unified 'European Communications Commons', driving knowledge creation, innovation and learning by connecting and supporting the growth of European research and education communities.

'Ensuring that the power of the network is available to all, through simple, easy-to-use services, is at the heart of GÉANT today and in the future,' Niels Hersoug, joint project manager of the GÉANT project, says. 'GN3plus will build on GN3's success by continuing to deliver world-class class networking services with the highest levels of operational excellence to research and education communities within Europe and beyond. We will innovate to meet the needs of the community, helping to develop a competitive European ICT sector.'

The project was coordinated by DANTE (Delivery of Advanced Network Technology to Europe) in the United Kingdom.

- 1 'Multi-gigabit European research and education network and associated services'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Information and communication technologies'.
<http://cordis.europa.eu/marketplace/search/offers/10529>



INDUSTRIAL TECHNOLOGIES



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Researchers help develop next-generation bio-plastic materials

The Dutch company Avantium is leading the way in replacing plastic PET bottles and other oil-based products with 'green' versions made from sugar derivatives — starch, protein and cellulose. The successful technology breakthrough has been partly achieved thanks to the technological expertise brought to the company through the European Commission's Marie Curie Actions (MCAs) mobility support scheme.

Until 2005, the main business for Avantium — a spin-off from the petrochemicals giant Royal Dutch Shell — focused on contract research for the chemical and pharmaceutical industry. The company then decided to broaden its base and move into product and process development to exploit its in-house expertise in the field of advanced catalytic research. It initiated its own R&D programme focused on biomass conversion, in particular using sugar and starch-based products to replace the petrochemical feedstock generated from oil.

To support this move, the company was able to bring in three specialist researchers under the Marie Curie scheme to fill the gaps in its knowledge. Avantium's Chief Technology Officer, Gert-Jan Gruter, former Professor for Polymer Catalysis at Eindhoven University of

Technology, explains: "At that time Avantium lacked the in-depth knowledge of carbohydrate chemistry and bio-based polymers to help it produce bio-substitutes for oil-based products in bulk production chains.

"The objective of SUGAR¹ — a 'transfer of knowledge' project — was to expand the company's knowledge in these areas by recruiting, training and hosting experienced researchers in these fields for a two-year period."

Laszlo Sipos, a post-doctorate researcher, joined the Avantium team as a Marie-Curie fellow in 2006 and succeeded in developing the key elements in the final stage of the process (catalytic polymerisation of FDCA to PEF). This work also resulted in the filing of two patents.

In 2008, Sipos was offered a permanent contract with Avantium as a scientist (now senior scientist) having finished his Marie Curie project. He now leads the technical aspect of the process development efforts towards PEF bottles.

A critical aspect of Avantium's R&D was the development of a bio-based replacement of the PET bottle building block. The introduction of another post-doctorate researcher, Cesar Munoz de Diego, was very successful in developing the required catalytic oxidation process. His pioneering work resulted in two patent applications being filed before he moved back to his native country in 2010, where he continues to work in R&D in Madrid.

A third recruit under the Marie Curie scheme was a software development specialist,

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Nathan Brown. After supporting the development of informatics at Avantium he moved to Novartis in Switzerland and now works with the Institute of Cancer Research in London.

The legacy of all three Marie Curie researchers will be the sugar-based fully recyclable PEF bottles set to steadily replace the familiar PET bottles. The beauty of the PEF bottle is not only its bio-based origin but also its superior thermal and mechanical properties.

The patented technology developed by Avantium is known as YXY (pronounced as icksy) – and represents a family of green building blocks for making materials and fuels that can compete on both price and performance with oil-based alternatives,

but which have a superior environmental footprint.

In December 2011, a pilot plant for developing and demonstrating PEF technology was opened with a capacity of 40 tonnes per year. Avantium has now entered multi-year collaboration programmes with major brands such as Coca-Cola and Danone to introduce PEF to replace petrochemical-based alternatives.

The collaboration programmes, which will continue the development of PEF in readiness for mass production and recycling, are key to securing a smooth transition into the mass-production phase of PEF bottles. Commercial production of PEF is anticipated in about three to four years.

Gert-Jan Gruter commented: “The contribution of Marie-Curie-supported researchers has been essential in enabling us to undertake the very important initial development of these next-generation ‘green’ bio-plastic materials. We believe that PEF will become the new world standard for polyester bottles.”

The project was coordinated by Avantium Technologies in the Netherlands.

1 ‘Value-added chemicals and hydrogen from biomass’.

Funded under the FP6 ‘Mobility’ programme under ‘Marie Curie Actions’.
<http://ec.europa.eu/research> > Information Centre > search > 29318

Keeping European electronics competitive globally

EU sponsorship has supported the development of a secure networking tool to simplify the sharing of information between electronics companies. Better communication along the European electronics supply chain will keep the industry internationally competitive.

Small and medium-sized enterprises (SMEs) in Europe have to keep up with the pace of the global electronics markets. To do this, a strong network of information exchange is needed, starting from product development through to

manufacturing and, ultimately, the customer.

CONVERGE¹ is an EU-sponsored tool that enables such sharing of strategic information between customers and suppliers along the entire supply

chain. It is a portal that allows reliable data to be exchanged securely and confidentially.

Although the portal’s main use is for decision management and access to policy information, a few other tools have also been

integrated. The ‘knowledge explorer’ helps users to share their knowledge with each other and an ‘execution flow viewer’ can graphically monitor live processes.

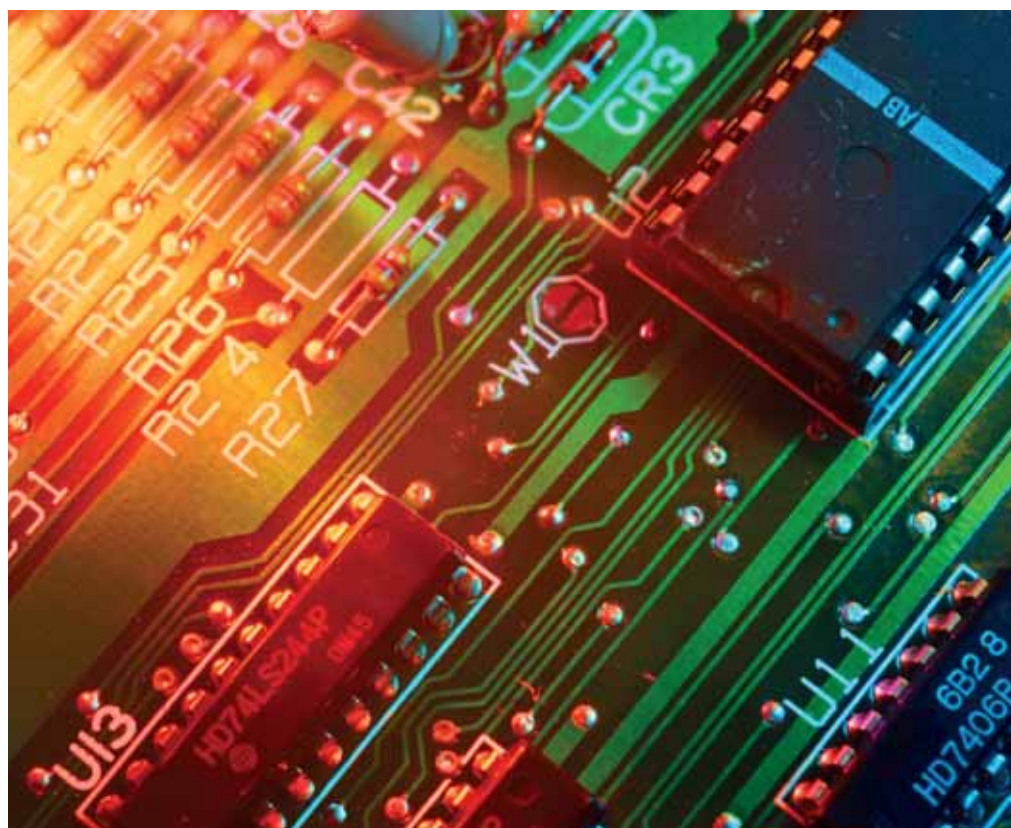
A CONVERGE tool prototype has been evaluated by end-users for its functionality, customisability and impact within their businesses. The portal shortened the response time of electronics manufacturers to changing markets and increased the tactical decision-making capacity of industrial SMEs.

CONVERGE is poised to simplify networking between European companies along the electronics supply chain. This improved communication should enhance SMEs’ ability to plan for and adapt to rapidly changing global markets.

The project was coordinated by CAS Software in Germany.

1 ‘Collaborative communication-driven decision management in non-hierarchical supply chains of the electronic industry’.

Funded under the FP7 specific programme ‘Cooperation’ under the research theme ‘Nanosciences, nanotechnologies, materials and new production technologies’.
<http://cordis.europa.eu/marketplace> > search > offers > 6716



INDUSTRIAL TECHNOLOGIES



High-power fibre lasers with unprecedented accuracy

Over the last ten years, high-power fibre lasers have moved quickly from the research laboratory into production. In stark contrast to traditional lasers, fibre lasers now offer near-perfect beam quality ensuring optimal focus even at long distances. In addition, high efficiency, low operating costs and virtually no maintenance allow for a simple integration into industrial, automated production processes.

Despite the advances, Femtosecond (fs) microprocessing, which occurs in one millionth of one billionth of a second, is still in its infancy and has the reputation of being complex, expensive and unreliable. The LIFT¹ project aims to change this by offering a new, reliable high-power fs-laser source at a competitive price.

LIFT is a EUR 9.6-million funded initiative under the Seventh Framework Programme. Started in September 2009, the

48-month project is coordinated by the Fraunhofer Institute for Material and Beam Technology IWS in Dresden, Germany and has a consortium of 21 partners from nine countries working on various aspects of fibre-laser development. In fact, according to LIFT project coordinator, Dr Udo Klotzbach from the Fraunhofer Institute Dresden, the consortium comprises a whole host of experts including laser suppliers, optical component producers, researchers and application engineers.

In practical terms, LIFT is developing fibre-based short-pulse lasers and an ultra-short-pulsed laser for the so-called gentle 'cold treatment' of materials, avoiding any use of heat, which is particularly relevant for special ceramic materials or thin-film applications. It is also hoping to enhance processes such as remote-laser cutting and welding with a new generation of fibre lasers. In the medical sector, LIFT aims to develop a fibre-laser system which will treat various health symptoms, such as acne, and could eventually also be used to combat certain types of cancer. Crucially, the project will address renewable energies by improving the individual production steps in the manufacturing of solar modules.

Despite the long-term success of established laser technology, such as CO₂ gas lasers, the fastest growing market sector is that of fibre lasers. In 2006, the fibre-laser market segment was 8 % and rose to 10 % in 2008. The general consensus is that by 2013, fibre lasers will have a 30 % share in the overall laser market.

Dr Klotzbach is well aware of this potential and its importance, saying: "In order to protect

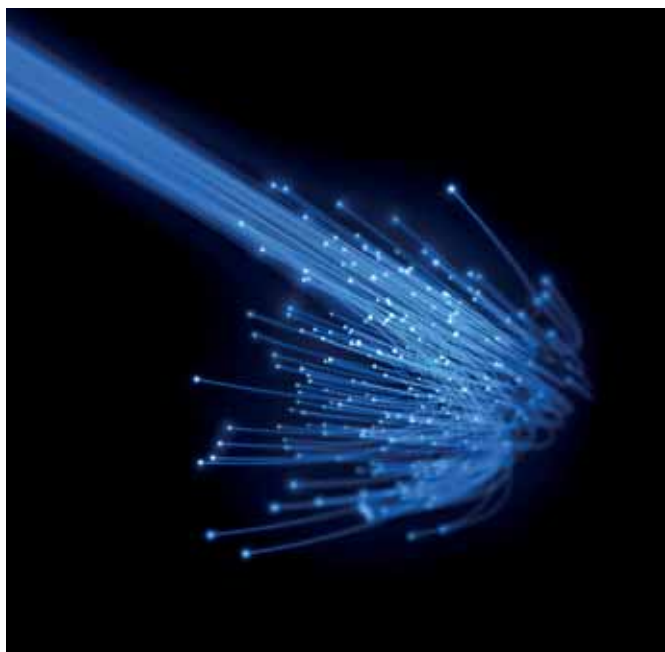
Europe's position as technology and manufacturing leader in industrial laser processing, it is imperative for European laser manufacturers to take a leadership role in fibre-laser technologies."

By the time LIFT finishes in August 2013, Klotzbach hopes to have shared its progress among three key audiences. First, by sharing pre-competitive information and results with the international professional R&D community, he aims to encourage technology progress. Secondly, he wants the general public to understand how European R&D programmes are improving both quality of life and the economy. Finally, by raising such awareness among the general public, he hopes that the next generation of young students will be sufficiently inspired by LIFT to begin a career in science and technology.

The project was coordinated by Fraunhofer-Gesellschaft in Germany.

1 'Leadership in fiber technology'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies'.
<http://ec.europa.eu/research> > Information Centre > search > 29373



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Using nanotechnology to detect food contaminants

Scientists supported by EU funding have developed nanosensors that identify contamination during the production and distribution of liquid foods. These monitoring systems are set to greatly improve quality control and hence competitiveness in both small and large industries.

Every year, hundreds of millions of tonnes of food are discarded in Europe. To avoid this bulk wastage of possibly

contaminated food, producers and distributors need a fast, user-friendly system to screen individual foods.

The NANODETECT¹ project has combined molecular biology and nanotechnology to develop such a system. The technology

is highly sensitive since it uses antibodies to directly detect contaminants in nano amounts of sample (this process is known as an immunoassay).

The researchers decided to pilot the project in the dairy industry since milk is vulnerable to contamination by

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pathogens, toxins and drugs. Milk production is also subject to fraud, whereby goat's milk may be blended with cow's milk, for example. The team successfully created antibodies to detect each of these contaminants, and several patents

and licence agreements are pending.

Software has also been developed for use in conjunction with bench-top and/or hand-held detection devices. The project's prototype device

is relatively cheap, reusable and user-friendly, and easy to clean, sterilise and reactivate.

In future, the technology could be applied to other liquid and solid foods, allowing producers to save time and prevent

large-scale discards or recalls. The devices will also serve to reassure consumers that food production is safe and transparent.

The project was coordinated by TTZ in Germany.



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- 1 'Development of nanosensors for the detection of quality parameters along the food chain'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology'.
<http://cordis.europa.eu/marketplace> > search > offers > 10269

Packing 'peanuts' made of starch and water

Scientists are developing starch-based packaging materials to keep items safe during transport. They should provide an eco-friendly alternative to current petrochemical-based products.

Foam packaging materials are widely used to protect products during transport. They are typically made from petrochemicals (chemicals made from petroleum). Expanded polystyrene (EPS) together with expanded polyurethane (EPU), polyethylene (EPE) and polypropylene (EPP) are the most popular moulded cushion packaging materials.

Despite their popularity, their potential impact on the environment as a result of manufacture, use and disposal have stimulated interest in developing alternatives. The petrochemicals are made from non-renewable hydrocarbons (essentially fossil fuels such as petroleum). Agents applied during processing are associated with greenhouse gas emissions.

In addition, although they are recyclable this has not been fully exploited, perhaps due to a current inability of existing programmes to address needs. With a short service life and

voluminous quantities in use, disposal of the non-biodegradable materials in landfills is becoming problematic.

European scientists initiated the EU-funded REBIOFOAM¹ project to develop materials and processes enabling production of biodegradable foam packaging from renewable raw materials, namely starch and water. In addition, sustainable manufacturing is exploited by using pressurised microwave technology. Energy-efficient microwaves utilise the water content of the materials themselves to generate water vapour that triggers the foaming process.

Work is progressing well and according to plan. Scientists have optimised raw material formulation and the extrusion process to make the starch-based polymers into pellets. They have also designed the prototype mould for use in the pilot production line. The mould is used to produce the three-dimensional (3D) foam



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packaging materials. The microwave cavity has been optimised for the microwave-assisted expansion process, and a semi-industrial pilot process line is being set up.

In the meantime, REBIOFOAM samples have been produced and extensively characterised via various performance tests. A life-cycle analysis (LCA) has also been performed to evaluate cradle-to-grave implications of bio-based transport packaging materials. The LCA demonstrates a significant reduction in carbon dioxide (CO₂) emissions compared to conventional materials.

REBIOFOAM is expected to significantly reduce the environmental impact of transport packaging materials. The new products are

manufactured from renewable resources, produce fewer emissions during their lifetime and are biodegradable. Their use will also significantly reduce the amount of waste currently going into EU landfills.

The project was coordinated by the Novamont in Italy.

- 1 'Development of a flexible and energy-efficient pressurised microwave heating process to produce 3D-shaped renewable bio-polymer foams for novel transportation packaging'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies'.
<http://cordis.europa.eu/marketplace> > search > offers > 6391

INDUSTRIAL TECHNOLOGIES

Sorting increases recycling and reuse of paper

Scientists have developed novel automatic sorting technology for the recovery and reuse of paper. Increased purity and yield with decreased energy consumption should benefit the paper industry and the environment.

Paper is made from trees grown specifically for this purpose, in so-called managed timberlands. Whereas the trees provide the top-grade raw material (pulp) to make paper, recovered fibres can be used to produce other paper products of varying quality. Among these are office-grade paper, newsprint, cardboard and tissue paper.

Wood is subject to supply-and-demand issues just like every other commodity. Rising prices of raw materials and of the energy used for production are increasing pressure on the paper industry to enhance recovery capability and quality. In addition, stricter legislation associated with treatment and disposal highlights the need for new technologies to optimise recovery and utilisation of paper products.

European scientists initiated the EU-funded SORT IT¹ project to develop novel sensor and measurement technologies for more efficient sorting and thus paper recovery. Close collaboration with industry has ensured appropriate specifications of the required purity of materials for given uses.

The comprehensive Unisort SORT IT automatic sorting machinery utilises optical sensors. The team has developed the Fusiosort sensor system, comprising one near-infrared (NIR)/short-wave IR (SWIR) sensor with expanded spectral range (wavelengths of 1 300 to 2 300 nanometres) and two visual inspection system (VIS) cameras. Testing has demonstrated the enhanced ability of the sensor system to detect paper components and quantities for optimal sorting.

Unisort SORT IT combines the optical-sensor technology with an improved pneumatic (using pressurised air) ejector system to eject material more effectively using less energy. Sorting robots have also been designed to sort materials quickly and precisely.

Following pilot tests, end-users awarded certificates of compliance for the sorted grades of recovered paper. The machinery was implemented in a full-scale industrial sorting plant in Austria. Thanks to the new technology, the plant has a capacity of 2000 tonnes per month using just two manual sorters.

Results of life-cycle analyses have been presented to industrial and governmental representatives in waste management as well as to

European standardisation bodies. Technology transfer activities are now under way.

The project was coordinated by Papiertechnische Stiftung in Germany.

1 'Recovered paper sorting with innovative technologies'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
<http://cordis.europa.eu/marketplace/search/offers/6020>





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Advancing engine technologies for space exploration

A strong space exploration programme can contribute significantly to European strategic independence, a specific aim for European space activities. A key to this interdependence could be a new EU-backed throttleable rocket engine, giving Europe a push in the international space race.

The term 'throttleable' in the context of rocket engines refers to their capacity to have varied thrust, crucial for enabling a higher order of vehicle manoeuvrability. The EU-funded SPARTAN¹ project is developing a throttleable propulsion system, a prerequisite for soft and precision planetary landings.

The innovative engine technology will enable a new generation of space missions. The ultimate aim is to help lay the groundwork for future robotic and manned space missions to Mars.

SPARTAN complements other research being carried out by the European Space Agency (ESA) and Italy's Piedmont regional development programme. The focus is on three major objectives: a new engine design with throttling capability, specific

throttleable device development, and the design of a testable landing scenario.

The project will perform real-life demonstrations of these and other high-level technologies. Notably, these demonstrations will include the first European soft-landing drop test employing a throttleable engine and an autonomously guided lander module.

SPARTAN's results will trigger both upstream and downstream research aimed at improving access to planet surfaces in the context of space-exploration activities. The ramifications could also extend to many other space- and ground-based applications. Specific characteristics of the envisaged hybrid-engine technology will have implications for safety, environmental impact, technology life-cycle costs, competitive performance and reliability issues.

Europe's desire for independence in space remains a strong driver for its space programmes, demonstrating European ambition and assertiveness on the international stage. Forward-looking research such as that being carried out by SPARTAN is helping to propel Europe into a leading position in the field of space exploration.

The project was coordinated by Thales Alenia Space Italia in Italy.

1 "Space exploration research for throttleable advanced engine".

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
<http://cordis.europa.eu/marketplace> > search > offers > 10492

SPACE

A European space exploration roadmap

European and international experts have developed a scientific roadmap of key issues for future human space missions as part of a European space strategy.



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Past space missions have demonstrated the feasibility of human survival and high-level functioning in space for extended periods of time. However, technological, medical and psychological issues associated with even longer duration missions must

be addressed before venturing farther afield or staying away longer to collect more valuable data.

The European Space Agency (ESA) has identified returning to the Moon and human exploration of Mars as key

drivers of its high-level space architecture development. Both the ESA and the National Aeronautics and Space Administration (NASA) have developed strategies and roadmaps for achieving future space exploration goals. However, Europe has yet to have its own roadmap approved and endorsed by the European scientific and industrial communities.

A European consortium initiated the EU-funded THESEUS¹ project to fill this critical need while maintaining synergy with the ESA strategy. Scientists developed an integrated life-sciences research roadmap to address such issues as life-support systems, behaviour and performance, prevention of bone loss and recycling technologies.

THESEUS formed and coordinated 14 expert groups (EGs) of European and international experts in related disciplines. The EGs succeeded in identifying 99 key scientific issues representing the most important challenges and

opportunities for future human space exploration. These were used to formulate three main themes consisting of adaptation to space environment, countermeasures to multiple stressors, and tools and methods. The THESEUS roadmap was finalised and officially launched in March 2012.

The consortium is now preparing to publish project results in scientific journals, and is actively seeking future directions based on the successful foundations that have been laid by THESEUS.

The project was coordinated by the European Science Foundation in France.

1 'Towards human exploration of space: a European strategy'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
<http://cordis.europa.eu/marketplace> >
 search > offers > 10361



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Solar sails help remove orbiting space junk

Scientists are developing technology to remove satellites and used rocket stages from orbit at the end of their useful lifetimes. Reducing space debris is critical to the safety of spacecraft, both manned and unmanned.

Earth, seas and atmosphere are often the first words to spring to mind when sustainability is mentioned. However, there is another negative impact of human activity which can be observed in the region from 80 km to 2000 km above the Earth's surface.

Known as Low Earth Orbit (LEO), this region 'houses' numerous satellites orbiting the Earth. Unfortunately, many of these are actually space 'junk' — abandoned satellites whose missions have been completed.

SPACE

Space debris poses an immediate threat of collision with manned and unmanned spacecraft. Current predictions suggest that dangerous amounts of debris will increase at a rate of 5 % per year if the problem is not addressed.

Due to their very high velocities, even small pieces can damage expensive equipment, disrupt satellite television and other communication signals, and even result in human casualties. Focus has turned to end-of-life (EoL) de-orbiting strategies as the only effective means to limit the growth of orbiting debris.

A European consortium is developing a low-cost and low-risk de-orbiting device with EU funding of the DEORBIT SAIL¹ project. The technology is based on the use of a 25m² solar sail and will be suitable for satellites and upper stages of up to 500 kilograms. Solar sails are large, highly reflective spacecraft that use the Sun's photons to propel themselves. DEORBIT SAIL is using the propulsion technology to provide drag, essentially applying propulsion in the opposite direction of flight.

Scientists have designed the system including sail,

deployment module and attitude control. Enhanced active attitude control provides a substantial improvement over passive control. Structural and thermal analyses were conducted with particular attention to loads on the gossamer-like booms that support the sails.

DEORBIT SAIL is expected to deliver the final design of a complete de-orbiting system with independent power, attitude control and communications, as well as demonstrating the sail deployment system.

Projections suggest that if all satellites and upper stages

launched from 2013 to 2020 carry the de-orbiting technology, hazardous space debris will be reduced by 70%.

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

1 'De-orbiting of satellites using solar sails'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
<http://cordis.europa.eu/marketplace> > search > offers > 10046

Avoiding a solar-induced, global black-out

Scientists are creating the first European-wide map of the vulnerability of power grids to extreme solar events. Advanced computer models are providing forecasting capabilities to protect ground-based infrastructure.

The Earth's magnetic field and atmosphere protect it from most solar activity. However, during periods of intense activity, the solar wind, streams of ionised particles, can cause major geomagnetic storms worldwide. The storms can create geomagnetically

induced currents (GICs) in conductors on the ground, including electrical transmission grids and buried gas pipelines. Failures can be severe and widespread, even global, unlike a lightning strike or localised equipment failure.

European scientists are producing the first European-wide, real-time forecasting service of GICs in power systems with EU funding of the EURISGIC¹ project. They are using *in situ* real-time solar wind observations and advanced modelling techniques to develop

a statistical map of GIC risk throughout Europe with predictive capability.

A major challenge has been assimilating geomagnetic data across Europe during the full solar cycle of 1996–2008. In addition to using digital



SPACE

data from archives, researchers are recording new GIC data and digitising old analogue recordings. Measurements from five sites in north-west Russia are ongoing, while digitisation of data from a Hungarian observatory and historical United Kingdom magnetograms are nearly complete.

EURISGIC is exploiting two advanced modelling packages developed in Europe and the United States. Using real-time solar wind observations, the algorithms will enable calculation of GICs within a 30-minute delay of space weather events. Excellent transnational cooperation will facilitate a truly global forecast service in line with both

European and United States goals.

The project is expected to have a significant and positive impact on the protection of Europe's ground-based power infrastructure from space weather events. In addition, the close international collaboration will benefit numerous large regions at the same latitudes.

The project was coordinated by Ilmatieteen laitos in Finland.

- 1 'European risk from geomagnetically induced currents'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
<http://cordis.europa.eu/marketplace> > search > offers > 10387

Forecasting the weather in space

The first European system to forecast the radiation levels in space has been developed by EU researchers. Predicting such space weather can help satellite operators to protect their spacecraft.

Satellites play an important part in our everyday lives: earth observation, communications and navigation systems all depend on them. There are two regions of radiation or high-energy electrons surrounding the Earth. These energetic electrons are trapped in the Earth's magnetic field and are known as the Van Allen electron radiation belts.

Most navigation satellites (e.g. such as the Global Positioning System (GPS)) pass through the heart of the outer radiation belt. Here, they may experience high levels of radiation that can cause damage to both the surface and the internal components of spacecraft.

SPACECAST¹ aims to take information from satellites and

ground-base stations, enter the data into a computer model, and forecast the radiation levels in space for satellite operators.

The EU-funded project has already been very successful. Exactly one year after SPACECAST began the forecasting system for space weather — the variable conditions that

surround the Earth in space — was opened to the public. It provides a forecast of radiation levels up to three hours ahead.

The forecasts are unique in that they cover the whole of the outer radiation belt where the European Galileo satellites orbit the Earth, and where many new navigation satellites will be placed. The Galileo programme is Europe's initiative for a state-of-the-art global satellite navigation system.

However, high-energy electrons in the outer radiation belt are not the only source of spacecraft malfunctions. Work in the project is continuing on forecasting space weather using the solar wind streaming off the Sun, something which can trigger magnetic storms on Earth.

The project was coordinated by the Natural Environment Research Council in the United Kingdom.

- 1 'Protecting space assets from high energy particles by developing European dynamic modelling and forecasting capabilities'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
<http://cordis.europa.eu/marketplace> > search > offers > 10392



Improved models of orbiting objects in the Universe

Charting the movement of celestial objects is important to understanding the nature of our Universe and for planning deep-space missions. Scientists are combining ground- and space-based data for highly accurate motion models.

The broad definition of the term satellite is simply a small body orbiting around a larger body. Hence, the Moon is a natural satellite of Earth. Mars, Jupiter, Saturn and Uranus all have natural satellites as well, the last three with more than 25 each.

Scientists initiated the ESPACE¹ project to advance European expertise in ultra-precise tracking of planetary probes and other deep-space science missions.

Using the expertise gained, researchers will develop new models describing the motion (ephemerides or assigned places at regular intervals) of several natural satellites. Models will include characterisation of their rotation properties, reference systems and systems of gravity, thereby improving the physical knowledge of natural satellites and spacecraft orbit-determination methods for man-made satellites.

The first project year was devoted largely to collecting information on astrometric data (positions, motions and magnitudes of celestial bodies) for natural satellites and spacecraft. Scientists were able to improve available data in several ways. New equipment enabled digitisation of existing photographic plates and thus additional astrometric measurements of two Martian satellites. Digitisation is under way for Saturnian

satellites. The consortium also collected ground-based data on mutual events, in which two bodies eclipse or occult each other. These observations provide highly accurate astrometric data and were collected for the Jovian (relating to Jupiter), Saturnian and Uranian systems of satellites.

Combining space-based observation with ground-based astrometry on a large scale for the first time in Europe is helping scientists improve constraints on models. Investigators plan to deliver highly accurate models of the ephemerides of several natural satellites and spacecraft. Such representations may contribute to the development of new models of the planets themselves based on interpretation of planetary effects on their satellites. Overall, ESPACE results are set to make an important impact on the guiding and analysis of future space missions to planetary systems.

The project was coordinated by the Paris Observatory in France.



1 'European satellite partnership for computing ephemerides'.

EVENTS

Third International Conference on Environment and Industrial Innovation

The Third International Conference on Environment and Industrial Innovation (ICEII 2013) will be held from 19 to 20 May 2013 in Copenhagen, Denmark.

The environmental problems currently facing industrialised countries are not new, but they will continue to escalate if nothing is done. Innovation is essential in this regard. This event will bring together researchers, academics and industrial experts to exchange and promote research and developmental activities.

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

Seventh International Conference on Sustainable Water Resources Management

The Seventh International Conference on Sustainable Water Resources Management will take place from 21 to 23 May 2013 in New Forest, UK.

Water is essential for sustaining life on our planet and its uneven distribution is a source of permanent conflict. The growing human population combined with irregularity in precipitation and water availability may further restrict access to water in certain regions of the world. This problem is made more severe by anthropogenic activities that affect water quality.

The conference will bring together various stakeholders to discuss the most recent technological and scientific developments associated with the management of surface and subsurface water resources.

For further information, please visit:
<http://www.wessex.ac.uk/13-conferences/water-resources-management-2013.html>

Korea EUREKA Day 2013

The 'Korea EUREKA Day 2013' will be held from 28 to 30 May 2013 in Istanbul, Turkey.

Co-hosted by the Ministry of Knowledge Economy (MKE), the Korea Institute for Advancement of Technology (KIAT) and the Turkish EUREKA Chairmanship, this fourth annual EUREKA event will aim to foster cooperation and the development of R&D consortiums between European and Korean SMEs and/or research centres.

It will be an opportunity for attendees to exchange ideas and foster networking and collaboration between bodies such as government research institutes, large companies and SMEs.

For further information, please visit:
<http://www.eurekaday.kr>

Sixth International Conference on Human System Interaction, Gdansk, Poland

The Sixth International Conference on Human System Interaction will take place from 6 to 8 June 2013 in Gdansk, Poland.

Attention to human-machine interaction is crucial, because poorly designed human-machine interfaces can lead to many unexpected problems. A classic example of this is the Three Mile Island accident, where investigations concluded that the design of the human-machine interface was at least partially responsible for the disaster.

The conference will cover theory, design and the application of human-system interactions in the areas of science, education, business, industry, services, humanity, environment, health, and government. It will also act as a platform for exchanging ideas, knowledge, skills and experiences amongst the participants.

For further information, please visit:
<http://www.hsi.wsiz.rzeszow.pl>

Social Robotics and its Sustainability

A conference entitled 'Social Robotics and its Sustainability' will be held from 10 to 13 June 2013 in Brussels, Belgium.

Researchers have exerted considerable efforts to advance robotic technologies and better understand their social implications. In this context, three COST Domains - Individuals, Societies, Cultures and Health (ISCH), Information and Communication Technologies (ICT) and Biomedicine and Molecular Biosciences (BMBS) - have joined forces to discuss innovative research and ideas.

The event will give an overview of the current state of robotics across disciplines in order to discern what the near future may hold. Covered topics will include the evolution of various fields such as engineering and social sciences, the emotional impact of robots, the models of society embodied in robots and the type of societies such robots will contribute to.

For further information, please visit:
<http://www.cost.eu/events/socialrobotics>

EURO-SME 2013

A conference entitled 'EURO-SME 2013' will be held from 11 to 12 June 2013 in Dublin, Ireland.

The conference will consider the role of SMEs in two key European Union initiatives. First, it will look into Europe 2020 and its foreseen smarter, more sustainable and more inclusive economy, where research and innovation are key. Then, it will focus on the Innovation Union which comprises the whole innovation chain from ideas to market, and places particular emphasis on innovation and support measures for SMEs.

The conference is organised by Enterprise Ireland and is supported by the European Commission Directorate-General for Research and Innovation and its Industrial Technologies Programme. It is one of a series of events being held around the Irish Presidency of the EU.

For further information, please visit:
http://www.fpiireland.com/Events.aspx?WCI=htmEvent&WCU=EVENT_PKEY=283

Ninth International Symposium on Paediatric Pain

The Ninth International Symposium on Paediatric Pain will take place from 17 to 20 June 2013 in Stockholm, Sweden.

Children are at risk of inadequate pain management. Misconceptions exist that may contribute to inadequate analgesia for procedures that would routinely be treated aggressively in adults. One of the problematic factors lies in children's difficulty to express their pain to those taking care of them — health professionals and parents — in ways that can be clearly understood. There can be particular difficulties in inferring the sensory and emotional experience of pain in children, especially in neonates and young children.

The meeting will provide opportunities for all delegates to share knowledge and to network. It will cover a broad selection of topics, ranging from basic to clinical science, pharmacology to psychological interventions, acute to chronic pain, and pain within hospital as well as community settings.

For further information, please visit:
<http://www.ispp2013.org/>

EuroNanoforum 2013

An event entitled 'EuroNanoforum 2013' will be held from 18 to 20 June 2013 in Dublin, Ireland.

This EU Irish Presidency event on nanotechnology innovation is Europe's largest nanotechnology and materials conference. Over 70 high-profile international speakers from industry, government and research will discuss the economic and technological impact of nanotechnologies on European growth, as well as the benefits of nanotechnology in every-day life and society. The conference focuses on the impact nanotechnology is having on solving societal problems in the environment, energy and health, showcasing innovation as a driver of economic growth.

With Horizon 2020 beginning in 2014, the conference will also show how nanotechnologies fit into the new structure within Europe's key priority areas of excellent science, industrial leadership and tackling societal challenges.

For further information, please visit:
<http://www.enf2013.eu/>

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