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'Preparing for the advent of smart cities'.

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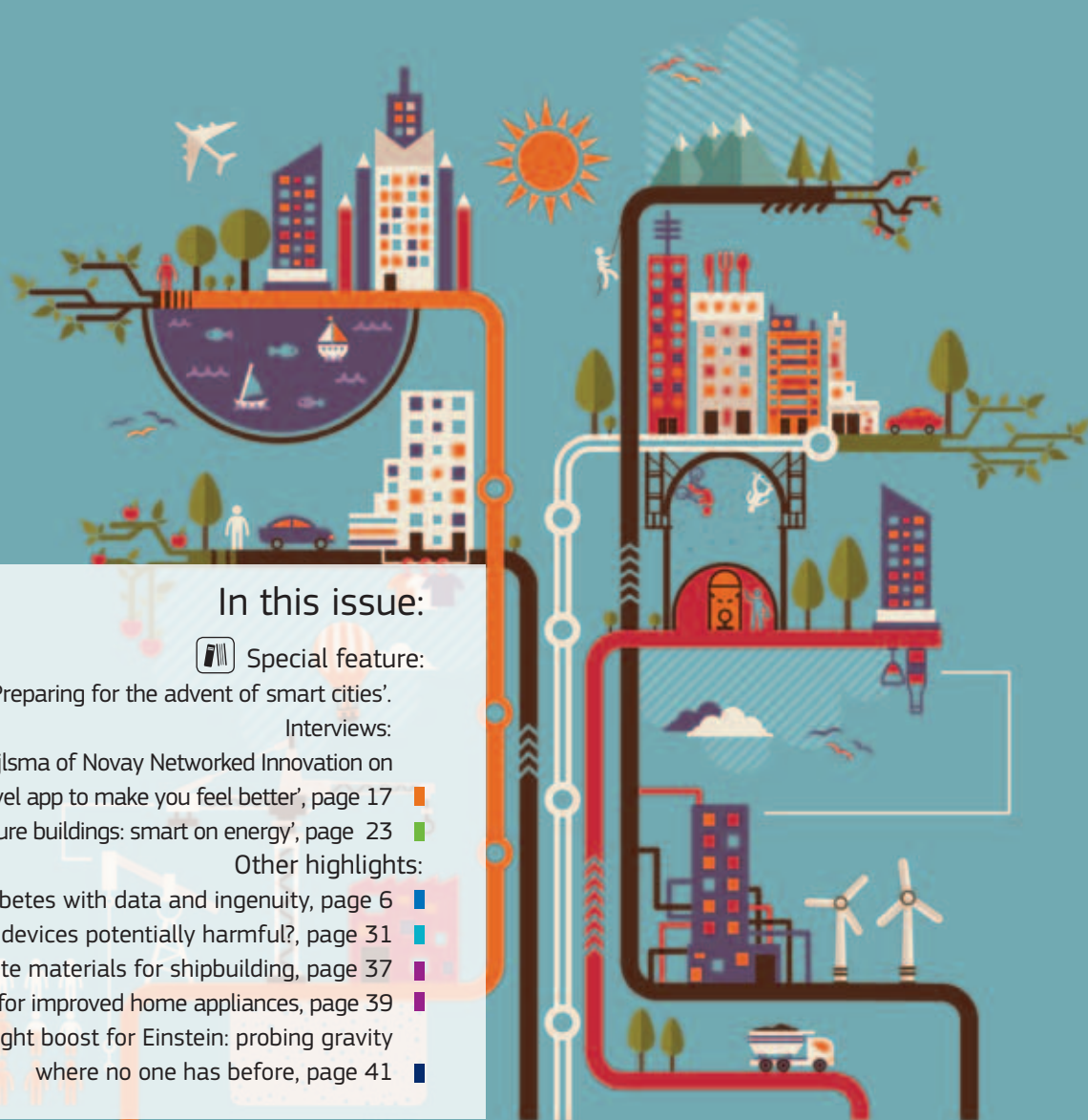
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Creating smart cities for 6 billion brains

The year 2050 is one of targets and mind-bending statistics. Notable among such staggering figures is the fact that, according to the United Nations, by then our planet will be home to 9 billion people, 70% of whom will be living in cities — or 6.3 billion people worldwide!

Contrary to expectations, this overwhelming mass of urban brains is still not capable (unaided) of making our cities smarter. The current thinking on smart cities, which is becoming increasingly popular among stakeholders and policy-makers alike, focuses on the development of ICT infrastructure, sustainability and education. Wireless technologies, networked infrastructures, improved travel solutions, rational and coordinated use of resources, social inclusion, and increased competitiveness are all implicated in the advent of smart cities.

In July 2012, the European Commission launched the Smart Cities and Communities European Innovation Partnership inviting energy, transport and ICT industries to work together, and to collaborate with the Smart Cities Stakeholder Platform to better spread information among stakeholders. Whilst the latter will be holding its annual conference in June, the first initiative translates into yearly calls for proposals and EUR 365 million in funding for 2013.

This issue of *research*eu results magazine* is 'Preparing for the advent of smart cities' by showcasing related research and recent achievements across all sections of the magazine except 'space'. We interviewed Dr Arne Skou, project coordinator of the ENCOURAGE project, (page 23, 'environment and society' section), which aims to enable the creation of smart energy grids in Europe, as well as Marcel Bijlsma from Novay, who coordinated the SUNSET project to provide European citizens with the ultimate travel app for their mobile devices (page 17, under the 'energy and transport' section).

After 'biology and medicine', which starts with 'Managing diabetes with data and ingenuity' on page 6, the 'social sciences and humanities' section opens on page 13 with 'Understanding consumers' eating habits'.

The 'IT and telecommunications' section begins with 'Are wireless devices potentially harmful?' on page 31, followed by the 'industrial technologies' section and a story entitled 'Making safer composite materials for shipbuilding', on page 37. Finally, the 'space' section features new evidence of the reliability of one of the smartest scientists the world has ever seen in 'A heavyweight boost for Einstein: probing gravity where no one has before', 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

The editorial team



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Special topic

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



Videos

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

See you next month!

Coming up in issue 24 of the *research*eu results magazine* — a special dossier called 'Plugging into wireless technologies'.

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Managing diabetes with data and ingenuity

An EU-funded project has developed a device which can predict sugar highs and lows for people with diabetes and provide them with advice on how to manage their glucose levels.

With our increasingly sedentary lifestyles and populations' growing 'body mass index' (BMI), diabetes is on the rise. When patients are able to control and reduce their symptoms, they can still enjoy a good quality of life. But even with the self-monitoring of blood glucose levels, insulin injections and careful management of diet and exercise, patients find it a challenge to manage this chronic disease.

Poorly controlled diabetes is a risk factor for many other medical conditions, from cardiovascular disease to blindness, so health professionals are keen to help people with diabetes to manage their disease well. Early intervention and disease management

prevents the disease from triggering other medical problems.

A diet of data

'The secret to managing diabetes is data and knowing how to interpret it,' says Jens Poulsen, from the Danish pharmaceutical firm Novo Nordisk, the world's largest manufacturer of insulin. 'At the moment, although the data is made available to patients, they don't really know how to use it to make on-the-spot decisions.'

Today, most patients rely simply on the results from their own, self-administered, finger-prick blood tests. If their blood glucose goes up, they inject insulin. If it goes down, they eat a biscuit.

But Mr Poulsen looks forward to the day when diabetes management is proactive, rather than reactive. 'What patients really need is something that tells them their glucose is going to spike unless they take preventative measures,' he says. 'This proactive fine-tuning would keep glucose levels steady and avoid all the ups and downs in sugar levels that can be so frustrating for the patients and damaging to the body in the long term.'

The DIADVISOR¹ project was funded by the EU to investigate how patient data could be used to forecast their glucose levels. 'The DIADVISOR consortium wanted to develop a system which would capture the most crucial patient data, then use this to provide the

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patient with useful information and guide them in their diabetes management,' explains Mr Poulsen, who coordinated the project. 'Short-term forecasts of blood sugar levels allow a patient to take action and improve the management of their disease.'

Vital signs

In the first phase of the project, a group of 90 diabetes patients volunteered to wear and carry a range of devices which continuously monitored their vital signs, not just blood sugar levels but also breathing, heart rate, etc. These volunteers spent three days in hospital and seven days at home during the study.

The wealth of data collected from the patients provided the project partners with a crucial data set from which researchers tried to find correlations. From the patient data they developed algorithms and models which predict future changes of blood sugar levels based on current values.

The research confirmed that the three most important parameters for their predictive modelling were blood sugar levels, insulin levels and food intake. By monitoring these three parameters, the researchers are able to predict the blood sugar levels for patients 20 minutes into the future with an acceptable accuracy in more than 90% of cases. Forecasts for 40 and 60 minutes ahead had acceptable accuracy in more than 80% of cases.

Help at hand

The project partners have created a prototype hand-held device which allows patients

to enter their readings and record their meals. The device's software integrates the forecasting algorithms with a decision-management module, developed in close collaboration with diabetes professionals, which guides patients in how they can manage their blood sugar levels. Surprisingly, the device needs little or no calibration to individual patients.

An extreme example illustrates the process. A patient has a low glucose reading and then eats a chocolate bar. When you plug these values into the system, the predictive algorithm shows that within 20 minutes blood sugars are going to spike perilously high. After telling the device they have just eaten some chocolate, the system recommends an insulin shot, which will prevent the spike from occurring.

'Using ICT to predict what will happen if no action is taken is just one side of the story,' Mr Poulsen remarks. 'What is most useful to a patient is some advice on what they can do about it.'

The project has been careful to demonstrate the clinical safety of their system. 'We are talking about people's lives,' Mr Poulsen observes. 'We cannot develop a system which makes dangerous and inappropriate recommendations, so we have set very high safety criteria.'

The project trials show that the predictive power of the system is clinically useful up to two hours ahead. The advisory component is also safe: its recommendations perfectly matched those of real doctors 88% of the time, and of almost 1500 recommendations

made during testing it never provided harmful advice.

These results were achieved in a final trial in which 55 patients spent three days following the recommendations of DIADVISOR and three days following their normal routines.

'A large-scale trial in the future is crucial to show whether DIADVISOR actually makes a difference in the daily lives of patients,' says Mr Poulsen. 'Our preliminary short-term results are promising: the time people spent in debilitating hypoglycaemia was reduced by DIADVISOR. Up until now people have speculated that automated advice for patients would improve control. The DIADVISOR consortium has now demonstrated this can be achieved. Partners in the consortium are now considering how to proceed to exploit the results of the DIADVISOR project and develop something to help patients maintain tighter control of their blood sugar and keep it in the normal range.'

The project was coordinated by Novo Nordisk A/S in Denmark.

1 'Personal glucose-predictive diabetes advisor'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Information and communication technologies' (ICT).
<http://cordis.europa.eu/marketplace> > search > offers > 10693
 Project website: <http://www.diadvisor.eu/>

Reducing pain in infants

Alleviating procedural pain in infants is just as important as treating their conditions. A thorough investigation of different analgesics, their efficacy and side effects has been performed by an EU-funded consortium to help choose the best regimen.



About one in five newborn babies needs special care due to pre-term birth or other complications. Most of these infants are subjected to painful and often distressing procedures, necessitating the administration of analgesics to alleviate the pain.

Several studies have shown that opioid treatment in newborns reduces pain and stress responses. However, these drugs also have side effects related to plasma concentrations of the drugs and their metabolites.

The main aim of the EU-funded NEOPIOID¹ project was to assess the effects and safety of opioid treatment in pre-term and full-term newborn infants. One of the project's objectives was to improve the analgesic treatment by performing a detailed study of the pharmacokinetics and pharmacodynamics of morphine. In addition, alternative drugs to morphine, such as fentanyl, were explored.

Since analgesic administration varies between European countries, the NEOPIOID project performed a clinical study to investigate the pharmacokinetics and genetics of the analgesic drugs. Furthermore, an epidemiological study of the



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current clinical practices using sedatives and analgesia in the EU was performed.

Pharmacokinetic analysis of fentanyl demonstrated rapid metabolism of the drug in infants regardless of term. An interesting association was also found between the 'catechol-O-methyl transferase'

(COMT) polymorphism and susceptibility to pain, including the amount of opioids needed.

Various morphine metabolites (M3S, M6S, M3G and M6G) were validated during the course of the NEOPIOID project and the doses required for newborn infants at different stages of development were determined.

Partners are hopeful that dissemination of the project findings to paediatricians and nurses across Europe will ensure safe administration of opioid analgesic treatment, thereby achieving the best care for infants.

The project was coordinated by the Karolinska Institute in Sweden.

- 1 'No pain during infancy by adapting off-patent medicines'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
<http://cordis.europa.eu/marketplace> > search > offers > 10347
 Project website: <http://www.neoopioid.eu/>

New drug targets cancer's unique adaptations

EU-funded researchers are taking the fight against cancer to the inner workings of tumour cells. They are developing drugs to target the unique cellular pathways that have allowed tumours to adapt to low levels of oxygen.

Scientists have known for a long time that the immediate environment of a tumour receives less oxygen than the rest of the body. This state of low oxygen is known as hypoxia and is a major cause of the spread of cancer to the rest of the body. It also causes the body to respond poorly to chemo- and radiotherapy.

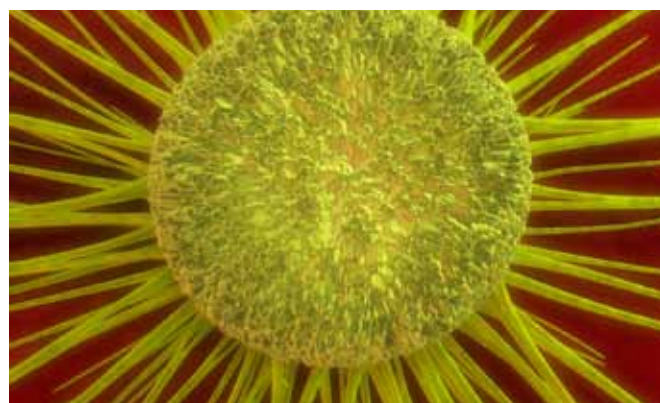
Normal cells cannot survive hypoxia, which means that tumour cells have adapted their cellular machinery to cope with less oxygen. The EU-funded METOXIA¹ research consortium is in the process of exploiting this adaptation to develop cancer-specific, low-toxicity drugs.

The 21 research partners, including some of Europe's leading cancer clinics, have already identified a protein that responds to

the slightest reduction in oxygen. This protein is known as 'hypoxia inducing factor' (HIF). It regulates the genes responsible for the cell getting its energy and maintaining its environment.

For example, HIF regulates 'carbonic anhydrase IX' (CAIX), which is involved in maintaining acidity levels in the cell. The researchers are applying for a patent for a chemical that would inhibit CAIX and thus the cancer cell's ability to regulate its own acidity. Further studies are being carried out to ensure that the chemical really is specific to CAIX only.

The team have also found that the cellular pathways involved in hypoxia are the same as those involved in resistance to chemotherapy. They have identified a target on this pathway, as well as a potential drug, which will



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hopefully lead to another patent later on.

Part of the project includes animal testing and three-dimensional (3D) modelling for preclinical studies. New technology to detect oxygen levels in the immediate environment of cells is also being developed.

The team has expertise from clinical and experimental medicine, molecular biology, synthetic chemistry, biophysics and electronics at their disposal to develop new drugs. For some of the most pervasive cancers in

the world, like lung, breast and prostate cancers, METOXIA promises to deliver huge benefits.

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

- 1 'Metastatic tumours facilitated by hypoxic tumour micro-environments'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
<http://cordis.europa.eu/marketplace> > search > offers > 10303
 Project website: <http://www.metoxia.uio.no/>



Health effects of noise

Recent studies have revealed the extent of the damage to health that can result from noise, prompting the need for more in-depth research on the topic. Factors such as pollution and age distribution must also be considered in such research.

The link between noise and health has prompted the EU to fund research into the phenomenon, raise awareness about the adverse

effects of noise, and propose solutions to address them. The EU-funded project ENNAH¹ took up these challenges by establishing a

research network of experts in the field and reviewing existing literature on noise exposure and health.

The project sought to improve noise-exposure assessment in health studies and build more accurate models in this respect. Another interesting correlation the project team studied is that

between noise and air quality. In 2010, they conducted a workshop in Athens on 'measuring health outcomes relevant to environmental noise exposure' and provided recommendations for evaluating noise effect in future health studies. They also studied existing methods to evaluate the health impacts of policy scenarios or actions.

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disorders in children, as well as fertility, diabetes and hypertension among adults. They also include heart attacks and strokes in the elderly, implying a much stronger impact of noise on health than previously acknowledged.

would positively impact the well-being of citizens across Europe.

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

Future research areas identified by the project include investigating the number of noise events, studying peak sound events and documenting duration of noise exposure. ENNAH has also encouraged assessing the validity of existing noise maps when used in health studies. The project has laid the groundwork for a strong research network on the topic, a move that

- 1 'European network on noise and health'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
<http://cordis.europa.eu/marketplace> > search > offers > 10480
 Project website: <http://www.ennah.eu/>

Many recommendations emerged from the workshop, such as distinguishing between short- and long-term effects, analysing exposure-disease pathways more

efficiently, and measuring outcomes for the specific age groups under scrutiny. The age-related research priorities highlighted include growth effects, puberty disorders and sleep

A new age in pharmaceuticals

Novel drugs, for advanced therapies, are currently emerging from European research, and the EU is ensuring that their safety and quality come first.

Pharmaceuticals have evolved significantly, in parallel with the rapidly growing area of translational research. Perhaps the most notable of these developments are 'advanced therapy medicinal products' (ATMPs) that are based on gene therapy, somatic cell therapy or tissue engineering. However, these complex 'next-generation' drugs pose challenges for the regulators who must balance industrial competitiveness with drug safety and efficacy for patients.

The EU-funded project ACADEMIC GMP¹ aims to assess how EU regulations have affected the progress of these new medicines. These regulations were designed to encourage free movement of ATMPs in the EU and enhance their marketability through 'good manufacturing practices' (GMP), ensuring quality and safety at the same time.

In a bid to gather enough data about regulatory impact, the project

team conducted a survey of GMP facilities covering 800 manufacturers and developers in 36 European countries. It undertook a preliminary analysis of the data and began designing an electronic tool to map the ATMP landscape for policy-makers and researchers. This was supported by a number of workshops that fostered debate, in addition to establishing an online platform for information exchange.

The survey, unprecedented in scale within the ATMP sector, highlighted successful institutions that followed the EU regulations in question. It also revealed that academia was often not involved in the development and manufacturing of ATMPs — and therefore called for more involvement of university institutions in trials and validations. Moreover, the project team identified a lack of harmonisation of ATMP-related regulations among EU nations, a situation which stifles research and exploitation of promising new therapies.

ATMPs, the team prepared a comprehensive report on the success of ATMP regulation, covering trends, threats, benefits and opportunities.

Another key achievement has been the establishment of a web-based data platform for policy-makers and researchers to guide strategic decisions in medical regulation, business modelling, forecasting and innovation policy. Thanks to the project, a wealth of best practices, recommendations, common standards and stronger academic involvement will ensure successful development and commercialisation of ATMPs in the EU.

The project was coordinated by the Hospital Klinikum rechts der Isar of the University of Technology of Munich in Germany.

- 1 'The impact of Regulation (EC) N° 1394/2007 on the development of Advanced Therapy Medicinal Products (ATMPs): an academic perspective'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
<http://cordis.europa.eu/marketplace> > search > offers > 10287
 Project website: <http://www.academic-gmp.eu/>

Several workshops have successfully debated the project's findings, such as one on 'The regulation of advanced cellular therapies'. In addition to a number of valuable project publications on regulating



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Gene therapy for retinal disorders

The retina is the visual sensory receptor of the central nervous system. Novel treatment approaches for retinal degeneration disorders, based on the transfer of the functional gene, could benefit millions of patients worldwide.

Inherited diseases of the retina, like 'retinitis pigmentosa' (RP) and 'Leber congenital amaurosis' (LCA), are caused by mutations in genes preferentially expressed in the photoreceptor cells. Currently, there are no available therapies for these disorders. Gene therapy constitutes a promising avenue for therapy in the eye, mainly because it is an immune-privileged site.

By using vectors derived from the 'adeno-associated virus' (AAV) that

are known to efficiently transfer genes into the retina of animal models, the EU-funded AAVEYE¹ project tried a new gene-therapy approach for the photoreceptor neurons in the retina.

Vector development consisted of the construction of safe AAV vectors that enabled efficient gene transfer and regulated gene expression in photoreceptor cells through the use of microRNAs — small, non-coding 'ribonucleic acid' (RNA) molecules.

Experiments in large animals demonstrated prevention of the spread of these vectors to the brain.

Introduction of the normal, 'healthy' gene into the photoreceptors of animals which carried the muted genes associated with RP and LCA resulted in significant inhibition of retinal degeneration. These results prompted AAVEYE partners to plan a clinical trial to test the efficacy and safety of AAV-mediated gene therapy for LCA.

The experimental work also led to the identification of mechanisms leading to photoreceptor death and to the discovery that inhibition of certain cell-cycle proteins could prevent cell death.

A cohort of RP and LCA patients were genetically analysed for mutations in the respective PDE6B and AIPL1 genes, and clinically characterised with respect to disease phenotype.

This information will form the basis for future clinical trials of photoreceptor gene transfer in humans.

These scientific discoveries could have an immediate impact on patients' health when implemented in clinical applications. Most importantly, the AAVEYE study carried out the groundwork for gene therapy to become a potent treatment for retinal degenerative disorders.

The project was coordinated by Fondazione Telethon in Italy.



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1 'Gene therapy for inherited severe photoreceptor diseases'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
[http://cordis.europa.eu/marketplace?search > offers > 5821](http://cordis.europa.eu/marketplace?search>offers%205821)

Unveiling how our genome is protected

By conducting research into small 'ribonucleic acid' molecules (RNAs), Dr Ramesh Pillai is trying to understand how the genome protects itself from an internal threat — namely 'transposons' or 'jumping genes', which can cause mutations. He was awarded an ERC Starting Grant in 2010.

Every cell in our body uses small snippets of genetic material (called small RNAs) to identify and control the activity of specific members of more than 25 000 genes (constituting about 2 % of the human genome). Apparently, 50 % of our genome plays host to sequences called 'junk DNA' — constituting repeated letters of the genetic code — which are unnecessary for the functioning of the cell. These sequences have a sinister potential, as some of them move about

— removing themselves from one location and setting up at a new location in the genome.

Since 2003, researchers have become aware of the existence of a special type of small RNA — called 'Piwi-interacting RNAs' (piRNAs) — and current studies are trying to understand their genesis and functioning. Dr Pillai's research under the PISILENCE¹ project draws from protein biochemistry, computational biology, mouse genetics and cell biology

to explain how the genome defends itself against 'transposons' which threaten its integrity. 'Our genome is populated by mobile alien DNA elements called "transposons" or "jumping genes" which can move freely within the cell, resulting in mutations. To locate and destroy such troublemakers, the germ cells of all animals produce particular molecules called piRNAs. Animals lacking these defenders are infertile. My group is studying how these small defenders are generated, and how they

function while protecting the genome,' he explains.

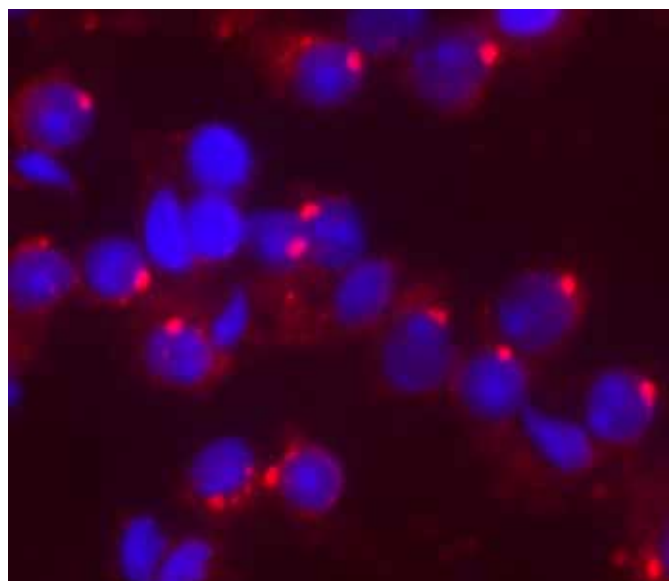
Dr Pillai has shown that 'Piwi' — a protein in our genome that binds the small RNA — is a small RNA-guided enzyme (or 'nuclease'). Once the small RNA has identified transcripts (or DNA codes) from the target jumping genes, the Piwi protein destroys it by cutting it up. His research group has shown that mice — which are genetically engineered to lack this activity — are infertile as a result of a failure to control transposons. The group has identified 'partner' proteins ('Tudor proteins') that team up with Piwis to combat jumping genes by birthing

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new piRNAs, and has revealed that Tudor proteins distinguish Piwis (from thousands of other proteins) by reading out specific chemical modifications on Piwis.

The team is studying whether the formation of this protein complex can be regulated, thereby making the path taken by the piRNA to the targeted DNA more responsive to cells' requirements. Current efforts are aimed at understanding other components needed for

the cell to produce piRNAs. His laboratory uses next-generation sequencing techniques and collaborates with biologists in understanding this machinery. One of their goals is to discover how the cell passes on the tricks it has learned in taming transposons to the next generation. It is hoped that this research will have future potential benefits in biotechnology, as any ability to manipulate our genome can be applied to the cure of genetic diseases.



© Project PISILENCE

Piwi proteins activity (red) protecting the integrity of genetic material, DNA (blue) in the normal development of mouse male germ cells

For Dr Pillai, 'Every researcher aspires to an ERC grant as it is indicative of high-quality research. With secured and substantial funding, we can focus on science. The prestige attached to the grant provides visibility within the scientific community, useful for establishing research contacts.' He collaborates with scientists across the globe active in mouse genetics and bioinformatics, besides engaging with other ERC grant holders who use mice as models in their RNA research. He says: 'The ERC provides a high level of funding, for investing well in infrastructure, for covering high costs of interdisciplinary scientific methods, and for establishing fairly large research groups. For early researchers, the grants are a pathway to independence.'

More importantly, the ERC grant has given him the opportunity to hire a specialised team. Originally hailing from India, Dr Pillai leads a highly diverse and international team, with members from Asia, Europe, North and South America and Australia. 'I encourage my team to do good science. I advise those I mentor to pursue research as a career and some of my team members may go on to apply for an ERC grant in the future.'

On the importance of the ERC in the Indian context, Dr Pillai comments: 'The ERC is a facilitator of creative ideas and its funding acts as a magnet for researchers to come to Europe. It offers young scientists from countries such as India the chance to benefit from excellent scientific facilities and to be part of the European research experience.'

Amongst the very first Indian researchers to receive an ERC grant, Dr Pillai was awarded his MSc in biotechnology in India and received his PhD in Switzerland where he also obtained a postdoctoral fellowship at the Friederich Miescher Institute.

The project is coordinated by the European Molecular Biological Laboratory (EMBL) in France.

1 'Small RNA-guided machinery for epigenetic silencing'.

Funded under the FP7 specific programme 'Ideas' (European Research Council).
<http://erc.europa.eu> > Project and results
 > ERC Stories
 Research group website:
<https://www.embl.fr/research/unit/pillai/>

Helping youngsters say goodbye to fast food

Investigation into the habits of overeating and bingeing on fast food among children and teens has led to new ways to avoid temptation and encourage better eating behaviour.



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European children and teenagers are living in a fast-food dominated world, full of temptations that lead to obesity and bad health. As extra weight and obesity become a major concern in Europe, the younger generation is finding it extremely hard to manage its eating habits and impulses. Experts in the field are viewing 'self-regulatory competence' (SRC), which involves controlling impulses for immediate gratification and planning for long-term goals, as a viable solution to this phenomenon.

The EU-funded project TEMPEST¹ analysed incentive schemes to combat overeating. It looked at how to improve and apply SRC

in the young, by considering environmental mechanisms such as banning products and increasing prices of certain foods.

In more specific terms, TEMPEST examined the impact of existing financial and non-financial incentive schemes and considered new experimental incentive schemes on weight-related temptations. It drew up a self-regulation questionnaire for eating that considered avoidance of temptations, controlling temptations, distraction, suppression, rule setting and goal setting. From this, the project found that respondents most often used goal deliberation to avoid overeating. On the other hand, they used



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techniques such as suppression and avoiding temptation the least often.

In parallel, a project survey of adolescents between 10 and 17 years old revealed habits related to disposable income, spending, food accessibility, food advertising, parenting style, family habits and meal practices. Another survey found that popular peers chose unhealthy food items much more often than healthy ones in comparison to unpopular

peers. Not surprisingly, the project's lab work found that exposure to food temptations under supportive circumstances might boost rather than compromise SRC in dealing with overeating.

Through these surveys and findings, TEMPEST gained valuable insight into the overeating habits and environments of children and teens. More importantly, it underlined ways to encourage healthy choices and highlighted

self-control strategies to overcome the temptation of eating unhealthy food, which was preferred to banning these foods altogether. The project subsequently discussed its findings in conferences, in addition to publicising them to parents, teachers, health professionals and policy-makers. It is likely that TEMPEST will help children and adolescents weather the storm of fast food temptations, fostering healthier younger generations across Europe.

The project was coordinated by the University of Utrecht in the Netherlands.

1 'Temptations to eat moderated by personal and environmental self-regulation tools'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Health'.
<http://cordis.europa.eu/marketplace>search>offers>10293>
 Project website:
<http://www.tempestproject.eu/>

The shoe fits for diabetes sufferers

High-tech footwear modelling could potentially bring comfort to millions of diabetes sufferers who have problems in their lower limbs.

Diabetes is a potentially debilitating disease that is set to affect 334 million people by 2030, according to the World Health Organization. One of its most common complications

is 'diabetic foot', which may involve amputation of a part of the foot. In a move to help sufferers, the EU-funded project SSHOES¹ supported the development and production

of footwear and insoles for patients with diabetic foot.

The project defined new industrial systems for the footwear industry, based on three-dimensional (3D) scanning, progressive design and customisation tools. It incorporated flexible production technologies that improved functionality, comfort, health and performance. It also made advances in modelling anatomy, particularly the biomechanics of the lower limb. Moreover, the products were designed to be eco-friendly and to promote sustainable production.

In more technical terms, the design process incorporated advanced software algorithms based on artificial neural networks — processing huge amounts of collected data in order to produce customised footwear. This high-tech approach employs advanced 'computer-aided design' (CAD) tools and accelerometer readings to measure gait activity levels, foot deformation and other parameters in order to create the ultimate shoe. Style and fashion have also been considered, as well as the most appropriate materials for insoles and outsoles.

The new prototype shoe would even be able to measure pressure points, temperature and

humidity inside the shoe itself, in addition to evaluating foot motion. Principally, the process has involved sophisticated 3D scanning equipment for the foot using several cameras, advanced software and two industrial robots.

The technology not only promises to bring relief to millions of diabetics, but also to advance the footwear sector in general, in applications such as those related to occupational or more comfortable fashion shoes. The humble shoe may finally be reinvented.

The project was coordinated by INESCOP in Spain.

1 'Special shoes movement'.

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>10295>
 Project website:
<http://www.sshoes.eu/default.aspx>





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Understanding consumers' eating habits

A well-balanced diet is central to overall healthy living. However, diet-related diseases have increased in recent decades and become a major public health concern in most developed countries. Consumers' information and responsiveness are therefore crucial when they purchase goods. On the occasion of consumers' rights week, Professor Rachel Griffith, an ERC Advanced grantee 2009 based at the Institute of Fiscal Studies in the United Kingdom, explains her research on consumer food-purchasing behaviour, businesses' food-pricing behaviour and the impact on nutrition.

Prof. Griffith comments: 'Poor nutrition has led to a range of health problems. There has been a rise in the availability and consumption of unhealthy foods. However, it is not all bad news. The food industry has been innovative in some areas, such as reducing the salt intensity of foods, but there are still doubts as to whether the food market is working well to align with consumers' nutritional needs.'

In this context, her research in the MAPFAN¹ project aims to understand how shoppers actually make their decisions when buying food, what are the key factors determining their choices and, in particular, what role firms play in forming consumers' decision. Her team is particularly interested in the impact of tax policies, regulation and information campaigns on consumer behaviour.

She says: 'There has been a lot of emphasis on prices and the role they play in consumers' decisions. Prices are pretty much the biggest factor in making purchasing decisions, but prices alone cannot explain consumers' behaviour. There are many other important factors that intervene when purchasing food, such as how much time and effort consumers put into understanding the nutritional properties of a particular food product, how easily accessible that information is and the propensity to self-control.' Talking about self-control, she adds: 'Consumers are often tempted by instantaneous pleasures, e.g. sweets, candies or chocolate bars, and they are not necessarily in a position to balance their short-term satisfaction with their long-term consequences. The way that firms provide

information to consumers can exploit this lack of self-control.'

What makes Prof. Griffith's project truly innovative is that it goes further than existing academic literature by analysing consumers' habits across a wide spectrum — considering people with poor and high-quality diets alike — and considering the interactions of company and consumer behaviours. It also takes into account the impact that government intervention has on consumer behaviour, with a view to informing policies that could ultimately change the market equilibrium.

Her advisory positions within a number of official UK and international bodies have led Prof. Griffith to engage with a broad user community, including >

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policy-makers, civil society, the media and business. Her research is analysing several policies, including the role that taxation would play in changing consumer behaviour.

Taxing times

She has looked at the impact that a minimum price on alcohol — a highly debated topic in the UK — would have on household consumption, and concluded that reform of the current excise tax on alcohol would be more efficient than other current policy tools. Prof. Griffin also examined the role of a tax on saturated fat, a policy that has been applied recently in Denmark; her results showed that the impact of such a policy depends crucially on the precise way it is designed. In ongoing research, she is looking at the ways that such a policy, which focuses on a specific food group, could drive consumers away from one unhealthy product, but lead them to buy another unhealthy product instead. For example, a tax on fats could lead consumers away from crisps but towards sugary products such as chocolate bars or fizzy drinks.

One example of the impact of information campaigns on eating habits is the evaluation of the 'five-a-day' campaign, which recommends eating five portions of fruits and vegetables per day. Her work points to the partial

success of this campaign, although the subsequent increase in the price of fruits and vegetables meant that we have seen little increase in overall consumption levels.

The project team is using rich new data from market research firms in the UK, France and the US. These data include details on the price paid and the product characteristics, including nutritional information (energy, protein, fat, or sugar, the store purchased from, etc.). These 'disaggregated data', which contain millions of observations on purchases made by around 20 000 households over a ten-year period, are proving extremely valuable to the group. They have enabled them to model the market, simulate alternative market situations and to better assess the nutritional patterns across those countries.

Prof. Griffith expects a number of interesting findings from her project, including a better understanding of the way that information helps consumers to make decisions, which will hopefully lead to a more appropriate and effective regulation of the food industry. In her words: 'The idea is not to put the firms and the government face to face but rather to put the right information in the hands of consumers, while rationalising and strengthening the legal base in which the industry is evolving.'

Talking about her ERC grant, Prof. Griffith comments: 'The ERC funding is a very substantial grant, but its attractiveness goes far beyond that; it allows researchers to fully invest in a very complicated problem. Projects like ours, which require long-term commitment, would maybe have been too risky for other research funding agencies to fund.' She also confirmed the prestige attributed to ERC grants, saying: 'The grant helped me to attract good people to my team; it also helped to relieve me from other administrative duties, so that I can now really focus on the core of my research.'

The project was hosted by the Institute for Fiscal Studies in the United Kingdom.

1 'Microeconomic Analysis of Prices, Food and Nutrition'.

Funded under the FP7 specific programme 'Ideas' (European Research Council).
<http://erc.europa.eu> > Project and results > ERC Stories
 Researcher's website: <http://www.ifs.org.uk/people/profile/37>



Providing robotic carers and smart systems for the elderly

As people enter old age it can become increasingly difficult to maintain a good quality of life without help. Perhaps a faltering memory leads to missed meals or drinks, or a decrease in mobility leads to loneliness and social isolation. Many elderly people are lucky enough to have a carer, but sometimes that person — who may be a partner — is also of a similar age and may need help with caring duties.



A team of European universities, research institutes, commercial companies and care organisations have been developing a new type of social carer which can provide help in these and other situations. The EU-funded MOBISERV¹ project has been working for the past three years to create a robot companion for older adults that can remind them about eating, drinking, taking medicines, offer structure throughout the day, and help people to stay active by suggesting a variety of activities.

For example, when a person does not have a drink over a period of time, which can lead to dehydration, the robot will approach them and encourage him or her to drink, or even suggest a specific drink,

based on their preferences or needs. The same applies to food, physical exercises, activities, and also for social contacts. If a person does not communicate with anyone else for a while, the robot will suggest they make a call, or go out to visit someone — helpful advice for those at a risk of social isolation.

The robot is one component of a larger automated system that MOBISERV is developing for elderly people. It includes wearable smart clothes — which can, for example, monitor vital signs or sleeping patterns, and detect falls — and a smart home environment. This will consist of smart sensors, optical-recognition units, and home-automation elements, to detect, among others, eating and drinking patterns, activity patterns, and dangerous situations.

MOBISERV began in December 2009 and a prototype for the social companion robot was

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developed in the second year of the project, after conducting extensive research with end-users and their formal and informal carers.

Based on the findings and the prototype tests, the robot and other MOBISERV services are being improved and fine-tuned to be useful, acceptable and fun to use.

To find out how people experience and feel about this addition to their home, researchers from the University of the West of England in Bristol in the United Kingdom, as well as the Smart Homes Institute

in Eindhoven and care organisation Ananz in Geldrop, both in the Netherlands, will perform extensive user evaluation studies with the robot companion in the coming months. These will vary from usability tests in a home lab, through full-day experience simulations in a test home, to multi-day experiences in people's own homes.

In the upcoming evaluation, people will freely use their robot companion, and carers will personalise and use the system to support their loved ones. The purpose of the evaluation is to enable end-users

and care-givers to experience what MOBISERV can do for them, to further improve MOBISERV, and to find out how to go about bringing this robot to market. The ultimate goal is to enable people to support themselves, and others, in their well-being and independence.

The user evaluations will take place in the UK and in The Netherlands — coming to an end in June 2013. From June to August, the MOBISERV project and its companion robot will be presented and demonstrated at several events throughout Europe.

The project was coordinated by Stichting Smart Homes in the Netherlands.

1 'An integrated intelligent home environment for the provision of health, nutrition and mobility services to the elderly'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Information and communication technologies' (ICT).
<http://cordis.europa.eu/news> > search > 35660



Governing urban shrinkage in Europe's large cities

An in-depth study of shrinking cities can help unveil their problems and find remedies to reverse their downward development. Exchanging knowledge forms the basis for intelligent responses to declining populations and slowing economies.



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As the EU grows, it is opening up a myriad of work opportunities and spurring mobility among its cities and nations. While this generally boosts industry and competitiveness, many urban areas are witnessing a rapid decrease in their population, rendering current laws and policies in some of these areas ineffective or obsolete. The EU-funded project SHRINK SMART¹ studied how governance systems and their policies are affecting urban regions.

To improve urban governance and reawaken development, the project studied

seven disadvantaged regions in Central, Eastern and Southern Europe to analyse shrinkage while also looking at examples in Western Europe. In Poland, the project looked at the cities of Bytom and Sosnowiec, while in Romania it studied shrinkage in Timisoara, the third most populous city in the country. Donetsk in Ukraine, considered a major economic, industrial and scientific centre of the country, was also studied, as was the Czech Republic's third largest city, Ostrava.

In Western Europe, the project looked at Leipzig and Halle in

Eastern Germany, in addition to Liverpool in the United Kingdom. Italy's city of Genoa also benefited from the project team's in-depth studies. Overall, the team was able to identify the impact of shrinkage on urban and regional development, showing how a decreasing population affected the livelihood of communities. It closely investigated the dynamics between local institutional structures, decision-making and the challenges of shrinkage.

Revealing how the public and private sectors interact with governmental institutions and

frameworks in these cities, the project drew up new policy recommendations and tools on how to address shrinkage. Overall, this study could potentially help revitalise these cities and transform them into attractive places to live in, reversing the declining trend and revitalising whole communities.

The project was coordinated by the Helmholtz Centre for Environmental Research in Germany.

1 'Governance of shrinkage within a European context'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Socio-economic sciences and humanities'.
<http://cordis.europa.eu/marketplace> > search > offers > 10910
Project website: <http://www.shrinksmart.eu/>

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Europe's changing attitudes

A stronger collaboration among European nations on conducting social surveys will reveal a more accurate picture of how our perceptions, ideas and attitudes are changing in an evolving planet.

Our world is changing rapidly, and people's attitudes are changing with it. Often, industries, business sectors and policy-makers can find keeping in touch with these rapid changes a challenge which requires better ways to assess trends and attitude shifts. One such initiative is the European Social Survey (ESS), which has already revealed key changes in how we think. Now, the EU-funded project ESS-DACE¹ is improving links among several different institutions and stakeholders involved in the ESS to identify and explain changes in Europe's social, political and moral climate.

Through this initiative, the project team is improving measurement and coordination in order to raise the standards of national surveys. It is training researchers and supplying valuable information to policy-makers, academics and citizens.

To achieve its aims, the project team has been working on refining sampling techniques for participating countries. It has already designed and validated new surveys on issues of democracy and on personal and social well-being. Work has also progressed on ensuring accurate translations of survey questions and concepts among European languages.

In addition, ESS-DACE is focusing on quality enhancement to ensure equivalence of surveys and results in different European nations, in addition to preparing an ESS communication strategy in order to reach all stakeholders. A major achievement so far has been the development of an online ESS tool that has registered over 5000 data users and witnessed over 10000 active data sessions. Efforts are now under way to ensure research



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quality and that data and metadata from participating countries are presented to all end-users in the same format.

Overall, European academics, researchers and policy-makers will gain access to high-quality data through more user-friendly online tools. The improvements and coordination efforts are being highlighted to stakeholders through publications and events, as well as through the European Survey Research Association (ESRA). The project will ensure the continuity of the ESS and consolidate its achievements by establishing a valuable,

accessible and transparent mechanism for assessing the shifting values of Europeans.

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

- 1 'The European Social Survey — Data for a changing Europe'.

Funded under the FP7 specific programme 'Capacities' under the theme 'Research infrastructures'.
<http://cordis.europa.eu/marketplace>search>offers>10281>
 Project website:
<http://www.europeansocialsurvey.org/>



Conserving Europe's cultural heritage

A research team funded by the EU has developed technology to monitor the degradation of historically important buildings and artefacts. Their work should help drive conservation awareness and policies in urban areas.



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Historic buildings, monuments, museum collections and the like are collectively known as 'cultural heritage' (CH). To preserve Europe's CH for future generations and tourism, scientists have to know how exposed surfaces are being affected by the urban environment. Researchers need to be able to monitor the effects of temperature, light, humidity and pollution on the corrosion and soiling of CH.

The EU-funded project TEACH¹ has begun to address this need by developing sensors to assess, diagnose and monitor damage to CH surfaces. One such sensor monitors the dust and soiling of indoor artefacts. Another is a

customisable monitoring kit that can be easily installed on stone surfaces. Small and medium-sized enterprises (SMEs) are set to benefit from the production of these sensors.

During the project, the researchers provided new information about urban air quality in Europe and the Mediterranean Basin, which could inform policies aimed at better protecting CH. To further support decision-makers and conservationists, the scientists have created posters and brochures, DVDs and a website to create awareness around the effects of city environments on CH.

This research could also lead to reductions in the cost of cleaning buildings in Europe. By constantly monitoring the surfaces of buildings, necessary maintenance could be better predicted and organised.

TEACH guidelines are available on the project website and will be updated over the next 10 years to reflect results. It is clear that the TEACH project has already returned positive results in public education, commercialisation, policy advice and predictive maintenance plans.

The project was coordinated by the National Council of Research in Italy.

- 1 'Technologies and tools to prioritize assessment and diagnosis of air pollution impact on immovable and movable cultural heritage'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
<http://cordis.europa.eu/marketplace>search>offers>10298>
 Project website:
<http://www.teach-project.eu/>



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A travel app to make you — and your environment — feel better

Did you ever find yourself wondering what would be the quickest, healthiest and least costly transport options for a trip? Thanks to the SUNSET project and its 'tripzoom' app for Android and iOS, making the most efficient travel choice in real time is now within your reach.

An increasing market penetration by tablets and smartphones, combined with the success of social media, means citizens can now access a great deal of real-time information. Want to find out about traffic jams, delays in public transport departures or simply track down the quickest way or transport mode to get to work? An app, designed for our mobile devices, could enable us to access and share transport-related information and experience — helping us to better organise our daily life in the urban environment.

Stakeholders and policy-makers are increasingly considering how to empower European city dwellers to enhance their quality of life across the EU. In Belgium, Germany, Greece,

the Netherlands and the United Kingdom, for instance, the app 'FixMyStreet' allows citizens to report potholes, broken street lights and similar problems with streets and roads to their local council or responsible body.

In a similar manner, the FP7-funded SUNSET¹ project aims to provide information on, and incentivise smarter travel choices. Kicked off in 2011 by nine partners from four different countries, the project is developing 'tripzoom', an app with ambitions to reduce congestion, increase safety, protect the environment and increase individual well-being in European cities. *research*eu results magazine* interviewed Marcel Bijlsma, SUNSET project coordinator, to find out how SUNSET is helping the creation of 'smart cities'.

What are the main objectives of the project?

The yearly growth in demand for urban transport systems is causing safety, economic and environmental concerns. SUNSET is helping to alleviate these concerns by taking a new approach to urban mobility management using the latest ICT technologies. The project is about cooperation, by sharing travel information and providing positive incentives for travellers, road authorities and others to 'make the smart travel choice'.

To achieve this, we are developing social network services that inform people in a personalised way on their travel >

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© Marcel Bijlsma

Marcel Bijlsma,
SUNSET project coordinator

alternatives, allow travellers to optimise their route, inform them on how to reduce the impact of mobility on the environment, and allow them to set and monitor personal objectives regarding increased individual safety, reduced travel times and costs, improved comfort, and better health.

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

SUNSET is using three living labs, in the cities of Enschede (NL), Gothenburg (SE) and Leeds (UK), to validate the project innovations and measure their impacts in real life. It is an innovative project for three main reasons. First, SUNSET provides personal incentives to make the 'smart travel choice': we have developed an app called tripzoom, a 'logbook' which provides the traveller with insight into his or her mobility profile, actual travel behaviour and its impact in terms of travel costs, CO₂ footprint and calories burned.

Then, SUNSET will build real travel-related communities by allowing individuals to share (part of) their mobility profile on social networks to inform, share experiences with, impress or challenge their friends, family or colleagues. Lastly, SUNSET makes travel a positive experience by allowing individuals to share (part of) their (anonymised) mobility profile with road authorities, and public or private transport-service providers, in return for positive incentives such as premium information, services or rewards.

The dynamic nature of the system means that information, travel advice and incentives can change and respond to changing circumstances during a journey or over longer time spans, such as a week or a month. This allows for informed

decision-making on sustainable mobility by the traveller, by directly providing incentives (additional information, offering a restaurant or a reduced rate for public transport), influencing objectives (like a healthy lifestyle), or influencing preferences (based on reviews and experiences shared on social media).

What drew you to research in this area?

We believe that a people-centred approach, rather than the more traditional focus on infrastructure or modality, can create new cost-effective and flexible solutions to the complex challenges in urban traffic and mobility management. The 'people-centred mobility' approach puts users at the heart of the transport system in terms of needs, priorities, data flows and dynamic responses. It represents an enormous opportunity for the integration of a 'user-led' and individualised approach with the inevitable wider societal ('top-down') objectives in terms of sustainability, health and well-being, equity, safety and economic benefits.

What are some of the difficulties you have encountered and how do you solve them?

We are working here with a new paradigm that raises questions and includes difficulties on different levels and in different areas. First of all, we developed a system that is capable of automatically measuring a traveller's trips 24/7 as they use their smartphone, deduce their trip modality accurately and at the same time preserve battery power. This requires challenging technological innovations in smartphone sensing and data handling.

Secondly, there are important issues in terms of privacy, for instance regarding the tension between individual privacy and the sharing of information on social networks or with authorities, and the tension between the public-service aspect of transport systems versus the potential for commercialisation.

Thirdly, we had to analyse the extent to which city transport providers are ready to work and relate to information coming from the broader public. SUNSET entails changes in the central control of information along with an empowerment of ordinary people in transport governance, and hence a revised relationship between transport providers and travellers.

What are the concrete results from the research so far?

In the first two years of the project, we have designed and developed the tripzoom app in close collaboration with potential

end-users and the ICT infrastructure behind that. The app is available in the Apple Appstore and Google Play by registering via www.tripzoom.eu.

Moreover, up until now our research has provided concrete clues on what types of incentives are most valued by our target groups. Finally, a start-up company has already been created which will bring SUNSET-like personal and social mobility services to the commercial market.

How do you expect your research to help decongestion in cities?

Decongestion is a core objective of our project. We believe that a people-centric approach can make a real difference in influencing and supporting people in making the smart travel choice in a flexible and cost-effective way. Our objective is to reduce rush hour traffic by 5% in the three living lab trial cities.

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

We have now entered the last phase of the project, which is validation of the SUNSET tripzoom app and the concept of incentives in our three living lab cities. We are currently performing several communication campaigns in these cities to market tripzoom and develop the growing user base. In the end, that is the main parameter for success, as users are the key to reaching our city-level objectives in terms of congestion reduction, sustainability, safety and well-being.

1 "Sustainable social network services for transport".



Switch-and-drive batteries eliminate recharging

European scientists are improving technology and standards for switchable batteries made for electric vehicles (EVs). These will eliminate the need for time-consuming charging by affordably and seamlessly switching to a new battery.

The use of all-electric and hybrid vehicles is growing. Switchable battery packs that can be easily installed and removed extend the range of EVs while eliminating the sometimes lengthy process of recharging. However, advanced electronics for enhanced safety and power conversion make integration of switchable battery packs into vehicles much more challenging, particularly considering the lack of standards.

Scientists initiated the EU-funded project EASYBAT¹ to define new concepts for smart insertion and generic interfaces to improve operability between batteries and on-board electronics.

During the first phase, researchers defined system requirements and use cases, taking into account the battery, the car and battery switch station, and the car class description.

The consortium conducted a risk analysis, defined the general solution architecture and identified gaps in standardisation that must be addressed. Standardisation will be critical to project success, especially in achieving an edge on competitors who have yet to achieve standardisation.

Partners also made a list of legal requirements, directives and regulations to be met. Following the development of safety guidelines and a safety tool for batteries, scientists defined design rules for improved battery cycle management. Modules include a 'battery management system' (BMS) and a 'battery status system' (BSS). Communications between the modules was also defined. Finally, EASYBAT conducted an analysis of the environmental impact in three countries (Denmark, France and



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Israel), selected for their variety of energy sources and the ratio of electric to conventional internal combustion vehicles.

EASYBAT intends to work towards standardisation of the battery-swap concept for EVs. This, together with cost-effectiveness, will make EVs an attractive and affordable global solution while simultaneously providing the EU with a competitive advantage over Japan and the United States, where standardisation is lagging.

The project was coordinated by Better Place Labs in Israel.

- 1 'Models and generic interfaces for easy and safe battery insertion and removal in electric vehicles'.

Funded under FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace> >
 search > offers > 10596
 Project website: <http://www.easybat.eu/>



Innovating for more efficient goods deliveries

A new approach to the delivery of goods in urban areas promises improved efficiency, energy use, and provision of related services. EU researchers have worked towards this by integrating pioneering management and vehicle solutions.



Using EU funding, the CITYLOG¹ project was set up to boost the quality of urban delivery of goods. Partners aimed to realise this goal by offering adaptive and integrated mission management coupled with innovative vehicle solutions. They identified three areas that carry potential to improve current city logistics systems: logistic-oriented telematics services, vehicle technologies and innovative load units.

The latter includes a reconfigurable internal layout that enables different uses, such as a mobile pack station — the so-called 'BentoBox', a concept that leads to fewer non-successful deliveries by using a desynchronised delivery process

between operators and end customers.

The initial work entailed identifying functional requirements and designing various tools which subsequently advanced to the implementation phase needed to achieve project goals. Researchers also analysed the main trends in city logistics and collated stakeholder requirements by means of web questionnaires and a public workshop held in Brussels.

The proposed solutions detailed a pre-trip planner, ad hoc maps, dynamic assisted navigation and last-mile parcel tracking, all of which have since been integrated into a common architecture. >

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Regarding vehicle and load unit solutions, CITYLOG focused on technical solutions that would enable full interoperability between the freight bus and distribution van, in addition to the implementation of an effective and reliable BentoBox concept. For load unit operations, project members proposed a vehicle-centred solution and containers with extensible legs.

Field trials for test-case experiments were scheduled in the European cities of Berlin, Lyon and Turin, while plans are under way to introduce a freight bus and two distribution vans in field trials to validate the logistics model.

CITYLOG's innovative approach promises not only better quality services, but a reduced number

of delivery vehicles and optimal use of delivery trucks in urban areas. The far-reaching benefits of CITYLOG's solutions include enhanced energy efficiency along with the prevention of additional infrastructures in the cities.

The project was coordinated by Centro Ricerche Fiat in Italy.

- 1 'Sustainability and efficiency of city logistics'.

Funded under FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace> > search > offers > 10514
 Project website: <http://www.city-log.eu/>



Reducing rail-induced ground vibration and noise

A group of EU-funded researchers are pooling their expertise and efforts to reduce vibration-induced noise for residents close to railway tracks. Proposed solutions will be validated with field tests on major European rail networks.

While rail traffic and rail freight transport in particular is regarded as Europe's most sustainable form of surface transport, the noise and vibration that accompany its use represent the need for improvement. In this context, the RIVAS¹ project has been set up with a view to reducing the impact of ground-borne vibration from rail traffic. The project partners intend to advance innovative technologies to reduce vibration values in residential areas to near or even below the threshold of perception.

Railway operators, infrastructure managers, manufacturers

of infrastructure and rolling stock, construction companies, end-users of vibration mitigation technology, research organisations and universities are focusing work on low-frequency vibration from open lines. While this is primarily a concern for freight traffic, project results might also be applicable in suburban, regional and high-speed operations.

Activities are centred on the vehicle subsystem, track, soil and their interfaces. RIVAS also defines measuring procedures and methods for predicting exposure in buildings and annoyance. The approach takes into

account the need to safeguard the sector's commercial competitiveness. As such, partners are contributing to relevant, state-of-the-art technologies applicable to controlling vibration at source, and mitigating it on the transmission path. Another project goal is to ensure that measures undertaken can be implemented on existing lines (i.e. retrofitting).

To date, RIVAS has agreed on test procedures for determining dynamic soil characteristics, and on measurement protocols for assessing and monitoring the performance of anti-vibration measures. Researchers have also defined appropriate procedures

for predicting exposure in buildings and estimating corresponding annoyance, and classified track and wheel conditions in terms of vibration emission.

A parametric study has been carried out with field tests for vibration-mitigation measures on the transmission path, and partners organised a best practice workshop entitled 'Vibrations — annoyance, acceptance and assuming the challenge to find solutions'.

RIVAS activities set the groundwork for developing new vibration-reduction technologies and optimising solutions already in existence. Further work will include laboratory and field testing at European 'hot spots'. At the end of the project, the results of work carried out in these areas will be used to promote the efficiency of RIVAS-developed mitigation measures.

The project was coordinated by the International Union of Railways in France.

- 1 'Railway induced vibration abatement solutions'.

Funded under FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace> > search > offers > 10889
 Project website: <http://www.rivas-project.eu/>





Urban transport gets smart

Imagine a public transport web or mobile application that tells you the fastest, greenest and cheapest way to get to your destination, coupled with weather information and travel incentives. This exciting new technology has just been developed.

From downtown Bangkok to the rush hours of Brussels, urban traffic is a nightmare for commuters and a time-consuming ordeal that compromises productivity. EU policy-makers are devising ways to combat traffic problems in Europe, and the latest achievement on this front is the development of novel mobility information, or 'info-mobility' services.

Keeping in mind that traffic problems cost around 1 % of total gross domestic product (GDP) in the Union, the EU-funded I-TOUR¹ project attempted to increase transport efficiency and environmental sustainability in novel ways. While most public transport operators offer information via their websites and on smartphones, these efforts have not been consolidated into one

customisable platform that meets commuters' needs.

Addressing this limitation, the I-TOUR system took advantage of wireless technology such as Wi-Fi and WiMax, combining it with localisation technology to offer powerful info-mobility services for multimodal transport. The envisioned next-generation mobility information system would be able to facilitate transport accessibility, find lower prices, offer real-time updates, compare routes and even promote environmental awareness. While current systems offer different elements of this mix, none so far has combined all of them under one powerful system to such an extent.

I-TOUR has successfully defined the system and integrated public



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transport incentive mechanisms to encourage greener and more efficient transport. It developed a new approach to data collection based on an open software platform that seamlessly combines interfaces with data sources from transport operators, traffic controllers and weather centres.

The project has designed a state-of-the-art, user-friendly prototype — accessible through mobile phones and computers — to generate multimodal route options rapidly. The technology estimates public transport load and capacity in real time, making use of video surveillance and motion trackers, providing users with the best possible and least congested routes.

The project's results have been unveiled at several conferences where they were met with very positive reviews, promising to revolutionise public transport in Europe if the technology is adopted.

The project was coordinated by Forinit Servizi in Italy.

- 1 'i-TOUR: Intelligent transport system for optimized urban trips'.

Funded under FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace> > search > offers > 10445
 Project website:
<http://www.itourproject.com/web/>



A business model for European fuel-cell vehicles

A European consortium of automotive industry representatives, suppliers and research organisations has developed a viable business plan for fuel cell integration. It has already spurred a flurry of research initiatives.

Fuel cells convert the chemical energy contained in a fuel such as hydrogen or conventional petroleum-based fuels into electricity. Common examples are the 'polymer electrolyte membranes' (PEM) used in automobiles, which are combined in a configuration called a fuel cell to deliver enough power to the vehicle.

While Europe's supply chain for the necessary materials for these products is well developed and competitive, 'stack integration' (a business model for manufacturing value-added products as well as components) is lagging behind due to the costs and risks associated with commercialisation.

The EU-funded AUTO-STOCK¹ project focused on creating a viable business model for a European stack integrator to be used in automotive applications. The project involved key European players including original equipment manufacturers (OEMs), component suppliers and research organisations.

Together, the stakeholders developed OEM specifications and a stack platform design concept. They also created a technology roadmap focused on meeting the mid-term technical and cost targets using the European supply chain. While the focus was on PEM fuel cells for cars and light-duty vehicles, the consortium explored synergies with



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mass transit buses and off-road vehicles and investigated stationary applications as well. In the end, the consortium successfully defined a business model for the European stack industry.

Project results are being used by partners to guide product development with numerous research proposals in preparation. Clearly, AUTO-STOCK has provided major impetus to the development of a European automotive fuel-cell stack industry.

The project was coordinated by ZSW in Germany.

- 1 'Automotive fuel cell stack cluster initiative for Europe'.

Funded under the FP7 specific programme 'Cooperation' via the 'Fuel cells and hydrogen Joint Undertaking' (FCH-JU), one of the 'Joint Technology Initiatives' (JTI).
<http://cordis.europa.eu/marketplace> > search > offers > 10441
 Project website:
<http://www.fch-ju.eu/project/autostack>

ENERGY AND TRANSPORT



A hybrid transport solution for urban living

A new breed of urban public transport could fill the gap between mass and private transit options.

The EU-funded CATS¹ project represents the final development stages of a new generation of city transport vehicles known as Cristal. It combines two vehicle

and station services in one system.

The first service is a self-service option whereby users can rent a

clean urban vehicle over a short term. The second is a flexible service with a professional driver to shuttle users along a line at fixed time intervals.

The Cristal system has been introduced into three European cities — Strasbourg (France), Ploiesti (Romania) and Formello (Italy) — in order to assess its feasibility. The CATS project is responsible for this task and draws on the insights of transportation system manufacturers, researchers, service providers and end-users across Europe and Israel.

The team is conducting studies on the performance of the system, user needs, the market potential and environmental considerations. In Formello, for example, researchers propose that the most viable solution would

be using Cristal to complement existing regional rail networks.

It was also found that the system would best serve people with reduced mobility, young passengers and tourists. As such, it is set to improve urban quality of life and will result in a drastic reduction in energy dependency, pollutants and emissions.

The project was coordinated by LOHR in France.

1 'City alternative transport system'.

Funded under FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace>search>offers>10815>
 Project website:
<http://www.cats-project.org/>



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Greener aircraft get ready for quiet take-off

Ways of reducing aircraft noise during landing and take-off have been developed. Lower-noise aircraft can now meet our needs for more environmentally friendly air transport.

In years to come, air traffic is expected to grow by 5% every year. Technological advances are required to facilitate this growth, without increasing noise to unacceptable levels. To fulfil these future demands in aircraft noise reduction, new concepts involving airflow control will need to be developed.

Aircraft generate broadband noise whenever air turbulence interacts with solid surfaces. FLOCON¹, an EU-funded project, aims to offer the European aero-engine industry methods designed to reduce broadband noise at source.

Previous attempts at reducing such noise have been hindered by a lack of knowledge about it and the availability of very few accurate numerical models to predict it. FLOCON's ultimate aim

is to enhance the global competitiveness of European aeronautics. It is building on the work of a previous EU-funded project, PROBAND².

To achieve its goals, FLOCON has been designing and assessing noise-reduction concepts that are able to reduce fan noise from aero engines. In addition, the project has developed an understanding of the underlying mechanisms involved in noise pollution. Through the use of state-of-the-art numerical methods — computer simulations — the best concepts to produce prototypes for further testing were selected.

A number of novel concepts for reducing aircraft engine noise have been developed. Several new engine components have had to be redesigned and their



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shape optimised before being manufactured and tested. These new parts include rotor blades engineered with independent internal airflow channels. Numerical work to assess and extend the experimental findings is under way.

The noise-reduction concepts developed in the FLOCON project are broadly applicable to the fan stage of all new aero-engine designs. However, further work will be needed to develop and exploit the recommended methods to reduce aircraft noise.

The project was coordinated by the German Aerospace Center in Germany.

1 'Adaptive and passive flow control for fan broadband noise reduction'.
 2 'Improvement of fan broadband noise prediction: experimental investigation and computational modelling'.

Funded under FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace>search>offers>10388>



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Future buildings: tough and smart on energy efficiency

As the world sharpens the focus on mitigating climate change, smart grid technology is expected to make energy production and consumption more efficient, flexible, reliable and, of course, more sustainable. The ENCOURAGE project set out to achieve these objectives through inter-building energy exchange and systematic performance monitoring.

Increasing energy efficiency by 20% before the year 2020 will not be easy. According to experts, reaching the EU's commitment will require drastic improvements in the way buildings are designed, networked and monitored, as they currently account for 40% of the total amount of energy used in Europe.

From 2007 to 2013, EUR 290 million have been allocated to energy-efficiency projects under FP7. Better insulation materials, greener energy sources, more efficient financing, and better use of information and communication technology are just some of the main paths being explored. ICT, in particular, is expected to help monitor

and synchronise area networks, with the ENCOURAGE¹ project showing much promise in this respect.

With the aim of developing embedded intelligence and integration technologies 'that will directly optimise energy use in buildings and enable active participation in the future smart grid environment', ENCOURAGE is targeting residential buildings and campuses in particular while also being relevant to other types of buildings and built areas.

*research*eu magazine* interviewed Arne Skou, project coordinator of ENCOURAGE, to discuss the project and its role in helping to reach

the EU's energy-efficiency target through improved interoperability between various types of energy generation, consumption and storage devices; inter-building energy exchange; and systematic performance monitoring.

What are the main objectives of the project?

The ENCOURAGE project aims to develop embedded intelligence and integration technologies that will directly optimise energy use in buildings and enable active participation in the future smart grid environment. The desired energy savings will be achieved in three complementary ways. ➤

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© Arne Skou

Dr Arne Skou

First, it is developing supervisory control strategies to coordinate larger subsystems (HVAC, lighting, renewable energy generation, thermal storage, etc.) and to orchestrate operation of the numerous devices operating in such systems. The energy use will be optimised as a trade-off between occupants' comfort, energy costs and environmental impact while considering people's habits, weather conditions, appliance characteristics, local generation and storage capacities, as well as market conditions.

Secondly, using an intelligent gateway with embedded logic supporting inter-building energy exchange, the ENCOURAGE technology will communicate directly with other buildings and local producers to negotiate possible use of the electricity produced locally in their premises. And lastly, we aim to develop novel virtual sub-metering technologies and event-based middleware² applications that will support advanced monitoring and diagnostics concepts. Systematic performance monitoring will ensure that the achieved savings are sustained over a long period of time without adversely affecting the performance of both the mechanical equipment and the actual monitoring and control system.

What is new or innovative about the project and the way it is addressing energy use in buildings?

The main innovative element of the ENCOURAGE project is the development of a new message-oriented middleware, which enables the coexistence of the solutions targeted in our project objectives. The middleware architecture allows for the interoperation of legacy and newly developed systems, also allowing for the coexistence of gateways from multiple vendors, abstracting them into an integration model. The middleware will also be demonstrated at three different sites by using various gateway standards:

the existing SEP (Smart Energy Profile) and a new ENCOURAGE-specific low-cost protocol, which will be promoted by the project partners through national standardisation bodies. The sites demonstrate supervisory control of residential intelligent buildings (Aalborg, Denmark), energy optimisation of high-energy laboratories (Pisa, Italy), and energy visualisation on a university campus (Terrassa, Spain).

What first drew you to research in this area?

Around five years ago, several Danish SME companies pointed out that in order for them to enter the growing market of smart grids and home automation, there was a need for the development of flexible middleware, which supports the coexistence of several vendor-specific gateway protocols. This is both a financial and a scientific challenge, which has been addressed jointly by both national and international partners over the last four years. The companies' needs were very much in line with our interest in developing a flexible middleware platform to experiment with communication protocols for home automation and with automated controller synthesis from our model checking engine UPPAAL. Traditionally, strategies are developed manually, so there is huge potential in automated synthesis as the manual work can sometimes be very complex.

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

The objectives of ENCOURAGE are very ambitious for such a relatively small project and, as it turned out, the idea of having all three demonstrator sites up and running at the same time has proved too demanding. Instead, we have decided to prepare them one at a time — starting with the most complex one in Aalborg. Also, the SEP standardisation work has evolved at a slower rate than expected, which forced the project to include a less-demanding protocol as an interim solution. However, this may turn out to be an advantage for future market opportunities as there is a need for a simpler standard to facilitate the introduction of new home automation devices.

What are the concrete results from the research so far?

A first version of the middleware is currently being tested and the first demonstration of the supervisory control and business intelligence is ready for use at the Aalborg site.

How do you expect your research to help the EU achieve its energy consumption target?

The ENCOURAGE middleware provides the basis for more flexible and reduced electricity use. In addition, there is a need for better coordination with other related projects within FP7 and to demonstrate how a general

cross-domain energy market can be developed. Several ENCOURAGE project partners are currently taking up this challenge in the newly started ARTEMIS Innovation Pilot Project (AIPP), ARROWHEAD³.

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

The immediate next step for ENCOURAGE is the validation phase, where the actual energy consumption at the three sites will be compared with their baselines. The results will be disseminated through the Artemis community and, in particular, we will interact with other projects on the issue of middleware for intelligent buildings. As a continuation of the project, we will experiment with different supervisory control strategies using our UPPAAL suite of tools.

- 1 'Embedded Intelligent Controls for Buildings with Renewable Generation and Storage'.
- 2 Middleware is computer software that provides services to software applications beyond those available from the operating system. The term is most commonly used for software that enables communication and management of data in distributed applications.
- 3 An ARTEMIS Innovation Pilot Project (AIPP) on 'Production and energy systems automation'.

Funded under the FP7 specific programme 'Cooperation' via the EU's 'Public-private partnership for R&D in embedded computing systems' (Artemis Joint Undertaking), one of the 'Joint Technology Initiatives' (JTI).
For further information, see: <http://www.encourage-project.eu/>

Shaping the future of non-food crops

Plants have many potential uses in industrial processes. To make the farming of such non-food crops more competitive, a European study has put forward a series of cropping system recommendations to improve the current situation in Europe.

Non-food crops are increasingly being used as raw materials for biofuel production, and to produce fibres, polymers and pharmaceuticals. But their yield has to be maximised in order to minimise the competition for land with the food and feed sectors.

The main objective of the EU-funded 4F CROPS¹ project was to survey and analyse all the parameters that play an important role in successful non-food cropping systems in EU agriculture.

Initially, partners set out to estimate the area of land currently available for the cultivation of non-food crops and to gauge how this availability would change over the next years. The biggest

share of available land between now and 2020 was recorded in Spain, but they forecast that by 2030 it will be in Poland.

By taking into consideration the selected crops, rotation possibilities, yields and the raw material characteristics, project partners were able to develop specific cropping systems for each climatic area. In addition, they developed different scenarios based on climatic zones, soil and crop type and level of input.

The economic analysis of non-food crops relates to their financial performance. On this basis, the consortium examined all parameters directly related to growers' profitability in many different European countries

and climatic zones. The overall conclusion was that non-food European crops had a very promising future, although today most of them are not making back the 'opportunity cost' of the land devoted to them.

Social impact was also evaluated in terms of rural income, infrastructure development, rural economic development and employment. This was compared to food-crop systems, yielding favourable results.

Overall, the 4F CROPS initiative provided an extensive overview of the current situation in non-food-crop agriculture and land usage predictions for the future. The proposed cropping systems will benefit farmers in a wide range of climatic, soil and crop conditions.

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



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1 "Future crops for food, feed, fiber and fuel."

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

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

> search > offers > 10439

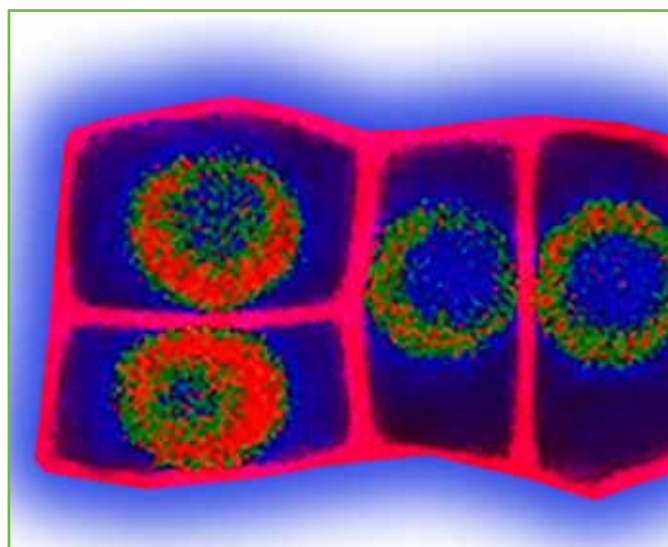
Project website:

<http://www.4fcrops.eu/>



Decoding the origin of plant formation

"Would you tell me, please, which way I ought to go from here?" "That depends a good deal on where you want to get to," said the Cat.' This dialogue, from Alice's Adventures in Wonderland by Lewis Carroll, could well be the starting point of the research carried out by Dr Pankaj Dhonukshe on plant morphogenesis.



© Project DivisionPlaneSwitch

Two neighbouring and recently divided plant cells with 90 degree rotated division planes

The researcher received a Starting Grant of EUR 1.5 million from the European Research Council (ERC) to study the process of oriented cell divisions in plants and the role of the micrometre-long hollow cylinders called microtubules that are involved in it. His recent findings were published in the March 2013 issue of *Nature* magazine.

The Cheshire Cat's observation could in fact apply to any living organism. Indeed, every cell, including plant cells, needs to know where it is heading in order to make the right decisions. Plant cells must know where their top or their bottom is to organise themselves, transport hormones

in the right direction and coordinate the development of their roots, stems and leaves.

Dr Pankaj Dhonukshe from the VIB/University of Gent in Belgium, along with a team of three post-doctorate and three doctoral students, has been investigating how oriented cell division shapes tissues and gradually builds multicellular plant organs within the framework of the DIVISIONPLANESWITCH¹ project. 'Cell polarity' refers to how cells arrange their shape, structure and function asymmetrically along a particular axis. While scientists know a lot about how cell polarity works in animals, the situation in plant cells remains elusive. To address this question, Dr Dhonukshe has focused on the role of auxin, one of the most important hormones involved in the generation of tissues and organs in plants. ➤

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This hormone is transported in a polar way by a protein family called PIN, which concentrates at the top or the bottom of cells depending on their 'polarity'.

Using *Arabidopsis thaliana*, the standard model for plant studies, the research team discovered that the polar localisation of PIN proteins is controlled by the same molecules (CLASP and MAP65) that determine the direction of cell division during plant growth. 'We combined genomics, genetics, molecular cell biology and state-of-the-art imaging techniques, and discovered that the orientation of microtubules regulating the direction of cell division controls the localisation of PIN

proteins, which determine how auxin is transported,' comments Dr Dhonukshe.

This ground-breaking discovery is essential to understanding plant development. 'In plants, cell positions are locked: each cell is attached to a neighbour cell by its wall, like the rooms of a building. The mechanisms by which plants generate different tissues in the presence of rigid cells walls were poorly understood until now. What makes our findings fascinating is that by identifying the molecular machinery new doors are opened to creating new tissue layers and developing new organs, such as branches and leaves,' explains Dr Dhonukshe.

On the long-term applications of his research, he says: 'By manipulating the cell division and the hormone transport, we could design more "efficient" plants to increase crop yield and manage the global food demand'. He added: 'I am confident that, in about 10 to 15 years, biologists could design crop plants to increase the production from the same size of land.'

As regards the importance of his ERC grant, Dr Dhonukshe comments: 'The ERC provides a substantial amount of research money to the young researchers with exciting ideas. It is an essential support when you plan to set up a sizeable research team.'

In terms of his career, he concludes: 'The ERC grants are also recognition of high-quality research and their prestige undeniably accompanies researchers everywhere they go.'

The project was hosted by the University of Ghent in Belgium.

- 1 'Control mechanisms that pattern microtubules for switching cell division planes during plant morphogenesis'.

Funded under the FP7 specific programme 'Ideas' (European Research Council).
<http://erc.europa.eu> > Project and results
 > ERC Stories
 Researcher's website:
<http://www.vib.be/en/research/scientists/Pages/Pankaj-Dhonukshe-Lab.aspx>



Recycling demolition waste

Construction and demolition waste (C&DW) is one of the largest waste streams in the EU. Scientists are developing better ways to recycle and reuse materials from this sector for enhanced sustainability.

Much of the waste in the construction sector can be recycled or reused. This is encouraging, especially in light of the European Union Waste Framework Directive, which calls for a minimum recovery of non-hazardous C&DW of 70 % by weight by the year 2020. The EU-funded project IRCOW¹ was designed to provide validated technical solutions to achieve this goal.

IRCOW scientists are considering all stages of a product's life. They are developing innovative strategies to promote the reuse of materials while creating high-quality recycling of C&DW through advanced sorting and processing. In addition, they are investigating the production of high-grade construction products from C&DW, including concrete, gypsum boards, wood-polymer composites and

multilayer panels. Concepts will be tested on real construction sites and solutions will be evaluated for technical, economic, environmental and human health performance.

Within the first 18 months of the project, the researchers have already reached the point of implementation in demonstration activities, including testing at five test sites. Some activities have been completed ahead of schedule. Groundwork included identification of supply-chain networks guaranteeing at least 10% reuse of C&DW materials by weight — as well as identification of potential barriers to, and opportunities for, the reuse of waste in new construction materials. An easily adaptable business model and tools to stimulate reuse of C&DW materials has been made available for free distribution.

Novel technological developments for advanced sorting systems enabled maximisation of volume and improved quality of the materials recovered, as well as enhancing separation efficiency and decreasing processing costs. In addition, the team developed on-site microwave thermal treatment for inorganic fibrous materials and

stonery C&DW. On-site technology was also developed for plastics and wood. Project partners have applied for patents for novel materials and building components using a high percentage of C&DW materials.

Technological advances made by the IRCOW project, together with validated business models and life-cycle assessments, should help the European Union reach its ambitious goals regarding recycling and reuse of C&DW. By developing better recycling processes and novel products based on recycled waste, scientists are creating a win-win situation for the construction and demolition sectors.

The project was coordinated by Tecnalia in Spain.

- 1 'Innovative strategies for high-grade material recovery from construction and demolition waste'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
<http://cordis.europa.eu/marketplace>
 > search > offers > 10805
 Project website: <http://www.ircow.eu/>





Making 'the cloud' greener

As the world becomes increasingly digital, demand for data centres is booming — and so too is their energy consumption. Data centres worldwide — many of them providing 'cloud' storage and services — produce around half the volume of emissions the global aviation industry does, and more than the total emissions of the Netherlands. EU-funded researchers are developing ways to reduce the environmental impact of data centres.

With tens of thousands of processors and storage units needing to be kept cool, about the same amount of energy is used for cooling data-centre equipment as powering it. This makes the infrastructure behind cloud services ripe for improved energy efficiency.

'For every kilowatt of energy consumed by the data centre, almost another kilowatt is dissipated as heat,' explains Dr Massimo Bertoncini at Engineering Ingegneria Informatica in Italy. 'With ever-larger data centres being built around the world to meet rising demand for digital services, powering and cooling them is an increasingly significant environmental issue.'

Dr Bertoncini coordinated a team of researchers who spent 30 months tackling the challenge.

Their work on energy efficiency, conducted in the GAMES¹ project and supported by EUR 3 million in funding from the European Commission, is about to be applied commercially. So far, it has helped cut energy consumption at the data centres where it has been implemented by more than 20%.

The GAMES consortium investigated effective methodologies and enabling technologies aimed at reducing the energy consumption of the IT infrastructure, taking the view that any improvement in energy efficiency at IT infrastructure level will automatically reduce energy consumption at the cooling-facility subsystem level by the same amount.

'For data centres to become more efficient, it is essential to know how energy is being

consumed. Our focus was therefore to develop effective monitoring solutions that allow data centre performance and processes to be adapted in real time,' the GAMES coordinator explains.

The team developed methodologies, software tools and services, and innovative metrics with a focus on next-generation smart data centres. The key to their approach was to investigate and deploy technologies and methodologies to measure the energy consumption of IT infrastructure in a more detailed way than previously possible, all the way down to server level. Their solution is based on a mixed approach, combining real-time sensing and measurement with intelligent processing to infer predictive energy-consumption models.

The approach takes into account the trade-off between energy-efficiency optimisation and the needs of business — such as Service Level Agreements (SLAs) and Quality of Service (QoS) guarantees.

Although modern data centres are more energy efficient than their predecessors, only around 60% of the overall energy they use is for the servers, processors and software — the rest is mostly for the cooling system and the uninterruptible power system.

Towards a perfect PUE

Data-centre energy use is measured in units of 'Power-usage effectiveness', or PUE, which is the ratio of the total power used by the facility, divided by the power delivered to its IT equipment. An ideal PUE would be 1, while the average is about 1.83 to 1.92.

The GAMES team deployed and tested their energy monitoring

and real-time adaptation technology at two large and already relatively energy-efficient data centres, located at Pont Saint Martin in Italy and Stuttgart in Germany, representing two very different types of data centre.

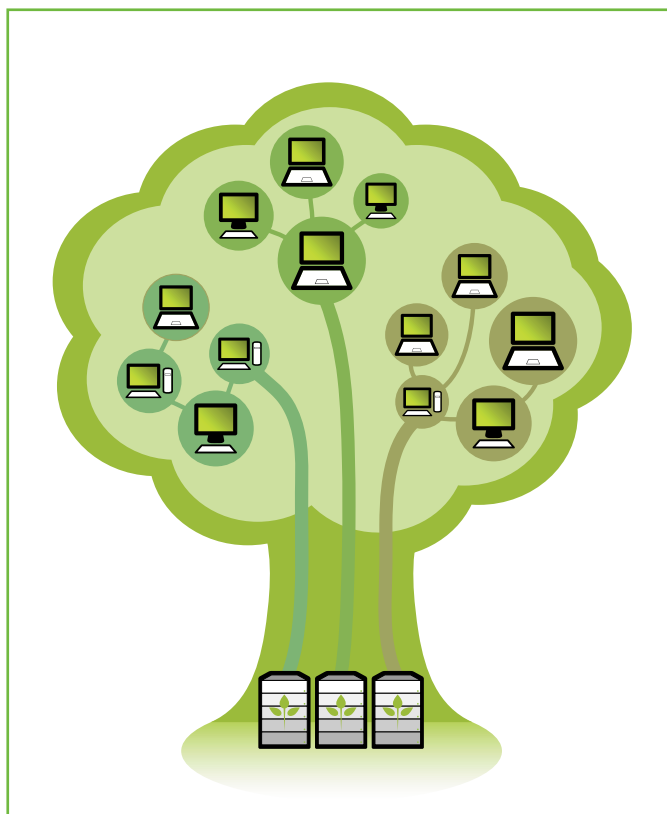
At Engineering's Pont Saint Martin site, used mostly for legacy application hosting services, the technology was able to improve PUE from 1.35 to 1.25 — a considerable energy saving. At the Stuttgart site, a high-performance computing centre operated by the University of Stuttgart, the GAMES system resulted in similar improvements despite the centre's different technology and applications.

'We showed that this approach works across technologies and at different data centres designed for performing different tasks,' Dr Bertoncini says. 'It enables data-centre operators to determine the best practices at each site to reduce power consumption without impacting performance.'

For example, at one site it may make sense to lower the frequency of the running processors, while at another the optimal approach might be to transfer computation load from one server to another one and run all servers at 80% of their capacity, rather than running fewer at 100% capacity. Similarly, with adaptive technology, underused servers can be dynamically powered down when necessary.

'There is always a trade-off between energy efficiency and performance: essentially, the more performance required, the more energy will be used. The key is finding the right balance to provide the best service at the lowest energy cost,' Dr Bertoncini notes.

Another key outcome of the project was the study and categorising of families of applications exhibiting common energy-consumption behaviour patterns. This categorisation



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enabled the team to associate together a set of best practices, and optimised hardware and software adaptation actions, in order to achieve the best possible trade-off among SLAs, performance and energy consumption. The project has made publicly available a living repository of these best practices.

Improving data-centre energy efficiency will not only help the environment but it also makes financial sense for data-centre operators. Running a large

data centre can cost more than EUR 10 million a year just for the electricity. It is not surprising therefore that data-centre operators are keenly interested in the work of the GAMES team.

'We've received a lot of interest from industry,' Dr Bertoncini says. 'First we are implementing this solution at our data centres and then we will start to offer it to clients.'

The team is also looking into launching a follow-up project

to advance the technology and achieve further improvements in efficiency.

With industries from banking to health care — as well as government — moving more processes online and into the cloud, global cloud IP traffic is projected to increase six-fold over the next five years, while the number of data centres is increasing by close to 20% per year. Designing and managing them with energy efficiency in mind will be essential in order to avoid a similar

increase in environmental and energy costs.

The project was coordinated by Engineering-Ingegneria Informatica in Italy.

- 1 'Green active management of energy in IT service centres'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Information and communication technologies' (ICT).
<http://cordis.europa.eu/marketplace>
 > search > offers > 10751

Stopping the spread of ash dieback fungus

The destruction of trees as a result of the ash dieback fungus has been a growing concern among scientists, who have seen its rapid spread across Europe since the 1990s.

The fungus, which originated in Japan, emerged in Lithuania and Poland two decades ago, and moved swiftly across the continent, with 300 confirmed cases reported in the United Kingdom alone. But now scientists have just completed an EU-funded project to detect and monitor quarantined plant pests, which were previously putting both European forestry and crop production at risk. Methods were

devised under the three-year project entitled Q-DETECT¹. The project was supported under the EU's 'Food, agriculture and fisheries, and biotechnology' (KBBE) programme to the tune of EUR 3 million.

The main objective of the project was to heighten biosecurity efforts against invasive pests by developing a method based on a portable deoxyribonucleic

acid (DNA) testing machine that can diagnose ash dieback within 30 minutes. Previously, scientists had to wait for days to obtain laboratory results.

Tools developed by the Q-DETECT consortium now allow for detection of quarantined pests at, among others, airports and ports. The researchers also worked on devices that can 'hear' the larvae of the pests as they bore into the tree. In addition, they developed satellite image analysis that can identify infested forests, as well as an 'electronic nose' that is able to detect infested potatoes in warehouses.

Dr Neil Boonham from the Food and Environment Research Agency in the UK, who has been working on the project says, 'Acoustic and vibrometric methods were demonstrated to be a successful approach in detecting wood-boring insect larvae. One of the key outcomes was the development of software that can identify which sounds come from wood-boring beetles and which come from the environment.'

Although, as he points out, 'The system needs to be validated to achieve this, so the partners are providing recording equipment to end-users. This will encourage

them to contribute to a library of analysed sounds with which we can validate the software. Ultimately, this may then be run as a service or released in another format so that end-users can access the data.'

In addition, he says, 'Smelling volatiles from quarantined pests proved to be one of the most challenging approaches. However, great strides were made in identifying potential compounds specific to pests and the use of the electronic nose to detect a wide range of different bacterial pathogens.'

Future funding is now being sought by the consortium along with other partners for specific applications of volatile detection. Further work on remote imaging is also planned, for which the system will be trialled by the UK inspection service.

The project was coordinated by the Department for Environment, Food and Rural Affairs in the United Kingdom.

- 1 'Developing quarantine pest detection methods for use by national plant protection organizations (NPPO) and inspection services'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology' (KBBE).
<http://cordis.europa.eu/news> > search > 35666
 Project website: www.qdetect.org





Hydrogen storage for energy-efficient buildings

Accounting for some 40% of all energy consumption, the building sector is one of Europe's most energy consuming. With the vast majority of this power coming from fossil fuels, increasing energy efficiency, reducing CO₂ emissions and using renewable energy sources (RES) has become a priority in recent years.

Started in October 2008, the four-year H2SUSBUILD¹ project aimed at developing a self-powered sustainable and zero-CO₂-emission building by integrating a hybrid energy system where the storage of hydrogen provides the energy supply in situations where renewable sources are lacking.

With funding of EUR 6.7 million under FP7, the project is coordinated by the Italian engineering consulting company D'Appolonia and has 18 highly qualified industrial partners, universities and research organisations from eight EU Member States and Norway.

'H2SUSBUILD combines the efficient use of renewable-energy technologies like wind-power generators and photovoltaic panels with water electrolysis, a process that produces hydrogen,' says project representative Alessandra Monero from D'Appolonia. 'This means that when renewable energy is in short supply, hydrogen can instead be used to produce electricity and heat. Conversely, [an excess of] renewable power can be

converted into hydrogen for use at a later date.'

H2SUSBUILD was demonstrated in a building located in Greece through a reduced-scale pilot project and a subsequent full-scale installation. This demonstration was a success and showcased the technical feasibility of installing and operating such a system within a real building. Moreover, it assessed the measures necessary to operate safely despite the use of hydrogen, resulting in guidelines being developed for the inflammable gas's future use in buildings.

The objectives of H2SUSBUILD could only have been met at a European level due to the wide variety of knowledge and skills required. Furthermore, no single Member State could have come up with the necessary financial and personnel resources with the same level of scientific-technological excellence and engineering skills.

The transnational consortium has in fact helped both research teams and industrial participants



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to further develop their science and technology (S&T) capabilities. They have also benefitted from associated synergies and gained valuable insights into new markets.

H2SUSBUILD involved a number of Europe-wide and international dissemination actions, including broadcasts in over 130 countries and 10 languages. The project is also fully in line with the objectives of the 'Energy-efficient buildings Public Private Partnership' (EeB PPP), launched by the European Commission in 2008.

The project was coordinated by D'Appolonia in Italy.

- 1 'Development of a clean and energy self-sustained building in the vision of integrating H₂ economy with renewable energy sources'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP).
<http://ec.europa.eu/research> >
 Information Centre > search > 29553
 Project website: www.h2susbuild.ntua.gr

Investigating the environmental impact of nanosilver

When it comes to materials used in the fight against bacteria, silver may not be the first element which comes to mind. However, the precious metal has been used in the medical industry as a biocide — a substance which can deter, render harmless, or exert a controlling effect on any harmful organism — since the 1930s.

These days, antimicrobial silver nanoparticles are used in a variety of ways, such as for preventing unpleasant odours caused by bacteria in sport shirts or socks. While silver's antibacterial properties have been appreciated, there has always been a concern over

the effect nanosilver may have when it is released into wastewater during washing. Research has shown that nanosilver presents a minute risk to the environment, as it is transformed into a nearly insoluble substance called silver sulphide in wastewater treatments.

In search of a definitive conclusion on the potential risks, the EU-funded PROSUITE¹ project has been set up to analyse the environmental impact of nanosilver released from sports T-shirts during their entire life cycle, from raw material extraction to end-of-life disposal.

'Nanosilver can be applied in lower quantities than other antimicrobials and hence has advantages for resource use and environmental loads,' says Tobias Walser, a researcher at the Institute for environmental engineering at the Swiss

Federal Institute of Technology in Zurich. However, 'the environmental and human risk of nanosilver has yet to be fully understood', he adds.

The PROSUITE study 'is very relevant' because it 'gives a fingerprint' about the impact of such T-shirts, says Professor Anders Baun from the Department of Environmental Engineering at the Technical University of Denmark. However, he continues, in general, 'it is a bad idea to distribute silver in the environment'. He points to a study that found evidence for nanosilver accumulating in >

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the food chain based on a study of plants and animals in an experimental wetland environment.

PROSUITE's research, the first of its kind on a nanomaterial, found that a nanosilver-treated T-shirt's environmental impact could be reduced during use if its antimicrobial properties meant it needed to be washed less often than conventional T-shirts. This could even

compensate for a slightly higher environmental footprint during production. Walser explains: 'In comparison to all toxic releases during the life cycle of a T-shirt, those coming from nanosilver during washing appear to be of minor relevance.'

'The PROSUITE study is an important step into the right direction,' comments Bernd Nowack,

an expert in environmental risk assessment at Empa, the Swiss Federal Laboratories for Materials Science and Technology. Yet, to be able to fully assess the environmental benefits of nanosilver textiles, more should be known about issues such as the industrial production of nanosilver or whether the textiles are actually washed less often. Nowack regards nanosilver as an effective biocide, with few drawbacks. 'There is no strong evidence for the toxicity of nanosilver,' he adds.

Walser, currently a visiting scientist at the US Environmental Protection Agency, is now collecting data and conducting modelling studies on nanoparticle emissions from production sites to improve the life-cycle assessment of nanotextiles. While there is no threat to people

using such textiles, this is possibly not the case for workers in the nanotechnology industry who may inhale the particles, Walser says. 'The nanoparticles can penetrate deeply into the lung' and inhalation therefore remains 'the critical pathway'.

The project was coordinated by the University of Utrecht in the Netherlands.

- 1 'Development and application of standardized methodology for the prospective sustainability assessment of technologies'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
<http://cordis.europa.eu/news> > search > 35663
 Project website: www.prosuite.org

Environmentally important bacteria for pollution treatment

Specific bacterial strains are used in the biodegradation of waste in environmentally polluted sites. However, their success is largely unpredictable as our understanding of how these bacteria survive under stress is limited.

The main idea behind the EU-funded BACSIN¹ project was to improve the exploitation of bacterial activities for targeted pollution treatment, removal and prevention.

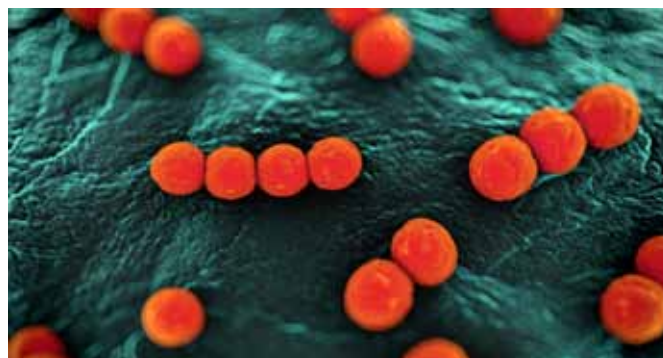
The first part of the project investigated the effect of stress-related conditions on bacteria physiology and responses. Particular emphasis was placed on drought-related and organic-solvent exposure stress. Genome-wide transcription responses to these stress conditions were also reported for various bacterial strains.

In addition, transcriptomes of two so-called 'secondary bacsins' — superior surviving strains from contaminated environments — were obtained and used for comparative analysis, in order to identify common gene programmes against drought stress. Results showed that acute stress leads to immediate induction and repression of a large number of genes, but most bacteria can 'adapt' to the conditions under prolonged exposure.

Wishing to further delineate the mechanisms of bacterial survival under stress, researchers identified a role of 'universal stress proteins' (USPs). Using *Pseudomonas putida* as a model organism, they were able to unveil a role for transposon-mediated mutagenesis, post-transcriptional regulation in catabolic responses and resistance to bacteriostatic compounds.

Bacterial behaviour was also modelled from a micro-economic perspective in order to understand the general phenomenon of stress-related survival on the basis of the costs and benefits of mixed carbon-source degradation. Interestingly, the model suggested that cells used the substrate that provided the most utility for their limited energy budget.

Another part of the BACSIN project involved the development of reporters of ecological success by fluorescently tagging reporter proteins as a means of monitoring bacterial activity. Several sterile and



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non-sterile microcosm experiments were performed to understand the factors that determine survival and catabolic activity of various bacteria strains in their habitat.

Suitable strains with special root and leaf applications were identified and the interplay between stress conditions and catabolic responses was monitored. To better understand the genetic basis of bacsins, scientists sequenced their genome and found that they expressed genes for nitrate respiration, possibly allowing them to survive under conditions of low oxygen.

These findings, together with the isolation of natural bacsins from environmental sites, significantly enhance our understanding of

the physiology of these bacteria. Implementation of the BACSIN findings at contaminated sites could improve the biodegrading of pollutants, with obvious benefits for the environment.

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

- 1 'Bacterial abiotic cellular stress and survival improvement network'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology' (KBBE).
<http://cordis.europa.eu/marketplace> > search > offers > 10462
 Project website: <http://www.unil.ch/bacsin/>



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Are wireless devices potentially harmful?

Mobile smartphones, wireless internet access, Bluetooth and other types of wireless communication devices and technologies are becoming so common that it is getting harder to imagine a time when they did not exist. Most people living in the European Union (EU) use some form of wireless equipment, and the number and variety of uses continue to grow.

The rapid expansion of these technologies, however, has outpaced research into whether they could pose health risks to the people who use and benefit from them. Millions of people using wireless devices are exposed to radio waves on a daily basis, and there is a lingering concern about potential health effects.

This is where the EU-funded SEAWIND¹ project comes in. SEAWIND aims to achieve better scientific understanding of the potential adverse health risks of the radio waves associated with the ubiquitous presence of wireless devices.

Comprising universities, private companies and research institutes from Belgium,

Denmark, Germany, Greece and Switzerland, the SEAWIND team is pursuing a series of significant research avenues. These include measuring the public's exposure to wireless network devices; determining the electromagnetic fields induced in the various tissues of the body; examining the potential effects on cells; and providing guidance for the objective communication of exposure-related safety and risks.

'The timing of SEAWIND's work is critical,' explains project coordinator Niels Kuster of the Foundation for Research on Information Technologies in Society in Zurich. 'The usage and application of wireless communication

will continue to grow,' he adds. 'However, government and the industry largely stopped funding research in 2008 as public concerns started to decrease when the research programmes on potential adverse health effects of second-generation mobile technology (GSM) were completed. So, only a few projects have been performed in relation to the third generation of mobile and wireless network technologies. SEAWIND is one of the largest of these projects.'

Kuster's team has measured the exposure to radio waves in typical locations such as homes, offices and schools. Building on these measurements and ➤

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electromagnetic propagation theory, novel models were developed to predict human exposure. 'The validation was conducted in Belgium and Greece,' Kuster says, 'but the results can be applied anywhere in the world.'

These results could be very useful to manufacturers and service providers which need to comply with regulations that limit maximum human exposure. 'With its advanced evaluation instrumentation and technologies, SEAWIND will remove the uncertainty and enable the industry to operate on well-defined grounds,' Kuster explains.

To put their findings into practice, SEAWIND's researchers are collaborating with standardisation groups and regulators worldwide, with an eye on harmonising regulations,

and confirming or adjusting safety levels. The project also stands to benefit health agencies, risk assessors, and various organisations interested in minimising the public's exposure to wireless network devices. The SEAWIND project could lead to new research activities or even new products and spin-off companies.

In 2011, in light of findings by the World Health Organization and the International Agency for Research on Cancer that linked radio waves to a certain type of brain cancer, Kuster says the best rule for minimising exposure is to increase the space between devices and the body by using hands-free kits, third-generation technologies, and placing base stations at least one metre from people.

The three-year SEAWIND project, which ran from December 2009 to November 2012, had a total budget of EUR 3.9 million, of which the Commission contributed EUR 3 million.

The project was coordinated by the Foundation for Research on Information Technologies in Society in Switzerland.

- 1 'Sound exposure and risk assessment of wireless network devices'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
<http://ec.europa.eu/research> > Information Centre > search > 29653
 Project website: <http://seawind-fp7.eu/>



Improving communication to make public transport more efficient

An efficient transport system does not only rely on clear roads and unobstructed rail and tram routes. Communication lines — such as mobile and broadband networks — must also operate unhindered for the whole public transport infrastructure to work safely and without a hitch.

In this context, the EU-funded MOBICLOUD¹ project is implementing innovative mobile cloud services for personnel working in the Karlsruhe Public Transport Authority (Verkehrsbetriebe Karlsruhe or VBK) in Germany. VBK is recognised worldwide for its forward-thinking tram-train integrated model, whereby city trains run as fast trains in the wider region but return to their role as normal trams once they enter the city limits.

By improving coordination between staff using standard smartphones and tablets, the MOBICLOUD platform is making public transport greener, safer and more efficient. The VBK deployment provides a suite of cloud applications for mobile control-centre staff and field staff involved in vehicle operations.

'Efficient and fast information flow is essential for safety and incident management,' explained

Dr Walter Casazza, CEO of VBK, at the unveiling of the project in April 2013. 'Not only will passengers benefit from shorter journeys through improved information about traffic disruptions, but vehicle operations teams will also benefit from access to real-time information.'

Other advantages of the MOBICLOUD project should include operational cost savings through efficiency improvements

to control-centre communications. In addition, maintenance teams will also be able to pinpoint the cause of disruptions faster through the improved communication system. With these benefits, the project expects to improve overall customer satisfaction.

The project is run by the MOBICLOUD consortium, funded under the European Commission's ICT Policy Support Programme (PSP) — part of the Competitiveness and Innovation framework Programme (CIP).

The team is led by Appear (Sweden) and includes Nettetropolis (Germany), EsperantoXL (the Netherlands), Costain (UK) and COMIT Projects (UK). The project aims to stimulate the provision of new mobile services in the cloud and to support the emergence of a European ecosystem of mobile cloud application developers.

The project is coordinated by Appear in Sweden.

- 1 'Mobile business cloud application platform'.

Funded under the CIP specific programme 'ICT Policy Support'.
<http://cordis.europa.eu/news> > search > 35657
 Project website: <http://www.mobicloudproject.eu/>





Smart ways to keep buildings in good order

EU researchers have developed a wireless network of sensors to monitor the structural integrity of buildings. Using this system can improve the safety of buildings while reducing maintenance costs.

As soon as a building is constructed, it starts to age. Buildings require safety inspections throughout their life and to evaluate their structural condition, especially after earthquakes. However, such activity can be severely hindered by the difficulty of gaining access to all relevant areas in a building while it remains in use.

The development of an inexpensive system to overcome these obstacles was the aim of the EU-funded MEMSCON¹ project. Researchers set out to design a new generation of tiny, networked sensors that can be embedded into new buildings during construction or into old ones during renovation. These sensors are designed to provide *in situ* information on the structure's condition.

By combining 'micro-electro-mechanical systems' (MEMS)

and 'radio-frequency identification' (RFID) technology, the MEMSCON project has produced a small integrated device. The system employs accelerometer and strain sensors to measure the forces as the building moves or vibrates, and to determine the strength of the construction materials.

Both types of sensor are incorporated into wireless sensor modules to form a monitoring system able to communicate the measurement data to a remote base station. They can be placed within the reinforced concrete beams of a building during its construction to create a monitoring network. Under laboratory conditions, the sensors developed by the MEMSCON project have been tested on both small- and large-scale models.



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The next stage for the project is to install the prototype system in a building to fully validate both the system's hardware and software. If successful, the system would not only be suitable for commercial and residential buildings but could also be applied to monitoring the condition of bridges and roads.

The project is coordinated by the Institute of Communication and Computer Systems in Greece.

- 1 'Radio frequency identification tags linked to on board micro-electro-mechanical systems in a wireless, remote and intelligent monitoring and assessment system for maintenance of constructed facilities'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP).
[http://cordis.europa.eu/marketplace > search > offers > 10702](http://cordis.europa.eu/marketplace/search?offers%3E10702)
 Project website:
<http://memscon.tositemou.com/>



Mind-controlled exoskeleton to help disabled people walk again

Every year, thousands of people in Europe are paralysed by a spinal cord injury. Many are young adults, facing the rest of their lives confined to a wheelchair. Although no medical cure currently exists, in the future these people could be able to walk again thanks to a mind-controlled robotic exoskeleton being developed by EU-funded researchers.

In the United Kingdom, every eight hours someone suffers a spinal cord injury, often leading to partial or full lower-body paralysis. In the United States, more than 250 000 people are living with paralysis as a result of damage to their spinal cord, usually because of a traffic accident, fall or sports injury. Many are under the age of 50, and with no known medical cure or way of repairing damaged spinal nerves they face the rest of their lives in a wheelchair.

But by bypassing the spinal cord entirely and routing brain signals to a robotic exoskeleton,

they should be able to get back on their feet. That is the ultimate goal of researchers working in the MINDWALKER¹ project, a three-year initiative supported by EUR 2.75 million in funding from the European Commission. The new system, based on innovative 'Brain-neural-computer interface' (BNCI) technology — combined with a lightweight exoskeleton attached to a user's legs and a virtual reality environment for training — could also find applications in the rehabilitation of stroke victims and in assisting astronauts rebuild muscle mass after prolonged periods in space.

'MINDWALKER was proposed as a very ambitious project intended to investigate promising approaches to exploit brain signals for the purpose of controlling advanced "orthosis", and to design and implement a prototype system demonstrating the potential of related technologies,' explains Michel Ilzkovitz, the project coordinator at Space Applications Services in Belgium.

The team's approach relies on an advanced BNCI system that converts electroencephalography (EEG) signals from the brain, or electromyography (EMG) signals from shoulder muscles, into

electronic commands to control the exoskeleton.

The Laboratory of Neurophysiology and Movement Biomechanics at the Université Libre de Bruxelles (ULB) focused on the exploitation of EEG and EMG signals treated by an artificial neural network, while the Foundation Santa Lucia in Italy developed techniques based on EMG signals modelled by the coupling of neural and biomechanical oscillators.

One approach for controlling the exoskeleton uses so-called 'steady-state visually evoked potential', a method that reads flickering visual stimuli produced at different frequencies to induce correlated EEG signals. Detection of these signals is used to



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© MINDWALKER



trigger commands such as 'stand', 'walk', 'faster' or 'slower'.

A second approach is based on processing EMG signals generated by the user's shoulders and exploits the natural arm-leg coordination in human walking: arm-swing patterns can be perceived in this way and converted into control signals commanding the exoskeleton's legs.

A third approach, 'ideation', is also based on EEG-signal processing. It uses the identification and exploitation of EEG Theta cortical signals — the oscillations sometimes called 'theta waves' — produced in the brain by the natural mental process associated with walking. The approach was investigated by the MINDWALKER team but had to be dropped due to the difficulty, and time needed, in turning the results of early experiments into a fully exploitable system.

Regardless of which method is used, the BNCI signals have to be filtered and processed before they can be used to control the exoskeleton. To achieve this, the MINDWALKER researchers fed the signals into a 'Dynamic recurrent neural network' (DRNN), a processing technique capable of learning and exploiting the dynamic character of the BNCI signals.

'This is appealing for kinematic control and allows a much more natural and fluid way of controlling an exoskeleton,' Mr Ilzkovitz says.

The team adopted a similarly practical approach for collecting EEG signals from the user's scalp. Most BNCI systems are either invasive, requiring electrodes to be placed directly into brain tissue, or require users to wear a 'wet' cap on their head, necessitating lengthy fitting procedures and the use of special gels to reduce the electrical resistance at the interface between the skin and the electrodes. While such systems deliver signals of very good quality and signal-to-noise ratio, they are impractical for everyday use.

The MINDWALKER team therefore turned to a 'dry' technology developed by Berlin-based eemagine Medical Imaging Solutions: a cap covered in electrodes that the users can fit themselves, and which uses innovative electronic components to amplify and optimise signals before sending them to the neural network.

'The dry EEG cap can be placed by the subject on their head by themselves in less than a minute, just like a swimming cap,' Mr Ilzkovitz says.

Efficient, robust robotic legs

The universities of Delft and Twente in the Netherlands proposed an innovative approach for the design of the exoskeleton and its control. The exoskeleton is designed to be sufficiently robust to bear the weight of a 100 kg adult and powerful enough to recover balance from external causes of instability, such

as the user's own torso movements during walking or a gentle push from the back or side. Compared to other exoskeletons developed to date it is relatively light, weighing less than 30 kg without batteries, and — because any final version of the system should be self-powered — it is designed to minimise energy consumption.

The MINDWALKER researchers achieved energy efficiency through the use of springs fitted inside the joints that are capable of absorbing and recovering some of the energy otherwise dissipated during walking, and through the development of an efficient strategy for controlling the exoskeleton.

Most exoskeletons are designed to be balanced when stationary or quasi-static and to move by little steps inside their ground stability perimeter, an approach known as 'zero moment point', or ZMP. Although this approach is commonly used for controlling humanoid robots, when applied to exoskeletons it makes them heavy and slow — and usually requires users to be assisted by a walking frame, sticks or some other support device when they move.

Alternatively, a more advanced and more natural control strategy can replicate the way humans actually walk, with a controlled loss of balance in the walking direction.

'This approach is called "limit-cycle walking" and has been

implemented using model predictive control to predict the behaviour of the user and exoskeleton and for controlling the exoskeleton during the walk. This was the approach investigated in MINDWALKER,' Mr Ilzkovitz explains.

To train users to control the exoskeleton, researchers from Space Applications Services developed a virtual-reality training platform, providing an immersive environment in which new users can safely become accustomed to using the system before testing it out in a clinical setting and, the team hope, eventually using it in everyday life.

Tests with able-bodied trial users were scheduled for completion at the end of last year, before transferring the system to the Foundation Santa Lucia for conducting a clinical evaluation, with five to 10 volunteers suffering from spinal cord injuries. These trials will help identify shortcomings and any areas of performance improvement, the project coordinator says.

In the meantime, the project partners are continuing research on different components for a variety of potential applications. The project coordinator notes, for example, that elements of the system could be adapted for the rehabilitation of stroke victims or to develop easy-to-use exoskeletons for elderly people for mobility support.

Space Applications Services, meanwhile, is also exploring applications of the MINDWALKER technology to train astronauts and help them rebuild muscle mass after spending long periods of time in zero-gravity environments.

The project was coordinated by Space Applications Services NV in Belgium.

- 1 'Mind-controlled orthosis and VR-training environment for walk empowering'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Information and communication technologies' (ICT).
<http://cordis.europa.eu/marketplace> > search > offers > 10601
 Project website:
<https://mindwalker-project.eu/>



Technology for safer crowded spaces

Most people are unaware of how much effort goes into making the crowded spaces they walk through safe from crime, flooding or even earthquake.

The EU-funded DESURBS¹ project has developed a series of tools — accessible through an interactive portal — to assist those responsible for crowded areas in planning, designing, managing and maintaining them in a safer way.

The design and redesign of secure urban spaces is often constrained by limited local knowledge and inexperience on how to deal with potential hazards and security threats.

As such, the objectives of the DESURBS project are to analyse the various risks and their impact on crowded spaces, and to devise solutions to manage these potential risks.

Over the last 16 months, tools have been developed to map and visualise resilient urban space design or even redesign. Key to the project's research is the compiling of a database which covers 174 incidents that have affected

urban spaces. The project has identified weaknesses relating to these specific incidents in order to learn more about analysis, design, planning, construction and management of urban spaces so as to avoid or mitigate such incidents in the future. This analysis is the foundation for the development of an open source, web-based database that will be revised and updated regularly to advise on current urban space design.

The project's 'integrated security resilience' (ISR) design and assessment framework incorporates comprehensive supporting tools, including preliminary

work on urban resilient design guidelines. These tools have been developed through case studies in Nottingham, Jerusalem and Barcelona. They also have the potential to have a much wider impact as generic tools in other cities in and around Europe.

Some of the supporting tools being developed include a smart-phone application for measuring the 'sense of fear' in different urban spaces. It is expected that this tool could be useful for urban space managers to investigate the perception of security in urban spaces all over Europe. Finally, the DESURBS Decision Support System Portal (DSSP) will combine all of the project's tools in a user friendly, high-tech package aimed at urban planners, designers and engineers.

The project was coordinated by Research Management AS in Norway.



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1 'Designing safer urban spaces'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Security'.
<http://cordis.europa.eu/marketplace> >
 search > offers > 10925
 Project website: <http://www.desurbs.eu/>



Helping drivers drive more safely

Scientists have developed a simulation platform that integrates computer models of the driver, vehicle and environment. Enhanced predictive capability of human thoughts and actions should enable better design of safety systems.



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With EU funding of the ISI-PADAS¹ project, European scientists have developed an integrated driver-vehicle-environment simulation approach to support 'risk-based design' (RBD) and approval of new 'Partially autonomous driver-assistance systems' (PADAS). A key component of the ISI-PADAS system is advanced driver-modelling, incorporating key aspects of human

behaviour, cognition and decision-making.

Through extensive empirical studies with human drivers in real and simulated situations, together with the use of modern algorithms, scientists developed tools to predict correct and erroneous driver behaviour. They also improved assessments of the risk of human error and used it in RBD for



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advanced control systems for PADAS.

The researchers then integrated the driver models with vehicle and environment models to produce the Joint Driver-Vehicle-Environment (JDVE) simulation platform. The JDVE supports risk analysts by providing 'expanded

human-performance event trees' (EHPET) for various scenarios.

The JDVE simulation platform developed by ISI-PADAS will facilitate RBD for better PADAS through extensive integration with advanced driver models. The methodology is expected to significantly reduce human error,

as well as injuries and mortality associated with traffic accidents.

The project was coordinated by Offis E.V. in Germany.

- 1 'Integrated human modelling and simulation to support human error risk analysis of partially autonomous driver assistance systems'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace/search/offers/6587>
 Project website: <http://www.isi-padas.eu/>



Sensors to help fight fire

Beyond regular video cameras, a variety of new sensors can help enhance the safety and security of public places and key infrastructure sites. The technology could prove very useful to emergency crews.

When a natural or man-made disaster strikes a particular area, very often emergency services and communications are also affected, hampering rescue and recovery efforts significantly. When the infrastructure is damaged, 'first responders' must rely on efficient and ongoing communications with control centres to ensure optimal response and

minimise trauma. This was the aim of the EU-funded project DITSEF¹.

The project worked on the development of a network of sensors, localisation and communication systems — particularly focused on events such as large fires — to support first responders. Sensor technology

can help warn against hazards such as gases and toxic chemicals, as well as assist in low-visibility scenarios. This can then be enhanced through an indoor localisation network, improved radio data transmission and human-machine interface technology in order to improve the efficiency and security of first responders.

After several workshops and laboratory experiments, the project team completed the proposed security solution and tested it in two different settings, namely a chemical plant and a large hotel area. The technology integrates the latest indoor localisation, wireless communication, human interfaces, sensor equipment and radar technology, and other key innovations, appreciably facilitating data exchange with higher command levels.

All these technologies have been integrated into an easy-to-use wearable system for every first responder, offering a highly informative open channel to command and control centres. This security solution will be especially useful for European fire brigades and other emergency authorities, enabling quick response in disaster situations.

The project was coordinated by Sagem Défense Sécurité in France.

- 1 'Digital and innovative technologies for security and efficiency of first responders operation'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Security'.
<http://cordis.europa.eu/marketplace/search/offers/10689>





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Making safer composite materials for shipbuilding

Just like any mode of transport that carries people, ships are subject to strict safety regulations. These not only cover the use and maintenance of the vessel but also its construction and the materials from which it is made.

Until a few years ago, the European Union's Registration, Evaluation and Authorisation of Chemicals (REACH) Regulation, which addresses the production and use of chemical substances, stated that composite materials could not be used in the construction of commercial ferries and cruise ships due to safety concerns.

REACH, as part of the International Convention for the Safety of Life at Sea (SOLAS), dictated that ship components such as superstructures, bulkheads, decks and deck-houses must be made from steel or an equivalent material. Composite materials, especially those containing foam and plastics, were considered a risk, as they can be combustible and could release toxic fumes in the event of fire.

However, in 2002, a new rule in SOLAS allowed the use of materials other than steel to be used in shipbuilding. Technological advances had brought many composite materials up to the same safety levels as steel in terms of non-combustibility, prompting shipbuilders to experiment with new

lightweight materials while still adhering to the strict safety rules covering the construction of passenger-carrying vessels.

The development of increasingly lighter shipbuilding materials continues to this day, while new flame-retardant standards within SOLAS mean that this research also includes how to ensure a higher level of fire safety.

The EU-funded NANOCORE¹ project has been developing a new and cost-effective production technology for sandwich structures — polymeric foam core materials with non-toxic flame retardants and enhanced mechanical properties — which will meet these new standards.

Most current flame retardant (FR) additive systems used in polymeric foams are not able to meet the new SOLAS standards. So foam core materials for sandwich construction, used to produce lightweight and stiff structures, require a new generation of FR additive systems to reduce smoke toxicity and bestow fire-resistance properties.

NANOCORE is developing a new FR system based on a combination of nanoparticles modified with a phosphorous flame retardant. The technology will be directly and easily transferable to other polymer-based materials, such as bulk thermoplastics, thermosets, composites and other foams —enabling them to meet the new requirements set out in SOLAS.

In fact, the use of this technology will cross the boundaries of the shipbuilding industry. The project team anticipates that all applications of plastic materials requiring 'fire science technology' (FST) properties can be met by the NANOCORE system.

The project was coordinated by Acciona Infrastructure in Spain.

1 'Development of a low FST and high mechanical performance nanocomposite foam core material for ferries and cruise ship superstructures'.

Funded under the FP7 specific programme 'Capacities' under the theme 'Research for the benefit of SMEs'.
<http://ec.europa.eu/news > search > 35642>
 Project website: <http://www.nanocore-project.eu/>

INDUSTRIAL TECHNOLOGIES

From the nano- to the industrial scale

Scientists and researchers often lack the expertise to commercialise their research. An EU-funded support service helps researchers in the nano-sector transfer their results from the lab to the market place.

Europe is a global scientific powerhouse which produces some of the most cutting-edge science in the world. However, difficulties can arise when it comes to translating these results into commercial and social applications.

To address these issues in the nanoscience and nanotechnology sector, the EU-funded PRONANO¹ project has established a special support service which helps researchers and scientists in the nano-sector to transfer their technology and commercialise their research.

With EU funding, PRONANO brought together experienced consultancy firms and venture capitalists from half a dozen

European countries. The aim was to help the nano-research community overcome the main barriers standing in the way of successful commercialisation and transfer of unexploited results — whether market, technology, financial or managerial — including the evaluation of commercial potential and business coaching.

In addition to the expertise of the consortium itself, PRONANO has also entered into partnerships with nanotechnology networks and platforms, such as the NANOfutures platform.

Ultimately, PRONANO seeks not only to be a match-maker between investors and



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researchers but to seal actual investment deals. Over its two-year lifespan, 10 technology business opportunities were financed, commercialised or acquired, helping to raise some 17 times the EU funds invested in the PRONANO project itself.

The project was coordinated by Zabala Innovation Consulting in Spain.

- 1 'Promoting technology transfer of nanosciences, nanotechnologies, materials and new production technologies'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP).
<http://cordis.europa.eu/marketplace>search>offers>10338>
 Project website: <http://www.pronano.eu/>



A new era in bridge building

Innovative techniques for construction and repair of bridges will ensure bridge safety, speed up processes, enhance mobility and upgrade infrastructure.

Bridges old and new, of all shapes and forms, dot the European landscape, crossing rivers, valleys and waterways to facilitate transport and the quality of life for numerous communities. The EU-funded project PANTURA¹ is creating high-tech tools and strategies to radically upgrade and accelerate bridge construction, maintenance and renovation.

The project is designing ways to reduce labour, equipment and on-site activities through off-site construction — minimising disruption and reducing emissions. It is evaluating 20 existing bridge projects, establishing new strengthening techniques, investigating novel building materials, enhancing repair strategies and analysing best practices in the field. This lends

insight into the impact of different decisions over time, introducing factors other than cost into the equation and providing an integrated approach to building and repairing bridges.

Among its achievements, the project team developed a new strengthening and repair system for most types of bridges, featuring load-bearing beams that use pre-stressed composites without requiring anchorage systems. It has also made significant progress regarding the behaviour of adhesive joints and improvement of joints through geometrical modifications.

Once the project completes its operational strategy for organising construction processes in the most sustainable way, it will develop an



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interactive tool to plan and coordinate repairs and construction. The web-based tool will be able to integrate and manage logistics, geographical information, computer-modelling scenarios and online monitoring.

Towards the end of the project, the team will produce a comprehensive report on technical specifications for new concept design and engineering, including design guidelines and best practices. The report will also contain recommendations for off-site fabrication and on-site assembly of bridge components. These outcomes will be invaluable in enhancing bridge repair and

construction, improving urban infrastructure projects and benefiting the mobility of citizens significantly.

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

- 1 'Flexible processes and improved technologies for urban infrastructure construction sites'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Environment'.
<http://cordis.europa.eu/marketplace>search>offers>10789>
 Project website: <http://www.pantura-project.eu/>

Virtual humans reduce industry costs

Significant software advances in simulating human behaviour can help produce vehicles that are safer and more cost efficient. The technology also looks promising for supporting other industry sectors.

Ever since the advent of crash-test dummies in the 1950s, research and development teams in the transport sector have been designing human models that advance testing and safety considerably. With the digital age and realistic crash simulations being conducted successfully in the virtual world, laboratories are looking for the most accurate

digital models to conduct their testing. The EU-funded project DHERGO¹ designed precise models to achieve this target.

Aiming to develop anatomically and biomechanically accurate human models to assess posture and motion-related discomfort, the project team collected enormous amounts of data required

to make human models realistic. From joint strength and range of motion to exact musculoskeletal behaviour, the project consortium articulated software algorithms that approximate real motion and created specific computer tools to accomplish the task. The technology was tested successfully by different project partners and the results were announced at key conferences.

The researchers developed a software simulation package that features a dynamic multi-body-based model as well as a musculoskeletal model to calculate muscle forces with precision. They also simulated the physical interaction between the human model and different car parts, such as the seat. Validity of all components and actions such as upper-limb handbraking and lower-limb pedal depression was also established, ensuring comprehensive and meticulous consideration of all aspects.

To summarise, DHERGO has effectively exploited cutting-edge

knowledge in kinematic digital human simulation to produce dynamic, musculoskeletal models that approximate accident-related impacts and discomfort effectively. This will lead to better simulation capabilities in existing software tools which, in turn, will allow for more competitive products thanks to lower development costs. Lastly, other industries requiring simulation of human movement, from workplace hazards to extreme sports, could also benefit from this technology.

The project was coordinated by Europe Recherche Transport in France.

1 'Digital humans for ergonomic design of products'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Transport'.
<http://cordis.europa.eu/marketplace> > search > offers > 10300



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Better bio-plastics for improved home appliances

Bio-plastics have yet to make major inroads in non-disposable products, such as household appliances and electronic devices. A promising material for such applications is polyhydroxybutyrate, but new methods are needed to make it cost-effective.

Most plastics and synthetic polymers are currently produced using hydrocarbons. However, not only do hydrocarbon-based plastics not decompose in nature, but they are also made from increasingly scarce petroleum resources.

Organic bio-plastics are an environmentally friendly alternative to traditional synthetic polymers. However, although bio-plastics have found applications in disposable products, they have yet to be adopted in non-disposable products such as household appliances and electronics.

With EU funding from FP7, the BUGWORKERS¹ project is developing a new cost-competitive and environmentally friendly bio-nanocomposite material based on polyhydroxybutyrate (PHB). It comprises a combination of a PHB matrix combined with a novel chemical structure produced via a new fermentation-culture technology with two types of nano-fibres, cellulose whiskers and lignin-based fibres.

The resulting material will offer a real alternative to current engineering materials for household appliances, computers and



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INDUSTRIAL TECHNOLOGIES

telecommunications products. The four-year project, which started in July 2010, has already generated significant results.

The material requirements for the targeted applications were defined, including the properties of a number of identified parts from selected appliances and electronic devices. BUGWORKERS used novel extraction and purification

methods to acquire sugar hydrolysates from lignocellulosic waste, namely wheat-straw residue.

In addition, a series of trials were carried out to determine the best strain of bacteria to produce PHB and its copolymers. The project selected bacterial strains for the production of two types of polymers: a PHB homopolymer and a copolymer.

Overall, BUGWORKERS research promises to expand the multifunctional properties of bio-plastics and improve the performance of plastic parts in selected industrial sectors.

The project is coordinated by Aimplas in Spain.

- 1 'New tailor-made PHB-based nanocomposites for high performance applications produced from environmentally friendly production routes'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Nanosciences, nanotechnologies, materials and new production technologies' (NMP).
<http://cordis.europa.eu/marketplace> > search > offers > 10337
 Project website: <http://www.bugworkersproject.eu/>

A better way for aquaculture

Aquaculture may represent the ideal solution for fish shortages, but progress in the sector is hampered by equipment breakdowns and ecological challenges. New guidelines will make aquaculture more effective and safer for the environment.

If a fish escapes from a sea cage, this can have negative genetic effects on biodiversity through interbreeding and could transfer diseases to free-roaming populations. The EU-funded project PREVENT ESCAPE¹ undertook research across Europe to improve guidelines for aquaculture and minimise such escapes.

The project evaluated the extent, cost and causes of damaged

cages and fishing nets across Europe, underlining the need for better farming technologies and operations. It documented fish behaviour and spawning habits per species, outlining viable, cost-effective methods to trace escapees, particularly salmon, cod, sea bream, sea bass and meagre.

As cages break up in storms, and netting equipment becomes damaged over time, the project

team evaluated equipment under farming conditions to raise design and construction standards. It then produced suggestions for design modifications to render cage farming more robust, significantly minimising escapes and mitigating the genetic and ecological impacts of escaped fish.

The new guidelines and measures emerging from the project will benefit many stakeholders,

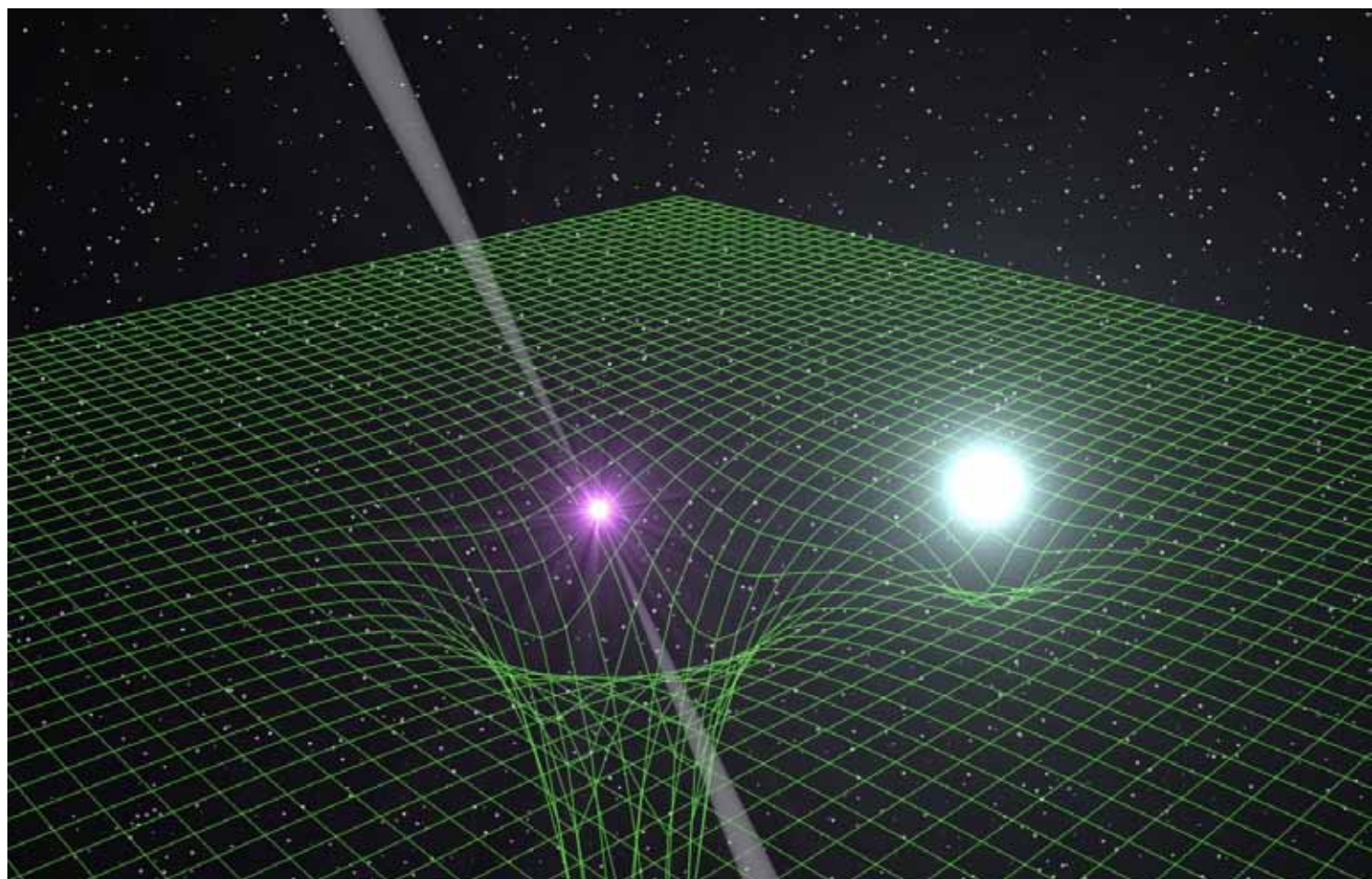
such as the fish-farming industry, equipment manufacturers, government organisations, regulatory authorities, marine scientists and the public. PREVENT ESCAPE has trained farmers in escape prevention and has disseminated its results to concerned organisations. If these recommendations are heeded and aquaculture systems are improved, the impact on the fish-farming sector and the environment will be very positive.

The project was coordinated by SINTEF in Norway.



- 1 'Assessing the causes and developing measures to prevent the escape of fish from sea-cage aquaculture'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Food, agriculture and fisheries, and biotechnology' (KBBE).
<http://cordis.europa.eu/marketplace> > search > offers > 10294
 Project website: <http://preventescape.eu/>



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A heavyweight boost for Einstein: probing gravity where no one has before

An international research team led by astronomers from the Max Planck Institute for Radio Astronomy (MPIfR), Bonn, Germany, used a collection of large radio and optical telescopes to investigate a newly discovered pulsar and its white dwarf companion. The observations revealed a system with unusual properties, which weighs twice as much as the Sun, making it the most massive neutron star to date.

Imagine half a million Earths packed into a sphere 20 kilometres in diameter, spinning faster than an industrial kitchen blender. These extreme conditions, almost unimaginable by human standards, are met in neutron stars — a type of stellar remnant formed in the aftermath of a supernova explosion — which offer the opportunity to test physics under unique conditions. While neutron stars were first discovered around 50 years ago, as pulsars which emit radio pulses like a lighthouse, the BEACON¹ project, led by ERC Starting grantee Dr Paulo Freire, recently found the biggest neutron star to date. Its findings, which reconfirm Einstein's theory on general relativity, were published in *Science* on 26 April 2013.

The pulsar, known as PSR J0348+0432, and the white-dwarf star in orbit around it, were recently discovered with the Green Bank radio telescope. Separated by just 830 000 km, the pulsar and the white dwarf in this system are close enough to emit a significant amount of gravitational waves. According to the theory of general relativity, the orbital size and period should also shrink over time — but to verify this, both the mass of the pulsar and its companion must be known.

'I was observing the system with the European Southern Observatory's Very Large Telescope in Chile, and I was trying to detect changes in the light emitted from the white dwarf caused by its 2 million km per hour

motion around the pulsar. These changes of light allow us to "weigh" both the white dwarf and the pulsar,' says John Antoniadis, a member of the research team at MPIfR and the leading author of the paper. 'After a quick analysis, I realised that the pulsar was a kind of heavyweight: a mass twice that of the Sun, making it the most massive neutron star we know about.'

With these masses, it is possible to calculate the amount of energy taken away from the system by gravitational waves, causing the orbital period to shrink. The team realised that this change in the orbital period should be visible in the radio signals of the pulsar and they focused on PSR



SPACE

J0348+0432 using the three largest single-dish radio telescopes on Earth (Green Bank, Arecibo and Effelsberg).

'Our radio observations with the Effelsberg and Arecibo telescopes were so precise that, by the end of 2012, we could already measure a change of 8 microseconds per year in the orbital period, exactly what Einstein's theory had predicted,' says ERC grantee Paulo Freire from MPIfR. 'The funding of the European Research Council is a truly momentous occasion for young researchers to conduct their research and acquire the equipment they need. My ERC grant will help us to develop a new state-of-the-art instrument for the Effelsberg radio telescope. With this new cutting-edge instrumentation, we expect to improve further the accuracy of today's results.'

In terms of gravity, PSR J0348+0432 is a truly extreme object, even compared to the other pulsars used in the high-precision tests of Einstein's general relativity. For instance, at its surface, the pulsar has a gravitational strength that is more than 300 billion times stronger than that on Earth. In its centre, more than 1 billion tonnes of matter is squeezed into a volume of a sugar cube. These numbers are nearly double those found in other pulsar 'gravity labs'.

Despite these extreme conditions, the research team finds that the theory of general relativity still holds true.

The findings are also important for scientists searching for gravitational waves emitted by a collision between two neutron stars. These new measurements give them added

confidence in the equations that describe the emission of gravitational waves during these events. These equations are the result of decades of mathematical research in general relativity and will be required to identify the first gravitational waves, which the team expects within the next five years.

The project is coordinated by the Max Planck Institute for Radio Astronomy in Germany.

1 'Beacons in the dark'.

Funded under the FP7 specific programme 'Ideas' (European Research Council).
<http://erc.europa.eu> > Project and results > ERC Stories
 Researcher's website:
<http://www3.mpifr-bonn.mpg.de/staff/pfreire/>

Hi-performance dry lubrication for space applications

Scientists are redesigning special gears and their lubricants used in space applications. These enhancements will accommodate use with heavy optical instrumentation such as solar panels and antennae.

The space industry is actively seeking ways to reduce mass and power consumption. One promising method for positioning heavy payloads of instrumentation and scientific equipment without heavy and powerful

motors is by using harmonic drives.

Harmonic drives, named after their producer, Harmonic Drive AG, are specialised mechanical gear systems enabling high

stiffness (zero-backlash) and precision even at very low speeds with low-mass, low-power actuator motors. Although harmonic drives have been used in space applications for over four decades, no solid lubricant is currently available.

The increase in expensive optical instrumentation has led to increasing customer requests for solid lubricants to replace liquid ones. Solid lubricants would avoid the outgassing and evaporation that affects optical components such as solar panels and antennae. This demand led a European consortium to initiate the EU-funded project HARMLES¹. Scientists set out to overcome the durability issues of other dry coatings with innovations in both coatings and harmonic gears.

During the first 12 months, the consortium surveyed and tested existing coatings. Roughness plays a fundamental role in the effectiveness of solid lubrication, so the scientists reduced the roughness of lab samples (discs) using newly available machining processes for gear components.

Researchers designed an upgraded gear-test device, the manufacture of which is under way. They also improved the existing 'finite element method' (FEM) gear-simulation software and redesigned the gears for new coatings and geometrical adaptations. Continued work will be focused on gear testing in air and thermal vacuum conditions to evaluate the coatings' performance.

The HARMLES project is expected to deliver much-needed solid lubricants and an updated harmonic gear design to accommodate use with optical equipment on spacecraft. They will decrease mass and fuel requirements as well as costs and help keep the European space programme on course.

The project was coordinated by AC2T Research in Austria.

1 'Dry lubricated harmonic drives for space applications'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
<http://cordis.europa.eu/marketplace> > search > offers > 10590



High-tech Earth monitoring fosters global security

Formidable progress on sophisticated global monitoring services can help manage disasters and overcome security issues in unprecedented ways. A system with this capability is now in operation.

Global Monitoring for Environment and Security (GMES), a European Earth Observation (EO) initiative, has advanced environmental monitoring and security considerably. Its use in a myriad of applications, from pinpointing the drivers of climate change to monitoring political instability, has proven crucial to advancing security.

The EU-funded G-MOSAIC¹ project developed geospatial tools to support EU external relations policies in different crucial security areas. Examples of such include illegal immigration, drug trafficking, protecting pipelines, piracy at sea, peacekeeping and nuclear proliferation.

In response to these threats, the project developed products and services that provide geospatial information to support the EU's international policies and prevent or manage external regional crises. It facilitated

the analysis of different contexts and situations, providing services that were validated by independent institutions and certified by end-users.

Recently, G-MOSAIC capabilities were activated on several occasions to guide disaster relief. In January 2010, the system delivered hundreds of maps, datasets and briefings to the United Nations (UN) and to various European ministries. In the same year, it also proved very useful in monitoring a strong earthquake in central Chile, providing crucial damage assessments and infrastructure analyses to the UN and to European users.

The year 2010 also saw the EU Council of Ministers formally adopt the GMES programme, paving the way for additional funds to strengthen its capabilities. The following year, G-MOSAIC held an important workshop that unveiled the

power of GMES and focused on its four domains: Natural Resources and Conflicts, Migration and Border Monitoring, Crisis Management and Assessment, and Critical Assets.

By the end of the project, the G-MOSAIC team had built a formidable user community that depended on its security capabilities. It successfully tested different pilot services and delivered a common portal that allows end-users, such as European governments and the UN, to access invaluable information. The system was thus capable of addressing all phases of the crisis-management cycle: intelligence for situation awareness, monitoring, early warning, preparedness, crisis management, and post-crisis management.

Overall success was demonstrated by the recent delivery of services, such as

damage-assessment data, post-earthquake reference maps and evacuation support maps in response to civil unrest. It also monitored border-crossing activities on sensitive borders. G-MOSAIC's invaluable insight should help safeguard European interests and citizens abroad while supporting the EU and other governments in mitigating disasters, illegal activity and political unrest.

The project was coordinated by E-Geos in Italy.

1 'GMES services for management of operations, situation awareness and intelligence for regional crises'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
<http://cordis.europa.eu/marketplace> > search > offers > 10467
 Project website:
<http://www.gmes-gmosaic.eu/>



SPACE

Better heat shields for dangerous phenomena

Spacecraft are subject to massive heating on re-entry into the Earth's atmosphere. Scientists are studying a phenomenon leading to a sudden and sharp increase in heat flux in order to design better thermal protection.

Spacecraft re-entering the Earth's atmosphere experience intense heat caused by friction with air molecules. 'Thermal protection systems' (TPSs) prevent the vehicles from overheating.

During the most critical phase of re-entry, the hypersonic flow of air (more than five times the speed of sound) over the surface of the spacecraft creates a sort of laminar boundary layer. Inside this layer, most of the heat, momentum and mass transfer takes place. During 'hypersonic transition', the boundary-layer flow goes from laminar to turbulent, causing the TPS at the same location to receive more than three times the incoming heat flux.

European and Russian scientists initiated the EU-funded TRANSHYBERIAN¹ project to study hypersonic transition and

propose local thermal-control mechanisms at the boundary layer for future space missions. Investigators chose to study a sharp cone configuration at five experimental facilities in the EU and Russia. Experimental data was complemented by numerical simulations.

During the first year of the project, investigators characterised the noise at each facility to explain possible differences in various measurements under seemingly comparable conditions. All numerical codes describing transition onset have been developed. Techniques include 'direct numerical simulation' (DNS), stability algorithms, 'Reynolds-averaged Navier-Stokes' (RANS) algorithms and correlation analysis. Scientists designed a common model experiment taking



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into account differences at the various facilities. Finally, a complete experimental and numerical — computational fluid dynamics (CFD) — campaign has been defined.

TRANSHYBERIAN expects to enhance the design of space vehicles for reuse with protection against heat generated during hypersonic transition on re-entry. The project will also reinforce Euro-Russian ties and cooperation in space research, thus strengthening the position of both space programmes.

The project was coordinated by the Von Karman Institute for Fluid Dynamics in Belgium.

- 1 'Characterization of wall temperature effect during transition of hypersonic flow over a cone by experiments and numerical simulations'.

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
<http://cordis.europa.eu/marketplace> > search > offers > 10591
 Project website:
<https://www.transhyberian.eu/>

Advanced on-board network for spacecraft data handling

Scientists are developing on-board networking technology to enable the simultaneous handling of avionics and payload data on spacecraft. The system will enhance the current European Space Agency (ESA) standard.



Highly responsive space capabilities capable of rapidly adapting to mission needs require a system of flexible on-board communication networks. Such systems must be fast, robust and reliable, and capable of recovering autonomously from transient faults. Decreased mass and enhanced international compatibility, to foster cooperation, are other key design considerations.

Scientists initiated the SPWRT¹ project to address these demands. 'SpaceWire' is the ESA standard for high-speed network technology for payload data handling on-board spacecraft,

but the ESA is currently developing the next-generation standard, 'SpaceFibre'. The latter will allow for higher data-rate fibre-optic communications while ensuring compatibility with SpaceWire. SPWRT sought to build on this technology to enable shared handling of avionics and payload data.

During the first 10 months of the project, the consortium defined the requirements and use of SPWRT, providing input to the quality of service (QoS) approaches for the SpaceFibre standard then being developed. Scientists also incorporated the desired system requirements from European and Russian spacecraft manufacturers, as well as those of spacecraft equipment suppliers.

The demonstrated compatibility of these requirements facilitated the adoption of SpaceFibre as the baseline networking technology for very high data-rate applications.

SPWRT is also providing the QoS layer needed for combining the SpaceWire and SpaceFibre technologies for mixed avionics and data-handling applications. QoS in data communications mainly

relates to the prioritisation of network traffic for efficient and predictable data flow. QoS also means achieving maximum data transmission rates while minimising latency, error rate and downtime.

SPWRT is defining technology solutions to support most, if not all, on-board spacecraft communication requirements, as well as to provide a coherent set of QoS

protocols. Avionics data handling covers the collection of 'house-keeping' information, device and subsystem networking, sub-system synchronisation and inter-processor communications. The system will enable a variety of QoS, broadcast and multicast capabilities, extremely low latencies and out-of-band signalling. Scientists are also developing 'fault detection, isolation and recovery' (FDIR) mechanisms.

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

1 "SpaceWire RT".

Funded under the FP7 specific programme 'Cooperation' under the research theme 'Space'.
<http://cordis.europa.eu/marketplace> >
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New space centre flourishes in Greece

An advanced space communications laboratory in Greece's northern city of Xanthi has created a superlative infrastructure for space research that collaborates with the finest institutions and researchers worldwide.

Established 40 years ago, the Democritus University of Thrace in Xanthi, northern Greece is considered one of the country's leading academic institutions. In the drive to enhance higher education in line with key research priorities, the EU is upgrading the university's internetworked systems laboratory at the Department of Electrical and Computer Engineering. This has been the mission of the EU-funded project SPICE¹, which aims to improve research innovation, recruit top research staff and encourage knowledge exchange.

The project is focusing on specific topics related to space research, such as the unification of space and Earth communications, attracting worldwide interest in

the institution's research efforts. To achieve this, in addition to staff training, recruitment and mobility, the project team is upgrading infrastructure by acquiring new hardware components.

Key new equipment includes a 'delay-tolerant networking' (DTN) test bed, which is being set up in a dedicated lab to support numerous applications — ranging from Earth disruptive communications to space-data exploitation. In the meantime, novel satellite toolkit software, a portable satellite simulator and other high-tech equipment are all helping to model planetary motion, weather conditions and space communication protocols. Overall, the new equipment has led to development of a

cutting-edge laboratory, featuring several workstations to facilitate research.

As regards human resources, recruitment of senior researchers has already linked space internetworking with hot topics such as 'vehicular *ad hoc* networks' (VANETs) and cloud computing. In addition, visiting guest lecturers and new partnerships with the National Aeronautics and Space Administration (NASA) in the United States and other notable institutions have strengthened the project's goals.

Numerous project findings and research results have been published in scientific journals and international conferences. The

results have also been made available on the project's website, while panel sessions and workshops have helped advance relevant scientific topics such as DTN. Participation of the SPICE project team in standardisation bodies that define space communication protocols has also highlighted the institution's pivotal role in space research.

Progress on all these fronts has helped establish the first European space internetworking centre, which is expected to contribute significantly to space missions. In the meantime, the laboratory has taken on important projects and has begun hosting world-class experts in space internetworking. SPICE will be a definite key player in the field, collaborating closely with the European Space Agency (ESA), NASA and other world-class organisations. The positive impact of such a formidable infrastructure will promote scientific research and competitiveness in the space field, not only in northern Greece but across the entire European Union.

The project was coordinated by the Democritus University of Thrace in Greece.

1 "Space internetworking centre".

Funded under the FP7 specific programme 'Capacities' under the theme 'Stimulating the realisation of the full research potential of the enlarged European Union Community'.
<http://cordis.europa.eu/marketplace> >
 search > offers > 10622
 Project website: <http://www.spice-center.org/>



EVENTS

International symposium on paediatric pain

The 'Ninth international symposium on paediatric pain' will take place from 17 to 20 June 2013 in Stockholm, Sweden.

Although much is now known about pain management in children, improvements are still needed to improve paediatric pain management in routine clinical practice. One of the problematic factors lies in children's difficulty to express their pain to those taking care of them.

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

For further information, please visit:

<http://www.ispp2013.org/>

EuroNanoforum 2013

The '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 bringing to solving societal problems in environment, energy and health, showcasing innovation as a driver of economic growth. It will also demonstrate how nanotechnologies fit into the new research 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/>

Sustainable energy storage in buildings conference

A conference entitled 'Sustainable energy storage in buildings' will be held from 19 to 21 June 2013 in Dublin, Ireland.

Energy storage in buildings, in particular commercial ones, is a growing market in Europe and overseas. This conference will introduce novel energy-storage materials, and testing and characterisation methods, as well as micro-scale and macro-scale modelling of sustainable energy-storage materials and applications. Examples of sustainable energy storage in buildings will be showcased, and sustainable energy options will be discussed.

For further information, please visit:

<http://www.sustainableenergystorage.com/index.html>

International congress: mobility and road safety in an ageing society

The 'International congress: mobility and road safety in an ageing society' will be held from 19 to 20 June 2013 in Vienna, Austria.

In Europe, the elderly is the fastest growing segment of the population. According to current estimates, one in four people will be aged 65 or over in 2030. Efficient transport infrastructure is crucial to this segment of the population. As people age, a number of factors can threaten their mobility, including impaired ability to drive, limited availability of alternative forms of transportation, and unwillingness to be dependent upon others.

The conference will focus on future aspects and solutions of mobility and transport versus safety and quality of life in the context of an ageing society.

For further information, please visit:

<http://www.kfv.at/congress2013/>

Transformation in a changing climate

A conference entitled 'Transformation in a changing climate' will be held from 19 to 21 June 2013 in Oslo, Norway.

There is growing recognition that traditional, 'business-as-usual' approaches to mitigation and adaptation are insufficient to address the breadth, scale and complexity of challenges associated with climate change. In fact, there have been many calls for new modes of thinking. Multiple interacting processes, policies and programmes, and both scientific and policy discourses, increasingly emphasise the need for deliberate transformation in response to climate change.

The conference will be discussing the concept of transformation and what it entails. It will look at issues such as the role of science in the transformation process and what types of transformation are needed in fields such as economics, politics and sociology.

For further information, please visit:

<http://www.sv.uio.no/iss/forskning/aktuelt/arrangementer/konferanser-seminarer/2012/transformation-in-a-changing-climate.html>

Future network and mobile summit 2013

The 'Future network and mobile summit 2013' will be held from 3 to 5 July 2013 in Lisbon, Portugal.

In the context of convergence and innovation, this conference — the 22nd in a series supported by the European Commission — will address the challenges of building the Future Internet Infrastructures, based on mobile, wireless and fixed broadband communications technologies.

The conference regularly attracts delegates from industry and research to share experiences and research results, identify future trends, discuss business opportunities and identify opportunities for international research collaboration under FP7-ICT and Horizon 2020. It will thus contribute to showcasing European research in the field, and position it within the multiplicity of related initiatives supported in other regions of the world.

For further information, please visit:

<http://www.futurenetworksummit.eu/2013/>

European conference on sustainability, energy and the environment

The 'European conference on sustainability, energy and the environment' (ECSEE2013) will be held from 4 to 7 July 2013 in Brighton, United Kingdom.

Once seen only as an environmental or political issue, sustainability has become a major concern of businesses, industry, government and academia. Issues such as poverty, hunger, education, healthcare, and access to markets should all be considered as part of the evolution of any comprehensive sustainability paradigm.

The conference will be an opportunity for attendees to address the various dimensions of sustainability and look for synergies and solutions for the complex issue of sustainability.

For further information, please visit:

<http://ecsee.iafor.org/index.html>

Ninth international conference on earthquake-resistant engineering structures

The ninth 'International conference on earthquake-resistant engineering structures' will be held from 8 to 10 July 2013 in A Coruña, Spain.

Major earthquakes and associated effects such as tsunamis continue to require further research. Existing problems are expected to intensify as population pressure results in construction works in regions of high seismic vulnerability. A better understanding of these phenomena is needed to design earthquake-resistant structures.

The event will provide attendees with an opportunity to discuss basic and applied research in the various fields of earthquake engineering.

For further information, please visit:

<http://www.wessex.ac.uk/13-conferences/eres-2013.html>

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